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## Abstract

Previous research has examined the economic feasibility of investing in the earnings of professional athletes, including professional tennis players. Recent changes in the economics of professional tennis, in particular those targeting gender parity and income distribution, inspire an investigation into the impact of gender on investments in professional tennis athletes. The analysis updates data incorporating the influence of gender and endorsement earnings in the potential return to investors investing in college tennis players who turned professional. The investment potential of female tennis players has increased substantially over time due to gender parity and other strategic decisions to distribute prize money among more players, suggesting that female players and those who might invest in their earnings stream stand to benefit.

## Introduction

Securitizing a professional athlete's earnings stream was first initiated in 1997 by Maarten Lafeber, a Dutch professional golfer who issued shares representing an interest in his future earnings. Investors provided him with money in the early and low-earning years of his career, allowing him to play professional golf for five years. In exchange, investors received a portion of his future earnings. Since then, other professional athletes have securitized their brand values and earnings streams (Medeiros 2017).

Today, college athletes can earn money from their name, image, and likeness (NIL) due to significant changes in NCAA policies and legal rulings. For many years, NCAA rules prohibited college athletes from earning money from their NIL. In June 2021, the U.S. Supreme Court ruled in *NCAA v. Alston* that the NCAA could not limit education-related benefits for student-athletes. Although this ruling didn't directly address NIL, it set a precedent that challenged the NCAA's restrictions. On July 1, 2021, in response to various state laws that were set to go into effect, which would have allowed NIL earnings regardless of NCAA rules, the NCAA implemented an interim policy allowing college athletes to profit from their NIL, allowing athletes to engage in NIL activities as long as they comply with state laws and NCAA guidelines.

Professional tennis has approximately one billion fans, equally split between men and women, making it the fourth most popular sport by fanbase.[1] Tennis ranks no higher than 16th in media revenue, however.[2] Many professional tennis players began their careers in college, and their earnings prospects have increased because the Association of Tennis Professionals (ATP) developed a long-term strategic plan called OneVision. OneVision is designed to increase media revenue, align the interests of players and tournaments with a 50/50 market share, and distribute prize money more evenly across a broader group of players, e.g., by gender and player rank.

Since the plan was implemented in 2023, prize pools in tennis have increased, and more revenue is being distributed to lower-ranked players, which may create additional investment opportunities for investors looking to take an interest in the future earnings of young tennis players turning professional.

In this paper, we examine the profitability of investing in a portfolio of tennis players who attended American colleges and turned professional between 2007 and 2018. These players often lack the resources to become professional but nonetheless may have the skills to succeed. Like Maarten Lafeber, some young players with limited resources aspiring to turn professional presumably would be willing to forego a portion of their future earnings to investors willing to subsidize their endeavors during the early, low-earning years of their careers, providing an opportunity to turn professional that might not otherwise be available.[3]

Farinella et al. (2024) show that investing in a randomly selected portfolio of college tennis players turning professional has limited investment potential. Forming portfolios using informed selection based on basic metrics, such as college ranking, substantially improves profitability. The financial changes in tennis during the past few years are substantial, offer the prospect of more revenue for players at all levels, and potentially improve investment potential in young college players. Motivated by these recent changes in the economics of professional tennis, we extend the Farinella et al. (2024) analysis in three ways:

1. We update career earnings through May 21, 2024, to capture some of the initial effects of the OneVision strategic plan for the ATP that aims to increase prize money for the Masters players, expand Masters tournaments, introduce a profit-sharing formula, and set a baseline compensation for the players.
2. We incorporate the influence of gender on the investment opportunity set because a stated purpose of OneVision is to create gender parity.

3. We incorporate an updated endorsement model that captures the brand value associated with an athlete's NIL because NIL can represent 90 percent or more of a top player's career earnings.

Following Farinella et al. (2024) in methodology, we examine several potential predictors of the most profitable players. We find prize money earned before turning professional is the best determinant of future earnings for gender-specific samples and significantly improves investment performance. This contrasts with Farinella et al. (2024), who find college ranking is the best predictor. Our sample is different from Farinella et al. (2024) across two dimensions. First, our sample includes three additional years of career earnings, including players who turned professional in 2016, 2017, and 2018, which captures more of the impact from the recent changes in the tennis business. Second, our sample includes both male and female players. We test for differences in career earnings for former male and female college tennis players and examine the investment potential of male- and female-only portfolios. The profit potential of female tennis players increases substantially across the vintage years and dominates that of men in recent years.

## Literature Review

Friedman (1955) proposed investing in an individual's human capital in the context of education in which an investor would subsidize a student's education in exchange for an interest in their future earnings. This principle has been applied to professional athletes, whose expenses tend to exceed revenue in the early years of their careers. Indap and Hook (2017) describe the business of Fantex, a brand-building company that intermediated the securitization of earnings of professional athletes from sports, such as the National Football League (NFL). Duggal (2016) evaluates the specific case of a tracking stock on the earnings of Vernon Davis, a former tight end with the San Francisco 49ers, from the NFL and related activities.

From a more general perspective, beyond the possibility of taking an equity interest in an athlete's earning stream, Kahn (2000) discusses the price of labor in North American team sports, focusing specifically on the monopsony characteristics of the market in which team owners can coordinate more easily than players. This paper, by contrast, focuses on professional tennis, which (like golf) is an individual rather than team sport. Professional tennis players choose tournaments in which they would compete. Ehrenberg and Bognanno (1990a; 1990b) examine the incentive effects of golf tournaments and find the amount and structure of the tournament purses influence player performance. A similar relationship has been documented in auto racing and marathon racing (Becker and Huselid 1992; Frick 1998).

### *Gender-Based Pay*

Professional tennis has been a leader in equal pay for male and female athletes. In 1973, the U.S. Open tennis tournament announced equal pay for men and women. As of 2007, the four major tennis tournaments provide equal pay to men and women. The Australian Open implemented equal pay in 1984, and the French Open and Wimbledon began in 2007.

Nonetheless, several studies identify discrimination and income inequality based on gender. Kahn (1991) found that, although male and female grand slam tennis matches draw the same amount of revenue, men were paid more than women. Flake et al. (2013) find the pay gap between men and women in grand slam tournaments has since been eliminated. Although a large pay gap in other tournaments remains, the authors find the pay gap between men and women in tennis is decreasing.

Cepeda (2021) examines gender pay differentials in the context of wage discrimination, which is defined as paying different compensation to workers that generate the same revenue for the employer. Although Cepeda (2021) finds a large pay gap between male and female tennis players, e.g., prize money paid to women in 2017 was 39 percent of the prize money paid to men, the author notes that men generate more revenue from ticket sales and television rights. Accounting for men's greater revenue generation, Cepeda (2021) concludes that higher wages paid to men do not constitute wage discrimination.

### *College Tennis Player Investments*

Farinella et al. (2024) find that 17 percent of former college tennis players who turn professional earn more than $50,000 in gross revenue per year. The Farinella et al. (2024) sample includes all male and female college players turning professional between 2007 and 2015 and incorporates their earnings through 2021. Analyzing a hypothetical securitization agreement paying a player $50,000 in exchange for 10 percent of their career earnings, they create portfolios of five players selected randomly each year using a Monte Carlo simulation and examine the profitability of each vintage year. The 2007 vintage year was the best-performing portfolio, generating a profit of $592,982 and an average annual return of 15.0 percent without accounting for endorsements. However, only 19 percent of the simulated portfolios constructed were profitable. Including endorsements increased the average annual return of the 2007 vintage year to 27 percent with 37.2 percent of the simulated portfolios being profitable. Average profitability across all vintage years was either modestly positive or negative, suggesting the investment potential of randomly selected portfolios is limited. Farinella et al. (2024) also show that forming portfolios based on simple performance metrics, such as college ranking, substantially improves profitability, generating net profitable portfolios in nine of the fifteen years. We extend the Farinella et al. (2024) analysis in several ways.

## The Changing Business of Tennis

Professional tennis is popular. One billion fans worldwide make tennis the fourth largest professional sport by audience behind soccer, basketball, and cricket; and the audience is split 50/50 between men and women.[4] Professional tennis lags in media revenue, however. Fifteen other sports earn more annual media revenue than professional tennis.

As a result, annual media revenue per fan for professional tennis is $0.60 compared to $18 for the NFL, $5 for soccer, and $3 for golf.

### *OneVision*

Professional tennis developed the OneVision strategic plan, in part, to address the relatively low amount of media revenue in tennis, i.e., $770 million compared to $10 billion for the NFL. The plan attributes this disparity in media revenue to fragmentation in tennis. For example, seven organizations independently operate tennis tournaments and negotiate their own media deals. The organizations include the U.S. Open, French Open, Wimbledon, Australian Open, ATP, Women's Tennis Association (WTA), and the International Tennis Federation (ITF).

As a result, several business trends in tennis are driven by the OneVision strategic plan, which should improve the earnings of college tennis players who turn professional and, by extension, those who might invest in their future earnings. These trends include:

- increasing the prize pools through media revenue;
- revenue sharing among tennis players;
- a shift toward equal pay for men and women;
- a baseline salary for players ranked in the top 250; and
- paying players' expenses at tournaments.[5]

OneVision was implemented in 2023. It provides more transparent financial results of tournaments and a 50/50 revenue-sharing plan between the players and the tournaments. From 2022 to 2023, total payments to players increased by approximately $50 million, from $180 million to $230 million. The $50-million increase in total compensation consisted of $22 million in performance bonuses, $18.9 million in additional prize money, and $9 million in additional Challenger (lower tournament) prize money. In 2023, the plan resulted in an additional $12.2 million being paid to players who played in the ATP Masters events in 2022.

The additional prize money also is distributed among more players. The number of players receiving the performance bonus increased from twelve players in 2022 to 150 players in 2023, a twelve-fold increase. The ATP also announced a baseline salary for players ranked in the top 250 to be implemented in 2024. The top 100 players are guaranteed $300,000 each. Players ranked 101–175 are guaranteed $150,000 each, and players ranked 176–250 are guaranteed $75,000 each. ATP will pay the shortfall of any player's earnings below the threshold.

Playing tennis is very profitable for the top players, but most players have difficulty covering the expenses required to play professionally—implying high selection risk for investments in professional tennis players.[6] For example, Kiranpal Pannu is twenty-five-years old and ranked 633 in the world. In the 2022 season, Pannu earned $6,771 in prize money and had expenses of $34,500 (Maine 2023). He continues playing professional tennis with his parents' support. To encourage a competitive landscape, OneVision offers expense assistance to all competitors of all events. Players in the 2023 U.S. Open, for example, received $1,000 travel vouchers, lodging subsidies, increased meal allowance, and free racquet stringing.

### *Gender Parity*

Despite equal prize pools for men and women in the majors, men still earned $1.36 per $1 earned by women in 2023. Table 1 summarizes the

**TABLE 1 Summary of 2023 Tournament Prize Money**

| TOURNAMENT | TOTAL PRIZE POOL | SINGLES WINNER | SINGLES ROUND 1 | SINGLES Q1 | TOTAL PRIZE POOL ANNUAL CHANGE | YEAR THAT EQUAL PAY STARTED |
|---|---|---|---|---|---|---|
| **Panel A: Grand Slam Tournaments** | | | | | | |
| Australian Open | $58,517,250 | $2,130,975 | $81,180 | $21,141 | 13.07% | 1984 |
| French Open | $47,641,788 | $2,496,039 | $74,881 | $17,364 | 13.76% | 2007 |
| Wimbledon | $56,577,988 | $2,974,458 | $69,615 | $16,138 | 17.50% | 2007 |
| U.S. Open | $65,000,020 | $3,000,000 | $81,500 | $22,000 | 8.15% | 1973 |
| **Panel B: Masters 1000 Prize Money (same amount paid to men and women)** | | | | | | |
| Indian Wells Open | $17,600,000 | $1,262,220 | $18,660 | $5,150 | 5.27% | 2012 |
| Miami Open | $17,600,000 | $1,262,220 | $18,660 | $5,150 | 2.52% | 2006 |
| Madrid Open | $17,103,051 | $1,226,573 | $18,133 | $5,005 | 17.20% | 2014 |
| Shanghai Masters | $8,800,000 | $1,262,220 | $18,660 | $5,150 | 17.75% | 2009 |
| Monte Carlo (Men only) | $6,310,145 | $974,571 | $25,222 | $6,769 | 6.72% | – |
| Paris Masters | $5,779,335 | $946,603 | $24,498 | $6,575 | 6.72% | 2007 |
| **Panel C: Masters 1000 Prize Money (different amounts paid to men and women; equal pay by 2027)** | | | | | | |
| **TOURNAMENT** | **TOTAL PRIZE POOL** | **MALE SINGLES WINNER** | **FEMALE SINGLES WINNER** | **MALE SINGLES ROUND 1** | **FEMALE SINGLES ROUND 1** | **TOTAL PRIZE POOL ANNUAL CHANGE** |
| Italian Open | $8,510,817 | $1,220,734 | $600,017 | $18,047 | $9,002 | 42.29% |
| Canadian Open | $6,600,000 | $1,019,335 | $454,500 | $26,380 | $12,848 | 11.36% |
| Cincinnati Open | $6,600,000 | $1,019,335 | $454,500 | $26,380 | $12,848 | 5.08% |

*Source: Perfect Tennis, www.perfect-tennis.com/prize-money/.*

prize pools of the Grand Slam tournaments and the ATP 1000 tournaments. Panel A presents the prize pool and payouts for the Grand Slam events, which offer equal payouts for men and women. The first tournament to have equal pay was the U.S. Open in 1973, and the events to implement equal pay more recently were the French Open and Wimbledon in 2007. The prize pool of each Grand Slam tournament increased substantially during 2022–2023, reflecting a longer-term trend.

Importantly, prize money increases exponentially as a player successfully advances through Grand Slam tournaments. The winner's purse for Grand Slam events is thirty to forty times the winnings of a semi-finalist's purse, whereas a semi-finalist's winnings are only four times that of a quarter-finalist's purse. This exponential scaling contributes to the earnings dichotomy between top-ranked and even medium-ranked players.

Panel B shows the payouts for the ATP Masters 1000 events that pay equal amounts to men and women. The first ATP 1000 tournament to have equal pay was the Miami Open in 2006. Prize pools in each tournament also increased from 2022 to 2023, with the Shanghai Open increasing by 17.75 percent. The size of the prize pool for winners grows even more rapidly than the Grand Slam tournaments. Winners receive nearly seventy times the prize money of semi-finalists.

Although most ATP 1000 tournaments provide equal pay for men and women, a few, such as the Italian Open, Canadian Open, and Cincinnati Open, presented in panel C, do not. The ATP 1000 and ATP 500 tournaments are beginning equal pay for combined tournaments (where both men and women compete) in 2027. The events where men and women are not at the same location will provide equal prize payouts to men and women by 2033. Pay equity is being addressed at the top thirteen tournaments, but the prize pool at smaller tournaments still is three times larger for men than for women (Akabas 2023).

Table 2 shows the top ten highest-paid tennis players in the trailing twelve months as of June 30, 2024 (Bandenhausen 2024). Although estimating off-court earnings is difficult, these top players earn most of their income from off-court activities, such as endorsements and appearance fees, which are available only to highly ranked players. Carlos Alcaraz leads the list with $15 million in prize money and $30 million from endorsements. The top-earning players based on the twelve-month period ending on June 30, 2024, turned professional from 2001 through 2018 at an average age of 15.9 years. The players in our sample play for an average of 11.4 years.

College tennis players often are not considered the top players at age fourteen to seventeen, when many top-ranked juniors turn professional, but are nonetheless often offered college scholarships to play tennis. These players improve during college and may become good enough to make money as professionals after college, but they often do not have the money to turn professional. Tennis professionals have significant costs for travel, food, coaching, and tournament entries. Unlike team sports where the organization pays for travel expenses, tennis players must pay their own expenses.

Investors can offer a tennis player a lump sum in the beginning of their professional careers to pay for some of these expenses in exchange for a percentage of future career earnings as well as a percentage of future endorsements. Gloster (2015) estimates it costs approximately $40,000 to travel and play professional tournaments for an entry-level player operating on a budget. Top players would have significantly higher expenses mostly due to paying their tennis coaches and securing nicer accommodations. Hadlich (2019) found a player had to be ranked in the top 300 of the ATP to break even with their travel expenses.

Our sample suggests that some college tennis players who turn professional have a sizable earning potential and that the changing nature of the tennis business increases this potential. John Isner, for example, attended the University of Georgia and turned professional in 2007, earning more than $22 million in prize money excluding endorsements. College players turning professional may therefore offer an opportunity to the savvy investor willing to subsidize their careers, which is the nature of our research question.

**TABLE 2 Highest-Paid Tennis Players for Twelve Months, Ending June 30, 2024**

| RANK | NAME | AGE WHEN TURNED PRO | YEAR TURNED PRO | ON-COURT EARNINGS (MILLIONS) | OFF-COURT EARNINGS (MILLIONS) | TOTAL EARNINGS (MILLIONS) |
|---|---|---|---|---|---|---|
| 1 | Carlos Alcaraz | 15 | 2018 | 15.0 | 30 | 45.0 |
| 2 | Novak Djokovic | 16 | 2004 | 12.7 | 26 | 38.7 |
| 3 | Jannik Sinner | 16 | 2018 | 13.7 | 12 | 25.7 |
| 4 | Coco Gauff | 14 | 2018 | 7.6 | 18 | 25.6 |
| 5 | Iga Switek | 18 | 2019 | 13.2 | 12 | 25.2 |
| 6 | Daniil Medvedev | 18 | 2014 | 9.3 | 13 | 22.3 |
| 7 | Naomi Osaka | 15 | 2013 | 0.5 | 16 | 16.5 |
| 8 | Emma Raducanu | 16 | 2018 | 0.3 | 16 | 16.3 |
| 9 | Rafael Nadal | 15 | 2001 | 0.2 | 13 | 13.2 |
| 10 | Alexander Zverev | 16 | 2013 | 8.6 | 3.5 | 12.1 |

*Source: Bandenhausen (2024).*

## Methodology

### *The Data*

Our dataset consists of active and inactive former college tennis players who turned professional from 2007 to 2018. We identify players ranked in the top 125 of the Intercollegiate Tennis Association (ITA) annual rankings.[7] The athletes we considered to be professional were those who also played ten or more Futures or Challenger level tournaments over two years.

The initial sample of players who turned professional between 2007 and 2018 included 316 players; 221 men and 95 women. We use prize money before turning professional as a filter. We remove 53 players who earned less than $1,000 in prize money before turning professional, resulting in a sample of 263 athletes; 189 men and 84 women.

We obtain career earnings for each player from January 2007 to May 21, 2024, implying that a given player's professional career ranges from seven to eighteen years.[8] Because the average tennis player retires at age twenty-seven, the career earnings in this sample is a reasonable proxy for total career earnings. We omitted former college players who turned professional after 2018 because our dataset ended in 2024; those players have a truncated career length in our sample and many of them will continue to earn significant prize money after 2024 (when our sample ends) and that therefore will not be reflected in our data. We nonetheless report descriptive statistics for these players as well as results of an identical Monte Carlo analysis that we perform for our core sample.

The WTA and ATP ceased all tennis tournaments from March 2020 to August 2020 due to the COVID-19 pandemic. Cary and Stephens (2023) examined the impact of COVID-19 on tennis players and found many tennis players, female players in particular, did not immediately return to play tournaments. Šimić (2021) also finds the COVID-19 pandemic significantly impacted tennis player earnings at the outset of the pandemic. The data in this paper captures earnings from 2006 to 2024 and is therefore impacted by COVID-19.

Table 3 provides descriptive statistics for our sample of college tennis players turning professional from 2007 to 2024 and compares it to the 2007–2021 sample period used by Farinella et al. (2024).

**TABLE 3 Descriptive Statistics for 263 College Tennis Players Turning Professional**

| | FULL SAMPLE | MALE | FEMALE |
|---|---|---|---|
| **Panel A: Descriptive Statistics for Earnings, 2007–2021** | | | |
| Mean | $475,627 | $547,934 | $321,546 |
| Standard Error | $109,954 | $157,376 | $76,695 |
| Median | $73,837 | $73,837 | $70,365 |
| Standard Deviation | $1,783,162 | $2,105,548 | $702,918 |
| Skewness | 8.79 | 7.72 | 4.47 |
| Kurtosis | 87.29 | 64.86 | 22.74 |
| Minimum | $3,326 | $3,326 | $5,682 |
| Maximum | $20,044,639 | $20,044,639 | $4,644,655 |
| Sum | $125,089,985 | $98,080,114 | $27,009,871 |
| Count | 263 | 179 | 84 |
| **Panel B: Descriptive Statistics for Earnings, 2007–2024** | | | |
| Mean | $720,511 | $793,856 | $564,215 |
| Standard Error | $132,125 | $184,946 | $125,630 |
| Median | $96,335 | $86,670 | $126,923 |
| Standard Deviation | $2,142,706 | $2,474,406 | $1,151,417 |
| Skewness | 6.85 | 6.28 | 4.86 |
| Kurtosis | 57.35 | 46.08 | 29.44 |
| Minimum | $3,326 | $3,326 | $4,635 |
| Maximum | $22,430,808 | $22,430,808 | $8,515,121 |
| Sum | $189,494,274 | $142,100,210 | $47,394,064 |
| Count | 263 | 179 | 84 |
| **Panel C: Comparison of Panels A and B** | | | |
| Difference in sum | $64,404,289 | $44,020,096 | $20,384,193 |
| Difference in mean | $244,883 | $245,922 | $242,669 |
| Difference in median | $22,498 | $12,833 | $56,558 |
| Percentage change in mean | 51% | 45% | 75% |
| Percentage change in median | 30% | 17% | 80% |

Table 3 highlights the importance of including more data reflecting recent changes in the tennis business, e.g., OneVision. Our sample includes approximately 2.5 years of additional earnings. The average career earnings for players in our sample increased from $475,627 to $720,511, approximately 52 percent during the 2.5-year period, which we attribute to recent changes in the business of tennis, such as the OneVision strategic plan. The earnings growth is consistent for both men and women. The average career earnings for men increased from $547,934 to $793,856, a 45-percent increase. The average career earnings for women increased from $321,546 to $564,215, a 75-percent increase. The standard deviation increased from $1,783,162 in the 2007 to 2021 period to $2,142,706 for the entire sample period. The prize money for all players has increased significantly (52 percent) over the past 2.5 years, and women have been the biggest beneficiaries, with their prize money increasing by 75 percent.

The distribution of earnings for both men and women is skewed, with the highest-paid players earning exponentially more than lower-ranked players, although men's earnings are more skewed than women's earnings.

### *Portfolio Construction*

We create hypothetical portfolios of tennis players that could be sold to investors across four vintages, consisting of college players who turn professional during 2007–2009, 2010–2012, 2013–2015, and 2016–2018. Within each vintage, we create male-only, female-only, and full-sample portfolios for a total of twelve vintages.

Table 4 shows a comparison of the vintages across time and gender. Panel A provides descriptive statistics for the four male-only vintages. The number of male tennis players in each vintage has held relatively constant. Interestingly, mean prize money earnings for men have

**TABLE 4 Descriptive Statistics of College Tennis Players Turning Professional Across Vintages**

| | VINTAGE 1 | VINTAGE 2 | VINTAGE 3 | VINTAGE 4 |
|---|---|---|---|---|
| **Panel A: Male Vintages** | | | | |
| Mean | $1,258,079 | $916,124 | $569,926 | $498,667 |
| Standard Error | $673,541 | $254,146 | $168,988 | $218,390 |
| Median | $33,732 | $135,103 | $90,434 | $99,119 |
| Standard Deviation | $4,365,044 | $1,666,544 | $1,095,166 | $1,574,832 |
| Skewness | 4.30 | 2.64 | 3.02 | 5.91 |
| Kurtosis | 18.22 | 7.83 | 9.74 | 38.08 |
| Range | $22,427,482 | $8,078,410 | $5,256,450 | $10,829,800 |
| Minimum | $3,326 | $4,278 | $12,600 | $10,624 |
| Maximum | $22,430,808 | $8,082,688 | $5,269,050 | $10,840,424 |
| Sum | $52,839,308 | $39,393,335 | $23,936,888 | $25,930,679 |
| Count | 42 | 43 | 42 | 52 |
| **Panel B: Female Vintages** | | | | |
| Mean | $86,218 | $298,413 | $565,163 | $914,809 |
| Standard Error | $28,356 | $126,167 | $217,313 | $279,549 |
| Median | $46,277 | $141,992 | $97,763 | $447,594 |
| Standard Deviation | $109,823 | $472,073 | $1,064,610 | $1,556,464 |
| Skewness | 2.05 | 2.77 | 3.52 | 4.11 |
| Kurtosis | 3.26 | 8.47 | 14.22 | 19.90 |
| Range | $355,741 | $1,770,481 | $5,024,471 | $8,506,497 |
| Minimum | $4,635 | $19,327 | $6,646 | $8,624 |
| Maximum | $360,376 | $1,789,808 | $5,031,117 | $8,515,121 |
| Sum | $1,293,277 | $4,177,782 | $13,563,917 | $28,359,088 |
| Count | 15 | 14 | 24 | 31 |
| **Panel C: Male vs. Female Vintages** | | | | |
| | T-TEST | | MANN-WHITNEY TEST | |
| | T-RATIO | PROB > T | PROB. < T | Z | PROB > \|Z\| |
| Full sample | 1.03 | 0.15 | 0.85 | 1.04 | 0.30 |
| Vintage 1 | 1.74 | 0.05 | 0.96 | 0.26 | 0.79 |
| Vintage 2 | 2.17 | 0.02 | 0.98 | −0.66 | 0.51 |
| Vintage 3 | 0.02 | 0.49 | 0.51 | −0.22 | 0.83 |
| Vintage 4 | −1.17 | 0.88 | 0.12 | 2.71 | 0.01 |

*Note: Vintages 1, 2, 3, and 4 represent college tennis players turning professional from 2007–2009, 2010–2012, 2013–2015, and 2016–2018, respectively.*

decreased substantially in each vintage period from $1,258,079 in vintage 1 to $498,667 in vintage 4. The median, however, has increased from $33,732 to $99,119, reflecting a distribution of earnings among more players. The standard deviation also decreased from $4,365,044 in vintage 1 to $1,574,832 in vintage 4. John Isner and Kevin Anderson, who turned professional in 2007 and earned more than $22 million and $17 million in prize money, respectively, account for the high mean and standard deviation in vintage 1. Their earnings represent 75 percent of prize money for the forty-two players in vintage 1. The three-fold increase in the median salary from $33,732 to $99,119 is encouraging for players and investors in these portfolios.

Table 4, panel B shows the descriptive statistics for female-only vintages. Unlike male cohorts, the size of the female cohorts has doubled during the sample period from fifteen to thirty-one, suggesting that the greater availability of prize money to these players has encouraged more female college tennis players to turn professional. Although average earnings have declined across vintages for men, they have increased for women. Mean earnings for women increased more than ten-fold from $86,218 in vintage 1 to $914,809 in vintage 4. The median also increased ten-fold from $46,277 to $447,594. The standard deviation increased from $109,823 in vintage 1 to $1,556,464 in vintage 4.

Table 4, panel C reports tests for gender differences across the full sample and the individual vintages using both parametric and non-parametric tests because outliers and kurtosis in the data suggest the data are not normally distributed. The *t*-tests indicate men earned more than women in vintages 1 and 2 but not in the later vintages at the 95-percent level of confidence, suggesting the changes in the business of tennis are closing the gender gap. The non-parametric Mann-Whitney test finds no statistical difference in the early vintages but does find that women earned more than men in vintage 4. The massive standard errors in the data make it difficult for tests of significance to detect differences. Both classes of tests, however, suggest that women are paid at least as much as men in the later vintages, making investments in their future earnings substantially more attractive.

## Results and Discussion

### *Randomly Generated Portfolios Based on Prize Money Only*

Unlike many other sports, tennis requires players to pay their own tournament fees, travel expenses, and other costs, which might be $50,000 per year. We therefore examine the profitability of an investor providing $50,000 to the player up front in exchange for 10 percent of their career earnings. To diversify risk, we consider creating five-player portfolios. It is impossible to know which players would accept the offer, so we use Monte Carlo simulation to create 10,000 random samples of five players within each vintage for the male-only, female-only, and full samples, assuming the investor pays each of the five players $50,000 and receives 10 percent of their total prize money. The total investment in one portfolio is therefore $250,000. The portfolio could be sold to a single investor, e.g., a fan, a sponsor, a manager, an agent, or divided into shares and sold to multiple parties.

Table 5 shows the range of profit outcomes for the Monte Carlo simulations in each vintage year. Panel A shows the results from portfolios

**TABLE 5 Portfolio Profit Simulations of Prize Money Only for Five Randomly Selected College Tennis Players by Vintage and Percentile**

| **Panel A: Male and Female Portfolios** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100% | 90% | 75% | 50% | 25% | 10% | 0% | Mean | Std. Dev. | Coef. Var. | % Profit | N |
| Vintage 1 | $7,797,485 | $1,690,455 | $81,294 | –$135,500 | –$223,891 | –$235,133 | –$247,071 | $224,205 | $847,249 | 3.78 | 27.7% | 57 |
| Vintage 2 | $2,011,666 | $609,900 | $299,118 | $42,907 | –$136,328 | –$196,005 | –$241,510 | $134,852 | $334,222 | 2.48 | 56.4% | 57 |
| Vintage 3 | $1,252,950 | $393,544 | $171,231 | –$46,058 | –$142,545 | –$202,039 | –$243,136 | $36,235 | $237,912 | 6.57 | 41.6% | 66 |
| Vintage 4 | $3,318,689 | $663,230 | $110,728 | –$34,925 | –$142,343 | –$186,386 | –$237,698 | $71,306 | $351,638 | 4.93 | 42.0% | 83 |
| **Panel B: Male-Only Portfolios** | | | | | | | | | | | | |
| | 100% | 90% | 75% | 50% | 25% | 10% | 0% | Mean | Std. Dev. | Coef. Var. | % Profit | N |
| Vintage 1 | $6,166,376 | $2,006,820 | $292,421 | –$95,376 | –$219,192 | –$235,545 | –$247,786 | $371,266 | $964,800 | 2.60 | 36.6% | 42 |
| Vintage 2 | $2,274,148 | $716,213 | $395,085 | $146,803 | –$85,222 | –$190,342 | –$241,591 | $205,716 | $361,402 | 1.76 | 64.1% | 43 |
| Vintage 3 | $1,488,912 | $380,778 | $172,854 | –$54,281 | –$148,818 | –$209,749 | –$240,983 | $31,686 | $239,893 | 7.57 | 41.4% | 42 |
| Vintage 4 | $2,241,767 | $344,420 | $58,852 | –$147,133 | –$186,308 | –$209,499 | –$238,914 | –$6,909 | $347,744 | 50.33 | 27.5% | 52 |
| **Panel C: Female-Only Portfolios** | | | | | | | | | | | | |
| | 100% | 90% | 75% | 50% | 25% | 10% | 0% | Mean | Std. Dev. | Coef. Var. | % Profit | N |
| Vintage 1 | –$93,054 | –$170,198 | –$193,849 | –$207,138 | –$226,983 | –$233,042 | –$247,521 | –$206,703 | $23,803 | 0.12 | 0.0% | 15 |
| Vintage 2 | $481,025 | $29,921 | –$33,848 | –$135,796 | –$177,614 | –$207,857 | –$239,405 | –$102,233 | $102,778 | 1.01 | 17.1% | 14 |
| Vintage 3 | $1,506,714 | $389,969 | $100,598 | –$46,545 | –$131,061 | –$178,403 | –$245,379 | $28,256 | $235,890 | 8.35 | 40.2% | 24 |
| Vintage 4 | $2,462,595 | $812,451 | $264,094 | $108,090 | –$5,217 | –$95,553 | –$241,418 | $209,077 | $346,119 | 1.66 | 73.9% | 31 |

*Note: Vintages 1, 2, 3, and 4 represent college tennis players turning professional during 2007-2009, 2010-2012, 2013-2015, and 2016-2018, respectively. The distribution of outcomes is derived from 10,000 randomly constructed portfolios of five players within each vintage, representing a $50,000 investment in exchange for a 10-percent interest in player earnings.*

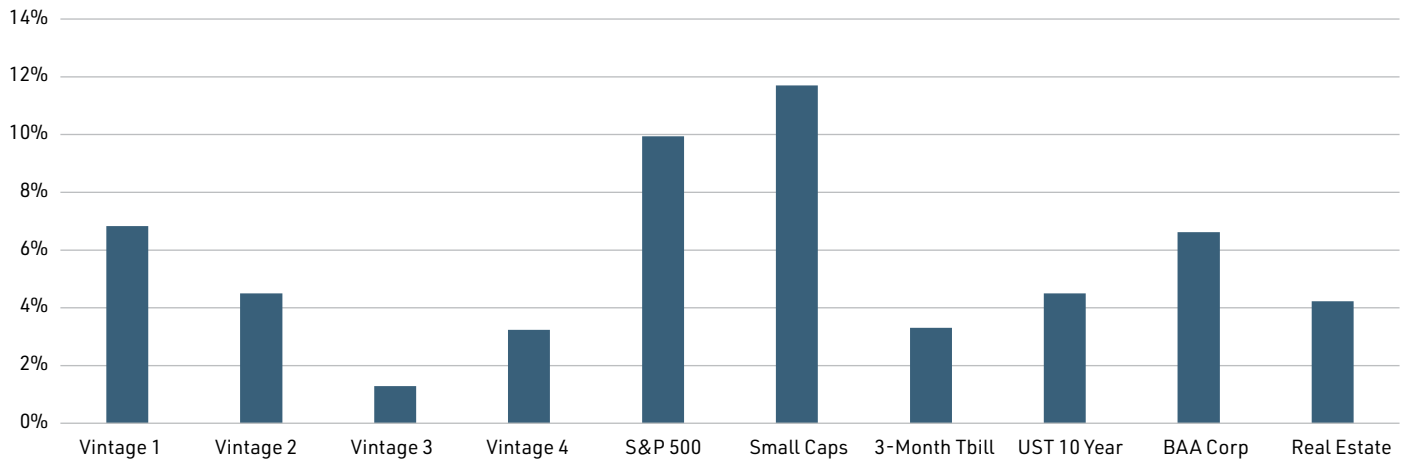
consisting of both male and female players. Vintage 1, which contains John Isner and Kevin Anderson, produced the highest profit of $7,797,485 and the greatest mean profit for the investor of $224,205. Vintage 2 produced the greatest percentage of profitable portfolios with 56 percent of the portfolios being profitable. Vintage 1 had the fewest (28 percent) profitable portfolios. Panel B presents male-only portfolios. Average profitability declined noticeably over the vintages, but median outcomes are more variable. The best portfolio occurred in vintage 1 and earned a profit of $6,166,376. Vintage 2 again had the highest number of profitable portfolios at 64 percent. The median portfolio for men still generates a loss in each of the vintages.

Panel C presents the results for female-only portfolios. Average profitability switched from negative to positive across the vintages. No portfolios generated a profit in vintage 1. In vintage 4, 74 percent of the portfolios generated a profit. The best portfolio is $2,462,595 in vintage 4, and the worst portfolio is in vintage 1 at –$247,521. The median portfolio of women turns positive in vintage 4. The improved performance of female-only portfolios from vintage 1 to vintage 4 is astonishing and represents the impact of gender-equity policies.

It is impossible to calculate the time-series volatility or risk-adjusted returns of these portfolios over time because the data does not include annual pricing data and the annual cash-flow data is incomplete. Authors typically revert therefore to non-parametric measures of return such as total value-to-paid-in (TVPI) (Kaplan and Schoar 2005; Brown et al. 2019). Table 5 nonetheless reports cross-sectional volatility of these portfolios and the coefficient of variation. A comparable benchmark would have a similar sample size because the standard deviation is calculated in the cross-section, making comparison challenging. That said, cross-sectional volatility is almost always a large multiple of the mean, ranging from 2.5 times to 6.5 times for the whole sample. Vintage 4 of the male-only sample has a cross-sectional standard deviation 50 times the mean, reflecting the highly risky nature of these investments and a similarity to venture capital.

Although it is a challenge to calculate volatility or risk-adjusted returns for private assets generally and for our data specifically, it is nonetheless instructive to compare internal rates of return (IRR) for our four vintages of randomly selected college tennis players with other passive investments. Figure 1 therefore displays vintage IRRs compared to the average return from 1928 to 2024 on passive benchmarks such as the S&P 500 Index, the small-capitalization stock index, three-month Treasury bills, ten-year Treasury bonds, BAA-rated corporate debt, and real estate. IRRs are calculated using the year-by-year portfolio-level cash flows where available.[9] Several observations are notable. First, vintage IRRs decrease across the vintages. Because the number of earning years across a tennis career is truncated for later vintages, the returns from these investments naturally are depressed and presumably would increase as the careers of the players develop further. Second, although the vintage IRRs of these randomly selected tennis players compare favorably to risk-free investments, such as the Treasury bills and Treasury bonds, risky liquid investments, such as the S&P 500 Index, small-cap stock, and risky corporate debt tend to perform better. As we show more fully below: however, using an informed selection criteria based on information available at the time portfolios are created increases the profitability five to ten times over building portfolios randomly, depending on whether endorsements are included in the analysis, which would create returns highly favorable to these passive investments.

**FIGURE 1 Internal Rates of Return of Tennis Player Vintages Compared to Passive Benchmarks**




*Note: Vintage internal rates of return (IRR) are calculated based on annual portfolio-level cash flows except for the past three years of data in which the three-year cash flows are averaged over each of the three years. Benchmark returns are average from 1928 to 2024 and derived from http://www.damodaran.com, which draws on Bloomberg, Morningstar, Capital IQ, and Compustat.*

**TABLE 6 Portfolio TVPI Simulations of Prize Money Only for Five Randomly Selected College Tennis Players by Vintage and Percentile**

| | 100% | 90% | 75% | 50% | 25% | 10% | 0% |
|---|---|---|---|---|---|---|---|
| **Panel A: Male and Female Portfolios** | | | | | | | |
| Vintage 1 | 32.19 | 7.76 | 1.33 | 0.46 | 0.10 | 0.06 | 0.01 |
| Vintage 2 | 9.05 | 3.44 | 2.20 | 1.17 | 0.45 | 0.22 | 0.03 |
| Vintage 3 | 6.01 | 2.57 | 1.68 | 0.82 | 0.43 | 0.19 | 0.03 |
| Vintage 4 | 14.27 | 3.65 | 1.44 | 0.86 | 0.43 | 0.25 | 0.05 |
| **Panel B: Male-Only Portfolios** | | | | | | | |
| Vintage 1 | 25.67 | 9.03 | 2.17 | 0.62 | 0.12 | 0.06 | 0.01 |
| Vintage 2 | 10.10 | 3.86 | 2.58 | 1.59 | 0.66 | 0.24 | 0.03 |
| Vintage 3 | 6.96 | 2.52 | 1.69 | 0.78 | 0.40 | 0.16 | 0.04 |
| Vintage 4 | 9.97 | 2.38 | 1.24 | 0.41 | 0.25 | 0.16 | 0.04 |
| **Panel C: Female-Only Portfolios** | | | | | | | |
| Vintage 1 | 0.63 | 0.32 | 0.22 | 0.17 | 0.09 | 0.07 | 0.01 |
| Vintage 2 | 2.92 | 1.12 | 0.86 | 0.46 | 0.29 | 0.17 | 0.04 |
| Vintage 3 | 7.03 | 2.56 | 1.40 | 0.81 | 0.48 | 0.29 | 0.02 |
| Vintage 4 | 10.85 | 4.25 | 2.06 | 1.43 | 0.98 | 0.62 | 0.03 |

*Note: Vintages 1, 2, 3, and 4 represent college tennis players turning professional during 2007-2009, 2010-2012, 2013-2015, and 2016-2018, respectively. The distribution of outcomes is derived from 10,000 randomly constructed portfolios of five players within each vintage, representing a $50,000 investment in exchange for a 10-percent interest in player earnings.*

Table 6 provides the total value to paid-in capital (TVPI) for the randomly generated portfolios. TVPIs greater than one generated a profit. The greatest TVPI was 32.19 for portfolios of men and women in vintage 1. The greatest TVPI for male-only portfolios is 25.67, also in vintage 1. The female-only portfolios had the best performance in vintage 4 with a maximum TVPI of 10.85. Again, we see the median profitability of the female-only portfolio turning positive in vintage 4, surpassing the median profitability of male-only portfolios.

In general, the median portfolio of randomly generated portfolios of college tennis players is unprofitable. Portfolios do not turn profitable until approximately the 75th percentile, suggesting that such investments compare unfavorably to either risk-free assets or risky assets such as public equity. One potential technique to increase the return of these portfolios is to decrease the initial investment by offering college tennis players turning professional $25,000 rather than $50,000 for the same 10-percent share of their future earnings. A lower initial investment, however, also decreases the likelihood of college tennis players turning professional accepting an investor's offer. Moreover, the players least likely to accept the less-attractive offer are those players with the most promising earnings prospects. Unreported results indicate that the median portfolio generally remains unprofitable even under these more optimistic assumptions. It appears therefore that portfolios of randomly selected college tennis players are unattractive relative to other investments.

### *Randomly Generated Portfolio Including Endorsements*

Top players receive a significant amount of their income from endorsements (see table 2), and this fact significantly increases the potential payout for an investor. Endorsement information for most players is obscure, however. Tables 7 and 8 report profit and TVPI for randomly generated portfolios assuming players also earn endorsements, according to an ad hoc model we develop in the appendix that relates endorsements to prize money based on observations in the marketplace. Including endorsements in the equity interest has little impact on most of the portfolio investments in individual players. It does not follow, however, that including endorsements (even in this more modest modeling) is unimportant. Like venture capital investments, the highly skewed nature of the payoffs of individual investments significantly influences the average outcome and is an important component of the profitability profile.

### *Selecting Tennis Players with Prior Information*

The preceding analysis based on randomly generated portfolios assumes investors have no prior knowledge of the tennis players composing the portfolio (or at least an inability to act on it). We relax that assumption and assume that investors can use informed selection criteria, such as college ranking, junior ranking, or prize money earned before turning professional, to select a tennis player in which to invest. Tables 9 and 10 provide the TVPI for informed portfolios of college tennis players turning professional by vintage year, gender, and selection criteria.

### TABLE 7 Portfolio Profit Simulations Including Endorsements of Five Randomly Selected College Tennis Players by Vintage and Percentile

| | 100% | 90% | 75% | 50% | 25% | 10% | 0% | MEAN | % PROFIT |
|---|---|---|---|---|---|---|---|---|---|
| **Panel A: Male and Female Portfolios** | | | | | | | | | |
| Vintage 1 | $16,035,647 | $4,219,788 | $74,532 | –$132,615 | –$222,821 | –$235,100 | –$247,094 | $723,637 | 27.4% |
| Vintage 2 | $2,882,364 | $839,185 | $409,550 | $76,172 | –$139,732 | –$195,044 | –$240,275 | $204,805 | 56.5% |
| Vintage 3 | $1,715,750 | $525,297 | $230,787 | –$41,801 | –$139,055 | –$204,020 | –$242,539 | $75,104 | 42.0% |
| Vintage 4 | $5,243,377 | $917,745 | $158,838 | –$31,589 | –$143,696 | –$186,660 | –$238,759 | $197,631 | 43.2% |
| **Panel B: Male-Only Portfolios** | | | | | | | | | |
| Vintage 1 | $16,083,203 | $5,191,716 | $414,340 | –$95,923 | –$218,532 | –$235,506 | –$246,857 | $1,076,713 | 36.9% |
| Vintage 2 | $2,802,863 | $961,756 | $544,994 | $229,196 | –$85,728 | –$189,392 | –$242,116 | $301,135 | 64.7% |
| Vintage 3 | $2,347,609 | $524,265 | $260,086 | –$45,814 | –$145,215 | –$209,331 | –$241,906 | $77,452 | 42.5% |
| Vintage 4 | $5,407,753 | $548,551 | $134,004 | –$150,517 | –$186,542 | –$209,442 | –$240,463 | $166,503 | 27.5% |
| **Panel C: Female-Only Portfolios** | | | | | | | | | |
| Vintage 1 | –$99,672 | –$171,360 | –$194,357 | –$207,968 | –$227,341 | –$233,107 | –$245,370 | –$207,371 | 0.0% |
| Vintage 2 | $523,065 | $31,334 | –$31,669 | –$134,767 | –$176,069 | –$206,680 | –$238,440 | –$100,284 | 17.4% |
| Vintage 3 | $2,330,803 | $535,233 | $103,080 | –$46,194 | –$130,362 | –$177,837 | –$244,202 | $62,389 | 40.3% |
| Vintage 4 | $3,060,523 | $1,046,476 | $280,080 | $112,779 | –$7,459 | –$97,356 | –$240,910 | $249,102 | 73.1% |

*Note: Vintages 1, 2, 3, and 4 represent college tennis players turning professional during 2007-2009, 2010-2012, 2013-2015, and 2016-2018, respectively. The distribution of outcomes is derived from 10,000 randomly constructed portfolios of five players within each vintage, representing a $50,000 investment in exchange for a 10-percent interest in player earnings.*

### TABLE 8 Portfolio TVPI Including Endorsements for Simulations of Five Randomly Selected College Tennis Players by Vintage and Percentile

| | 100% | 90% | 75% | 50% | 25% | 10% | 0% |
|---|---|---|---|---|---|---|---|
| **Panel A: Male and Female Portfolios** | | | | | | | |
| Vintage 1 | 65.14 | 17.88 | 1.30 | 0.47 | 0.11 | 0.06 | 0.01 |
| Vintage 2 | 12.53 | 4.36 | 2.64 | 1.30 | 0.44 | 0.22 | 0.04 |
| Vintage 3 | 7.86 | 3.10 | 1.92 | 0.83 | 0.44 | 0.18 | 0.03 |
| Vintage 4 | 21.97 | 4.67 | 1.64 | 0.87 | 0.43 | 0.25 | 0.04 |
| **Panel B: Male-Only Portfolios** | | | | | | | |
| Vintage 1 | 65.33 | 21.77 | 2.66 | 0.62 | 0.13 | 0.06 | 0.01 |
| Vintage 2 | 12.21 | 4.85 | 3.18 | 1.92 | 0.66 | 0.24 | 0.03 |
| Vintage 3 | 10.39 | 3.10 | 2.04 | 0.82 | 0.42 | 0.16 | 0.03 |
| Vintage 4 | 22.63 | 3.19 | 1.54 | 0.40 | 0.25 | 0.16 | 0.04 |
| **Panel C: Female-Only Portfolios** | | | | | | | |
| Vintage 1 | 0.60 | 0.31 | 0.22 | 0.17 | 0.09 | 0.07 | 0.02 |
| Vintage 2 | 3.09 | 1.13 | 0.87 | 0.46 | 0.30 | 0.17 | 0.05 |
| Vintage 3 | 10.32 | 3.14 | 1.41 | 0.82 | 0.48 | 0.29 | 0.02 |
| Vintage 4 | 13.24 | 5.19 | 2.12 | 1.45 | 0.97 | 0.61 | 0.04 |

*Note: Vintages 1, 2, 3, and 4 represent college tennis players turning professional during 2007-2009, 2010-2012, 2013-2015, and 2016-2018, respectively. The distribution of outcomes is derived from 10,000 randomly constructed portfolios of five players within each vintage, representing a $50,000 investment in exchange for a 10-percent interest in player earnings.*

**TABLE 9 TVPI for 10 Percent of Prize Money Only of Informed Portfolios of College Tennis Players**

| | TOP 5 PRIZE MONEY | COLLEGE RANKING | JUNIOR RANKING | PRIZE MONEY BEFORE PRO |
|---|---|---|---|---|
| **Panel A: Male and Female Portfolios** | | | | |
| Vintage 1 | 19.22 | 9.68 | 0.65 | 7.78 |
| Vintage 2 | 10.46 | 6.00 | 2.03 | 5.55 |
| Vintage 3 | 7.69 | 1.97 | 0.77 | 1.86 |
| Vintage 4 | 10.19 | 1.05 | 1.68 | 1.74 |
| Average | 11.89 | 4.67 | 1.28 | 4.23 |
| **Panel B: Male-Only Portfolios** | | | | |
| Vintage 1 | 19.22 | 10.10 | 0.51 | 17.13 |
| Vintage 2 | 10.46 | 5.46 | 2.03 | 5.55 |
| Vintage 3 | 6.28 | 2.17 | 0.79 | 1.24 |
| Vintage 4 | 7.91 | 5.78 | 4.75 | 4.63 |
| Average | 10.97 | 5.88 | 2.02 | 7.14 |
| **Panel A: Female-Only Portfolios** | | | | |
| Vintage 1 | 0.39 | 0.23 | 0.36 | 0.24 |
| Vintage 2 | 1.42 | 1.16 | 0.24 | 0.96 |
| Vintage 3 | 3.96 | 1.83 | 2.42 | 3.41 |
| Vintage 4 | 5.83 | 1.15 | 1.81 | 5.04 |
| Average | 2.90 | 1.09 | 1.21 | 2.41 |

*Note: Vintages 1, 2, 3, and 4 represent college tennis players turning professional during 2007-2009, 2010-2012, 2013-2015, and 2016-2018, respectively. The distribution of outcomes is derived from 10,000 randomly constructed portfolios of five players within each vintage, representing a $50,000 investment in exchange for a 10-percent interest in player earnings.*

**TABLE 10 TVPI for 10 Percent of Prize Money and Endorsements of Informed Portfolios of College Tennis Players**

| | TOP 5 PRIZE MONEY | COLLEGE RANKING | JUNIOR RANKING | PRIZE MONEY BEFORE PRO |
|---|---|---|---|---|
| **Panel A: Male and Female Portfolios** | | | | |
| Vintage 1 | 42.22 | 22.24 | 0.65 | 17.74 |
| Vintage 2 | 13.39 | 7.45 | 2.31 | 6.86 |
| Vintage 3 | 9.85 | 2.43 | 0.77 | 1.86 |
| Vintage 4 | 17.89 | 1.05 | 1.68 | 1.74 |
| Average | 20.84 | 8.29 | 1.35 | 7.05 |
| **Panel B: Male-Only Portfolios** | | | | |
| Vintage 1 | 42.22 | 22.66 | 0.51 | 39.66 |
| Vintage 2 | 13.39 | 6.92 | 2.31 | 6.86 |
| Vintage 3 | 7.87 | 2.62 | 0.79 | 1.24 |
| Vintage 4 | 14.98 | 12.20 | 10.82 | 10.70 |
| Average | 19.62 | 11.10 | 3.60 | 14.62 |
| **Panel C: Female-Only Portfolios** | | | | |
| Vintage 1 | 0.39 | 0.23 | 0.36 | 0.24 |
| Vintage 2 | 1.42 | 1.16 | 0.24 | 0.96 |
| Vintage 3 | 4.52 | 1.83 | 2.99 | 3.98 |
| Vintage 4 | 7.24 | 1.15 | 1.81 | 5.99 |
| Average | 3.39 | 1.09 | 1.35 | 2.79 |

*Note: Vintages 1, 2, 3, and 4 represent college tennis players turning professional during 2007-2009, 2010-2012, 2013-2015, and 2016-2018, respectively. The distribution of outcomes is derived from 10,000 randomly constructed portfolios of five players within each vintage, representing a $50,000 investment in exchange for a 10-percent interest in player earnings.*

An investor could observe college ranking, junior ranking, and prize money earned before turning professional to select the five best players ex ante based on each criterion, corresponding to the last three columns, respectively, in tables 9 and 10. As a point of reference, we also provide in the first column a portfolio of the five most profitable players ex post, which assumes the investor had perfect foresight to select these players as a point of comparison. Of course, an investor would not be able to invest in this portfolio ex ante because it is unknown when the players are selected. Once again, the investor would invest $50,000 into each player in each exchange for 10 percent of their future prize money. The total investment in a portfolio of five players remains $250,000.

Table 9 reports the TVPI assuming a share in a player's prize money only. Panel A provides results from the sample of both male and female players in which college ranking provides the highest average TVPI of 4.67, followed by prize money before turning professional of 4.23, representing a substantial improvement over random selection in which only one in four of the vintage portfolios was profitable (see table 6). In vintage 4, using the prize money selection criteria is the most profitable. Notably, all but one of the twelve portfolios selected according to three criteria over four vintages are profitable. Compared to the TVPI reported in table 6, these informed TVPI show that using informed selection criteria based on information available at the time portfolios are created increases the profitability by five times, i.e., 4.67 versus 0.86 median, over building portfolios randomly ignoring the impact of endorsements.

Portfolios of male-only players (see table 9, panel B) and female-only players (see table 9, panel C) are most profitable based on prize money before turning professional. Again, this represents a substantial improvement over selecting a portfolio randomly in which only one in four median portfolios is profitable (see table 6) and begins to approach the profitability of having perfect foresight. Although portfolios of female players are less profitable than male-only portfolios, their prospects have increased substantially in more recent vintages, suggesting OneVision successfully is providing opportunity for women to share in prize money. At the same time male-only portfolios have declined, suggesting a wealth transfer from male to female tennis players. The profit sharing does not appear to be random, however, because in vintage 4, for example, informed selection is five times more profitable than random selection.

Table 10 assumes the investor receives 10 percent of the prize money and 10 percent of the endorsement money. The endorsement money is calculated using the model discussed earlier in the paper. Compared

**WE EXAMINED PORTFOLIOS COMPOSED OF MALE AND FEMALE PLAYERS, MALE-ONLY PLAYERS, AND FEMALE-ONLY PLAYERS ACROSS FOUR VINTAGE YEARS.**

to the TVPI reported in table 7, these informed TVPI show that using informed selection criterion based on information available at the time the portfolios are created increases the profitability ten times, i.e., 8.29 versus 0.86 median, over building portfolios randomly ignoring the impact of endorsements. The same trends observed within table 9 are apparent in table 10. For the sample of male and female players, the college ranking selection criteria using male and female players slightly outperforms the prize money criteria.

Although the trends shown in tables 9 and 10 are similar, including endorsements (even using the more modest modeling we use in this analysis) nearly doubles the profitably of selecting portfolios using informed criteria, such as prize money before turning professional and college ranking, with TVPIs of 8.29 and 7.05, respectively, compared to 4.67 and 4.23 excluding endorsements. This especially is true for portfolios composed of both genders and male-only portfolios. It is less true of female-only portfolios. Overall, the prize money selection criteria improve across vintages compared to the college ranking criteria.

In the sample of male-only players (see table 10, panel B), TVPI using the prize money selection criteria is most profitable. For samples of male-only players and samples of female-only players the selection criteria of prize money before turning professional is most profitable. Farinella et al. (2024) found college ranking provided the most predictive power for profitability of a portfolio. Farinella et al. (2024), however, only examined the full sample of male and female players, which is consistent with our finding for the full sample. College ranking is a slightly more profitable selection criteria than prize money before turning professional. However, we find this changes over time for the full sample, and prize money before turning professional is the most profitable selection criteria for portfolios of male-only and female-only players.

## Conclusions

The tennis business has changed significantly during the past three years primarily due to the OneVision strategic plan. Prize money has grown substantially in most major tournaments and is distributed among more, lower-ranked players. It also is shared more equally between men and women. These changes have attracted more women to professional tennis, doubling the number of women in our sample during our ten-year sample. These changes also have improved the profitability of investing in former college tennis players who turn professional, especially female tennis players. Male and female former college tennis players who turn professional now earn similar prize money. Prize money earned by female players, however, has increased significantly. In fact, women in vintage 4 earn more than their male counterparts.

The mean and median career prize money for former college female players who turned professional increased ten-fold over ten years, making professional tennis more attractive for women. The median prize money for men increased over time as well, but the mean did not.

We evaluated the profitability of investing in portfolios of five players in which each player received $50,000 in exchange for 10 percent of their career earnings. We examined portfolios composed of male and female players, male-only players, and female-only players across four vintage years. The performance of female-only portfolios increased significantly and provided an attractive return for investors. No portfolios of former college female players in the earliest vintage earned a profit for investors. In the most recent vintage, however, 74 percent of the portfolios earned a profit. Meanwhile, the profitability of male-only portfolios decreased in both frequency and amount over the same timeframe, representing a wealth transfer from male to female players.

We also considered portfolios that would pay investors 10 percent of career prize money and endorsement income. The endorsement income impacted only a small number of players and portfolios but increased payoffs in the upper end of the portfolios. Better-performing portfolios have payoffs that increased 30 percent to 50 percent.

The investment performance of portfolios of randomly selected college tennis players is uninspiring. The median portfolio tends to have negative returns even when projected endorsements are considered. Building portfolios using informed selection criteria, however, substantially improves investment performance, with investors earning more than four times their original investment, depending on the selection criteria and improving the TVPI by five to ten times compared to randomly selected portfolios.

The changes in the payouts from tennis under the OneVision strategic plan have increased the career prize money for former college tennis players turning professional, especially female players. Although their careers may be profitable, many of these players struggle to pay expenses in the first year. A $50,000-investment in exchange for 10 percent of career earnings would help new players and can be profitable to investors. We demonstrated in this paper a unique investment opportunity that provides investors with significant returns and young athletes the ability to pursue their dreams.

Our sample necessarily truncates some career earnings in the most recent vintages, which biases against finding some of the results we have identified. That said, future research might reexamine these investments when that information becomes known. Moreover, our sample examines the experience of college tennis players that turn professional. Future research might identify other tennis players who turn professional but who face similar challenges to fund the earlier years of their professional tennis careers. Finally, we focused only on the sport of tennis. This investment approach could be extended naturally to other

individual sports, such as golf, in which the athlete is expected to fund expenses in the early years of a career.

As the alternative investment field expanded the scope of its investable assets, such as art and intellectual property, fund sponsors and investors also might consider investments in athletes of individual sports.

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## ENDNOTES

1. See "Top-10 List of the World's Most Popular Sports, Topend Sports, https://www.topendsports.com/world/lists/popular-sport/fans.htm.
2. See "Industry Trends," OneVision, https://onevision.atptour.com/one-vision/industry-trends.
3. One could conceptually extend a similar concept to the awarding of athletic scholarships in which universities offer scholarships in exchange for a share of post-collegiate earnings. Thanks to an insightful reviewer for making this observation.
4. See "Global Media Report 2021," SportBusiness Consulting, https://www.sportbusiness.com/global-media-report-2021.
5. See OneVision, https://onevision.atptour.com/one-vision/.
6. See "US Open Prize Money 2024," https://www.perfect-tennis.com/prize-money/us-open. The dichotomy between earnings for the top players and other has been blamed for match fixing.
7. See "Rankings Archive," Intercollegiate Tennis Association, https://www.itatennis.co/ita-archives/ResultsAndRankings/archive.html.
8. WTA Tour. (n.d.), retrieved from https://www.wtatennis.com/ and ATP TOUR (n.d.), retrieved from https://www.atptour.com/.
9. Year-by-year cash flows are unavailable for the past three years of our dataset. We approximate the annual cash flows for these three years only by smoothing them over the three years.
10. M. Morales, "How the 92nd-Ranked Tennis Player in the World Earns a Comfortable Living," *Forbes* (August 26, 2013), https://www.forbes.com/sites/miguelmorales/2013/08/26/aces-into-assets-how-michael-russell-has-made-a-profitable-career-in-the-demanding-world-of-pro-tennis/.

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## Appendix

### *Players Turning Professional After 2018*

The four primary portfolio vintages exclude college tennis players turning professional after 2018 because the career earnings stream for these recently turned professional players is substantially truncated compared to our four main vintages. In the interest of completeness, table A1, panel A, reports descriptive statistics for forty-two college tennis players turning pro between 2019 and 2020, which we can call vintage 5. As expected, average earnings for players in this sample are less than half that of the average earning of the 263 players turning pro between 2007 and 2018, presumably due to the fewer number of years over which earnings can accumulate. The uniqueness and non-representativeness of this vintage is exacerbated by the impact of COVID-19, which depressed earnings for all tennis players but which also had a disproportionately larger impact on the career earnings of players recently turning professional.

**TABLE A1 Descriptive Statistics for 263 College Tennis Players Turning Professional in 2019 and 2020**

| | FULL SAMPLE | MALE | FEMALE |
|---|---|---|---|
| **Panel A: Descriptive Statistics of Vintage 5** | | | |
| Mean | $318,118 | $465,624 | $121,443 |
| Standard Error | $92,953 | $155,134 | $35,032 |
| Median | $82,550 | $95,271 | $55,932 |
| Standard Deviation | $602,407 | $759,996 | $148,628 |
| Skewness | 2.79 | 1.96 | 1.85 |
| Kurtosis | 7.68 | 3.06 | 2.70 |
| Minimum | $4,446 | $4,446 | $6,425 |
| Maximum | $2,713,239 | $2,713,239 | $508,281 |
| Sum | $13,360,947 | $11,174,974 | $2,185,973 |
| Count | 42 | 24 | 18 |
| **Panel B: Monte Carlo Simulation of Portfolios of Five Randomly Selected Players (Vintage 5)** | | | |
| 100% | $704,691 | $798,421 | −$10,645 |
| 90% | $92,918 | $208,458 | −$143,897 |
| 75% | −$5,943 | $81,511 | −$169,926 |
| 50% | −$131,688 | −$47,139 | −$192,031 |
| 25% | −$195,476 | −$162,099 | −$215,540 |
| 10% | −$222,403 | −$211,564 | −$226,595 |
| 0% | −$245,313 | −$245,854 | −$244,707 |
| Mean | −$90,175 | −$17,478 | −$189,329 |
| Std. Dev. | $134,555 | $165,874 | $32,019 |
| Coefficient of Variation | 1.49 | 9.49 | 0.17 |
| % Profit | 23.93% | 42.02% | 0.00% |
| N | 42 | 24 | 18 |

Monte Carlo analysis of portfolios of five randomly selected players from this vintage (table A1, panel B) provides further evidence of the non-representativeness of this vintage. The median portfolio has substantially negative returns. Positive returns are not evident until the 90th percentile for the full sample compared to the 75th percentile for the four main vintages. Even the best-performing portfolio of female players loses money.

### *Randomly Generated Portfolio Including Endorsements*

Many companies that provide endorsement income require the monetary value of the contracts to be private. Players themselves may not want to disclose their income to the public. We therefore use anecdotal information to derive a hypothetical model for endorsements that builds upon the Farinella et al. (2024) model. The Farinella et al. (2024) model produced very high figures for the top players; for example, using that model resulted in lifetime earnings of $140 million for John Isner. John Isner earned only $22 million in career earnings and has a net worth of $12 million. We therefore believe the Farinella et al. (2024) model may overestimate career earnings and adjust their coefficients accordingly.

Using a similar framework as the Farinella et al. (2024) model, we use the ratio of endorsement money to prize money of the top ten players in table 2 to estimate the relationship between prize money and endorsement money for top players. Endorsement opportunities are influenced by factors beyond on-court performance, such as a player's life story, appearance, nationality, and charisma. Prize money is nonetheless a key factor driving endorsement opportunities. The endorsement-to-prize money ratio ranges from 0.41 for Alexander Zverev to 60.37 for Emma Raducanu. Excluding the three outliers above thirty, the average ratio of the remaining seven players is 1.42, which we apply to players earning $10 million or more in prize money.

Michael Russell, ranked 92 in the world, represents a data point for well-ranked players not in the top ten. He reports in a *Forbes* interview that he received $60,000 in annual endorsement money and $210,000 in annual earnings, representing an endorsement income ratio of approximately 0.28, which we use to estimate endorsement income for players earning between $2 million and $10 million in career prize money.[10] John Isner, the top-earning player in our sample with more than $22 million in prize money, believes that players ranked below fifty receive very little money from endorsements. Most players ranked below 100 receive no endorsements. They may get products such as shoes, racquets, and clothing from companies, but these perquisites are relatively modest and difficult to share with investors.

Tables 7 and 8 report profit and TVPI for randomly generated portfolios, assuming players also earn endorsements, $M$, according to the following model.

$$M = \begin{cases} 0 \text{ for } \times < \$2 \text{ million} \\ 0.28 \text{ for } \$2 \text{ million} \leq \times < \$10 \text{ million} \\ 1.40 \text{ for } \times \geq \$10 \text{ million} \end{cases}$$

Incorporating endorsements changes the overall conclusions very little. Vintage 1 is still the most profitable portfolio. Male-only portfolios have become less profitable over time, and female-only portfolios arguably have become more profitable over time. The most noticeable change is that profit and TVPI, in some of the most profitable percentiles (75th percentile and above), have increased. Median portfolios and below are relatively unaffected.

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