Location-based Barriers to Mobility: Evidence from Elite High School Football Players

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ABSTRACT: A growing body of literature explores how neighborhoods influence the success of those who are raised in them. In this study, we contribute by examining the relationship between neighborhood characteristics and the success of elite high school football players. Elite high school players are a compelling group to study because, as individuals, they are i) well-aware that they possess very valuable human capital, ii) recognize that exploiting that capital requires attending college, and iii) invariably offered football scholarships, vastly reducing financial barriers to attending college. And yet some of these players fail to make it to a college campus. What explains such costly failures – what we term "derailments"? We develop a simple model in which an elite player develops two forms of human capital: athletic and academic. The model predicts an "investment effect" (low-mobility areas induce greater investment in athletics) and a "resource effect" (lower-resource areas render investment in academics less effective). Employing measures of local mobility from Chetty and Hendren (2018b) and measures of the local resource base, we find associations consistent with the predictions: Lower mobility counties produce more elite players than higher mobility counties, and among those elite players, derailment rates are significantly higher in the most poorly resourced areas (which also tend to have the lowest mobility).

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I. INTRODUCTION

A growing literature provides evidence that the neighborhood in which a child is raised has a substantial effect on intergenerational mobility – that is to say, on the child's chances of achieving a standard of living better than his or her parents (Chetty, Hendren, and Katz 2016; Chetty and Hendren 2018a, 2018b; Chyn 2018; Deutscher 2020; Nakamura, Sigurdsson, and Steinsson 2022; Chetty, Friedman, Hendren, Jones, and Porter 2026).[1] In this paper, we draw on that literature to explore whether neighborhood effects are apparent in a population with very valuable human capital and a clear path to upward mobility that is ostensibly independent of neighborhood characteristics: elite high school football players.

Over one million students participate in high school football each year, and many go on to play college football. The "recruiting process" matching players and colleges can be frenzied, with players competing for spots on programs and programs competing for commitments from players. The best players are signified by high ratings from major news services (ESPN, 247Sports, Rivals.com), which are summarized as a number of stars.[2] Less than one percent of high school football players receive a rating of 3-star or above. Such a rating essentially guarantees the player an athletic scholarship, which presumably leads to a spot on a major college football program's roster, the primary step towards professional football riches.[3]

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[1] Chetty et al. (2014, 1554) open their article as follows: "The United States is often hailed as the 'land of opportunity,' a society in which a person's chances of success depend little on his or her family background. Is this reputation warranted? We show that this question does not have a clear answer because there is substantial variation in intergenerational mobility across areas within the United States."

[2] We describe the rating systems in detail in Section II. In a typical year, the services grant one-to-two thousand 3-star ratings, three-to-four hundred 4-star ratings, and thirty-two 5-star ratings (the latter awarded only to the best of the best).

[3] Because college football is essentially the only place where a graduating high-school player can further develop his skills, it is a necessary pathway to the NFL. The data we analyze in this paper precede the now common practice of universities paying players, encompassing a period when even minor forms of

These elite (3-star and above) high school seniors will invariably have received signals of their potential market value (probably many over a period of years) from coaches, friends, and family; from multiple media outlets; and eventually through scholarship offers. They are therefore far more likely to be aware of the life-changing economic consequences of the steps that follow than are graduating high school seniors with comparably high IQs, who may recognize neither the value nor the uniqueness of their abilities. The path to a college football program is clear and all an elite high school player needs to do is take the initial step and join one.

Yet a small but persistent number of elite players fail at that first step, typically because they cannot meet college football's academic or disciplinary requirements. We term such players "derailed." The number is not large, comprising only about 3 percent of the more than 30,000 players in our data set. But even that many is a puzzle, given the stakes involved. All of these derailed players would have been informed of the academic standards well in advance, by recruiters if not by their own coaches. All of them would have been well aware of the stakes. Nonetheless, they fail to pass muster. In theory, derailment can be remedied, for example, by enrolling in a junior college program until the college standards have been met. And indeed, many try, but most only fail again, and as a result, never play a down of major college football.[4]

The existence of derailed players poses a puzzle: How is it possible that individuals with recognized talent, significant money at stake, and a clear path before them fail to make it even as far as a (free) college campus? We seek an explanation in the nature of the neighborhoods from

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compensation (for signing autographs, for example) could be punished by prohibition from future college football competition.

[4] The Netflix documentary *Last Chance U* follows elite high school players who play football at "JUCO's" while attempting to earn college academic eligibility. Much of the program follows guidance counselors' efforts to prevent students from flunking out, with a common reason for failure being missing class.

which the players are drawn. We do not engage in causal analysis; rather, we explore the covariates associated with an elite player's failure to advance. What we find is consistent with the idea that even when offered a clear path out of a disadvantaged neighborhood and strong incentives to follow it, the neighborhood effects may leave an even stronger mark, so that the path out becomes the road not taken.

We begin by providing an overview of college football, the recruiting process, and the link between high school player star ratings and NFL success. We follow by describing our data. Our main data set consists of every high school player rated 3, 4, or 5-star from 2005 through 2022, 33,848 elite high school football players in total. We use a separate data set to match each of the elite high school players to the rosters of major college football programs and identify 2170 unmatched players. We dig deeply into the backgrounds of these unmatched players and find that academic or disciplinary problems "derailed" 932 of them, while the remainder appear to have voluntarily withdrawn from football, often to play other sports.

We develop a simple conceptual model in which a player allocates his time between investing in two forms of human capital: athletic and academic. Each player has a baseline level of athletic talent, and athletic performance depends on the effort the player devotes to athletic development. Each player also has a baseline level of academic aptitude, but academic performance depends not only on the player's academic effort but also on the resources available in the player's local environment. The model gives us two central predictions: i) holding academic resources constant, players from low mobility areas will invest more heavily in developing athletic skills, because the lack of alternative paths upward reduce the value of investment in academic skills; and ii) conditional on becoming an elite football player, those from neighborhoods with weaker academic resources will be more likely to fail to meet the academic standards necessary to attend college (i.e., will be derailed) both because the productivity of any given level of investment is reduced, and because that reduction further reduces the incentive to invest. We refer to the former as the “investment effect”, and the latter as the “resource effect.”

To test for an investment effect, we organize players by county and make use of Chetty and Hendren’s (2018b) county-level intergenerational mobility measures. The measure we employ is Chetty and Hendren’s “all children” estimate of the percentage gain (or loss) in annual household income relative to parent income, based on the 25th percentile of parent income.[5] Using this measure, we find that the complete set of elite high school players, both successful and derailed, is drawn mainly from lower intergenerational mobility counties, consistent with the investment effect, with derailed players coming predominantly from the very *lowest* mobility counties (which is potentially consistent with the resource effect). The relationships are very apparent in figures and simple tables. We also estimate a two-stage hurdle model on county-level data organized into mobility deciles. The results show that the probability that a county hosts any elite players falls as the county level intergenerational mobility deciles rise (that is, as county intergenerational mobility rises), as does the number of elite players in a county; the same results hold even more strongly for derailed players.

We also find that the proportion (not just the number) of derailed players among the total number of elite players in a given county falls as county mobility rises—suggestive evidence in the direction of the resource effect. To dig deeper, we organize our data set at the player level rather than the county. We focus on six measures at the player level: high school quality, high

[5] The Chetty and Hendren measure is based on the relationship between a family’s household income when the child is living at home and the child’s subsequent income at age 26. Chetty and Hendren (2018b) also provide several other mobility measures, estimated as county level causal effects.

school racial composition, participation in high school free lunch programs, neighborhood median household income, neighborhood racial composition, and neighborhood share of single-parent households. We find that derailed players attended significantly worse high schools (economically and statistically), characterized by lower academic scores and higher participation in free lunch programs, and that they were more likely to attend schools with a larger share of black students. In addition, these schools are located in neighborhoods with lower household income and higher rates of single parenthood. In short, the average derailed player went to a lower-performing school and lived in a more disadvantaged neighborhood than the average elite player, consistent with the resource effect.

Although our study is not designed to establish causal effects, it is useful to consider the direction of likely biases. A natural concern is that players may sort across schools or neighborhoods in ways that confound the relationships we document. However, to generate our findings mechanically, such sorting would need to send players who are more likely to be derailed to systematically worse environments. This is not the most plausible form of selection. If anything, higher-ability or more motivated players are likely to sort into stronger football programs and better-resourced schools, which would bias our estimates toward zero. Moreover, our study is conducted within a highly selected population, elite players who face strong incentives and clear information regarding academic eligibility, limiting the scope for unmeasured heterogeneity to drive the results. For these reasons, while we interpret our estimates as associations, the patterns we document are unlikely to be explained solely by standard selection mechanisms.

We finish our study by briefly reviewing the efforts by derailed players to remedy their situations by returning to school. Roughly 85 percent of derailed players enrolled in a junior college or equivalent in an attempt to meet the NCAA's academic standards. Yet fewer than 38 percent of all derailed players ultimately reached an FBS roster. And even conditional on making it to college and playing football, derailed players achieved NFL success at a rate well below comparably rated players who were not derailed.

By documenting the relationship between neighborhood characteristics and upward mobility for a set of young men with a well-defined path to success that is ostensibly independent of neighborhood circumstances, this paper adds to a growing body of empirical research showing how local environments influence long-term outcomes. Chetty, Hendren, and Katz (2016) examine the long-run outcomes of children who participated in the randomized Moving to Opportunity housing-voucher experiment and show that children who moved from high-poverty to lower-poverty neighborhoods are more likely to attend college and earn higher incomes as adults. Chetty and Hendren (2018a) develop a causal strategy to measure the effect of neighborhoods, finding that children who were younger when they moved to a higher mobility neighborhood (age 6 rather than age 12, for example) did better as adults. Employing Chetty and Hendren's empirical approach, Deutscher (2020) finds similar evidence of causal neighborhood effects when investigating neighborhoods in Australia. Focusing on exogenous shocks that force families to move, Chyn (2018) analyzes the effect of the demolition of public housing projects in Chicago and finds that children who were moved to better neighborhoods were more likely to be employed and earn higher incomes as adults, and were less likely to be arrested; Nakamura, Sigurdsson, and Steinsson (2022) find similar improvements when investigating the effect of a volcanic eruption in Iceland.[6]

[6] For other related literature, see, e.g., McLanahan and Sandefur (1994); Heckman and Masterov (2007); Deming (2009); Bertrand and Pan (2013); Hoxby and Avery (2013); Chetty et al. (2014); Jackson, Johnson, and Persico (2016); Autor et al. (2019); Danieli, Devi, and Fryer (2021).

In addition, by employing the county-level mobility measures created by Chetty and Hendren (2018b), we join other researchers who have demonstrated their broader usefulness. For example, Donnelly et al. (2017) link children's cognitive and behavioral outcomes to Chetty and Hendren's county mobility estimates and find that growing up in a high-mobility county is associated with fewer child behavioral problems and meaningful gains in early cognitive skills, while Mann, Edin, and Shaefer (2024) shows that counties with lower upward mobility according to the Chetty and Hendren measures experience higher rates of violent crime and homicide (indeed, the Chetty and Hendren measures may explain more than traditional measures such as poverty or unemployment). Fogli et al. (2026) use Chetty and Hendren neighborhood exposure measures to explore the relationship between residential segregation by income and income inequality, concluding that increases in segregation contributed substantially to the rise in US income inequality over recent decades. Chyn et al. (2026) instrument for racial segregation using the location of railroads tracks, and (employing the Chetty and Hendren mobility measures) find that racial segregation reduced intergenerational mobility among all black children and among white children from low-income households, accompanied by falling academic achievement and rising incarceration rates and teenage births. Our finding of a relationship between Chetty and Hendren mobility measures and the derailment of high school football stars fits right in.

Our findings likewise contribute to the longstanding, multi-field debate on whether emphasizing youth sports such as football is “good” or “bad” for disadvantaged youths (e.g., Beamon and Bell 2002). Much of the debate implicitly assumes that the opportunity cost of athletic competition is the time spent in the classroom. Our study suggests that elite players are disproportionately drawn from low-mobility areas and that, within this population, derailed players tend to come from worse schools and neighborhoods than their non-derailed peers—consistent with the idea that disadvantaged environments will impede even highly talented athletes from taking advantage of the opportunities their skills provide. In other words, a single-minded focus on athletics may be a rational response to the poor circumstances the children face.[7]

II. BACKGROUND

A. College Football and the Recruitment of High School Athletes

College football is hugely popular and an important source of revenue for many colleges and universities, either directly through dollars generated by football games or indirectly via attracting alumni donations and future applicants (e.g., Humphries and Mondello 2007; Pope and Pope 2009, 2014). The NCAA, the sport's governing body, divides college football into three divisions – Divisions I, II, and III – that differ in the number of scholarships granted, the time demanded of student-athletes, and the proportion of the student body that participates in collegiate sports. NCAA Division I football is further split into two subdivisions: the high-profile Football Bowl Subdivision (FBS), with 134 universities, and the Football Championship Subdivision (FCS), with 129 universities.

The FBS is where "big-time" college football is played; the much-watched College Football National Championship follows a playoff among the most highly ranked FBS teams. The vast majority of players who sign a contract with a high-paying National Football League team attended an FBS school, and the most talented high school seniors compete avidly for spots on

[7] For recent studies investigating the socio-economic backgrounds of elite high-school football players, see Allison, Davis, and Barranco (2018), who analyze a sample of 929 recruits, and White et al. (2021) who analyze a sample of NFL players.

FBS rosters.[8] The top FBS programs compete equally intensely for the best high school players. The "recruiting" process culminates when a given player accepts a football scholarship from a particular school.[9] The top players receive many scholarship offers. For a player to join an FBS program, he must meet the NCAA's academic standards and comply with the disciplinary standards set by his future school, as we will discuss in more detail. These standards have posed a barrier for some outstanding high school players.

B. Ranking the Recruits

For fans, tracking the off-season recruiting process is nearly as popular as following the in-season games, as colleges scramble to attract the best high school seniors to their football programs. In recent years, the paying of college players and the easing of rules regarding transferring from one school to another have altered college football in important ways. Yet the imperative to identify the best high school football players and convince them to enroll at State U remains unchanged.[10]

Several websites have emerged to rate high school football players, generally during the player's senior year. The three leading ranking services are 247Sports, ESPN, and Rivals.com, each of which assigns its own numerical rating to graduating high school seniors.[11] In addition to its own rating, 247Sports constructs a "Composite" ranking that aggregates ratings from ESPN,

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[8] https://www.collegetransitions.com/blog/colleges-with-the-most-nfl-players/

[9] Agreements are not binding until the player signs a formal commitment letter. For more detailed explorations of the recruiting process, see, e.g., DuMond, Lynch, and Platania (2008); Harris (2018).

[10] Our analysis covers 2005-2022, a period that is nearly all prior to the U.S. Supreme Court's 2021 decision in *NCAA v. Alston* which led to fundamental changes in the rules regarding paying and retaining players (see, e.g., Noll 2022 for details).

[11] The services may differ in their player rankings, but not by much. For example, in 2025, ESPN and 247Sports listed the same top three candidates in the same order, while Rivals.com listed two of the same three, with the third from the other two services appearing fourth.

Rivals.com, and 247Sports into a single normalized ranking that ranges from 0 to 100.[12] In the analysis that follows, we employ the 247Sports Composite ranking.

All three services express their ratings more concisely, as a number of "stars," with the top players receiving ratings from 3 to 5-stars, and players below the 3-star level seldom rated.[13] A "5-star player" is the elite of the elite, the very best of the best, and the rating services generally grant no more than thirty-two 5-star designations annually (to match the number of first-round picks in the NFL draft). Not quite as rare, but nearly so, are the several hundred 4-star designations granted annually, and the one-to-two thousand annual 3-star designations. To put these numbers in context, roughly 250,000 high school football players graduate each year, meaning that less than one percent of all graduating high school football players receive a rating of 3-star or higher.[14]

The potential value of the human capital reflected in these ratings is enormous. College football is the only path to professional football, and the chances of an elite player making it to the NFL and collecting an enormous salary for at least a short period of time (the minimum NFL rookie salary in 2025 was $840,000) are meaningful.[15] Table 1 shows several measures of the likelihood of NFL success by star rating. Not surprisingly, high school seniors with 5-star ratings fare best: More than one-third are on an NFL roster for at least one season, and more than 15 percent are in the league for five years or more. The NFL prospects for 4-star athletes are not quite as bright, but a 4-star player still has a greater than 13 percent chance of playing in the NFL

[12] As a practical matter, players who would receive a score below 70.0 are not rated.
[13] Our data set includes a few 2-star players, but such players compete almost entirely at Division II or Division III schools and will not be part of our study.
[14] The National Federation of High School Associations estimates that, on average, more than one million high school athletes competed on football teams annually from 2005 through 2022. See www.nfhs.org.
[15] As we mentioned above, our data set covers the period right before colleges began paying college football players (legally, at least).

for at least one season. The 3-star athletes are greater longshots but still have a 4.5 percent chance of making it to the NFL, 45 times the NFL odds for an unranked player.[16] In short, a 3-star rating or higher signifies the possession of very valuable human capital. And yet, many 3-to-5-star high school athletes never make it to a college football program. We will term these players "derailed."

III. A CONCEPTUAL MODEL

We develop a simple model to capture the key trade-offs faced by elite high school football players to provide the intuition behind the mechanisms that generate our empirical predictions.[17] The model has two stages. In the first stage, a player allocates effort between athletics and academics, determining both the probability of becoming an elite recruit and the level of academic preparation carried forward. In the second stage, conditional on becoming elite, the player again allocates effort between athletics and academics to determine whether he satisfies the academic requirements necessary to enroll in a major college football program.

A. Stage 1: Becoming Elite

In the first stage, a player allocates effort between athletic development and academic work. Let $e \in [0, 1]$ denote the share of effort devoted to athletics, so that $1 - e$ is the effort devoted to academics. Athletic performance depends on baseline talent and effort. A player becomes an elite recruit if his performance exceeds a threshold. Let the probability of becoming elite increase in athletic effort:

[16] Note that unranked players can also enjoy NFL success, but very rarely do so, as shown by the "Other" category in Table 1.

[17] The Appendix presents a formal two-stage model of effort allocation and derailment, developed by Jingyi Jia (University of Chicago) in collaboration with us, which underlies the simplified framework described here.

$$q(e),\ q'(e) > 0.$$

At the same time, academic effort generates a stock of academic preparation that carries into the next stage. Let this stock be:

$$\beta = w(1 - e),$$

where w captures the quality of local academic resources.

If the player becomes elite, he proceeds to Stage 2 with continuation value $W(\beta, w, m)$, where m denotes local economic mobility. If he does not become elite, he enters the conventional labor market, receiving a payoff that depends on both mobility and academic preparation:

$$\mu(m) + \beta.$$

Higher mobility raises the return to conventional academic advancement, while academic effort improves outcomes in either case. The player's Stage 1 decision therefore balances the benefit of increasing the probability of elite status against the cost of reducing academic preparation.

Economic mobility affects the player's Stage 1 decision by altering the value of the conventional fallback option. In high-mobility environments, academic investment has a high return outside of football. In low-mobility environments, the return to the conventional path is lower, making athletic success relatively more attractive. As a result, lower mobility reduces the opportunity cost of athletic effort and induces players to shift effort toward football. This leads to our first prediction:

Investment Effect Prediction: *Lower-mobility areas produce more elite football players.*

This shift in effort has an additional implication. Because more time is devoted to athletics, less is invested in academics, reducing the stock of academic preparation carried into Stage 2.

B. Stage 2: Converting Elite Status into Enrollment

In the second stage, conditional on becoming elite, the player chooses how much effort to devote to academics to meet the academic requirements for college enrollment. Let $s \in [0, 1]$ denote academic effort in this stage. Academic success depends on both inherited preparation and new effort:

$$K = \beta + ws + \varepsilon,$$

where ε captures idiosyncratic factors. The player enrolls in a college football program if K exceeds a threshold, k. Define the player's distance from the academic threshold at the start of Stage 2 as:

$$d = k - \beta.$$

A larger d indicates weaker inherited preparation and a greater academic deficit. The probability of meeting the academic requirement is increasing in study effort and decreasing in distance. Thus, players who arrive at Stage 2 with lower academic preparation must exert more effort to succeed. If the player satisfies the academic requirement, he receives the payoff associated with college football. If failure occurs, he enters the conventional labor market, receiving a payoff that depends on mobility and total academic capital accumulated across both stages.

Local resources directly affect the probability that an elite player satisfies academic requirements by influencing the productivity of academic effort. When resources are strong, a given level of study effort generates more academic progress. When resources are weak, the same effort yields less progress, making it more difficult to reach the academic threshold, which leads to our second prediction.

Resource Effect Prediction: *Conditional on becoming elite, players from lower-resource environments are more likely to be derailed.*

This effect operates both directly by reducing the effectiveness of academic effort, and indirectly by weakening the incentive to invest in academics.[18] Taken together, the model implies that the same environments that generate elite athletic talent may also hinder the ability of that talent to translate into college enrollment.[19]

The empirical analysis that follows focuses on these predictions. We will use county-level mobility measures from Chetty and Hendren (2018b) to look for evidence of an investment effect (i.e., that lower mobility counties are associated with the production of more elite players). We will use measures of the quality of local schools and neighborhoods to look for evidence of a resource effect (i.e., that worse schools attended and worse neighborhood characteristics are associated with more players who fail to meet academic or disciplinary standards).

[18] Mobility affects Stage 2 through two opposing channels in the Appendix model. First, lower mobility reduces academic investment in Stage 1, leading to weaker preparation and a greater distance from the academic threshold. Second, lower mobility raises the cost of failure, which can increase study effort in Stage 2 (a "gate" effect). The latter operates primarily for players near the academic threshold, while the former applies more broadly. As a result, for players with weak inherited preparation, the distance effect dominates, yielding higher derailment rates in low-mobility environments.

[19] The model also implies that players from lower-mobility areas arrive at the second stage with weaker academic preparation due to reduced investment in academics in Stage 1. While this mechanism plays an important role in linking the two stages of the model, we do not directly test this implication in the empirical analysis.

IV. THE DATA

A. Elite High School Football Players

Our primary data set consists of the universe of 33,848 high school seniors who graduated with a 247Sports Composite rating of 3-stars or higher from 2005 through 2022.[20] In addition to providing ratings, the 247Sports platform lists the high schools from which players graduated and the college football programs to which they committed. However, 247Sports provides no information on whether the player enrolled in the college to which he committed. To determine this, we match high school athletes from the 247Sports data set to CFBStats, a proprietary data set from SportsSource Analytics that tracks all Division I football players.[21] Our objective is to identify and compare ranked high school football players who successfully progressed to a Division I roster after their senior season with those who were "derailed." To identify derailed players, we proceed in two steps. First, we determine which of the elite high school seniors in our data set *cannot* be matched with a Division I football program the following year. Second, for any unmatched players, we conduct Google searches to determine why they did not transition successfully to a college football program. Determining what happened to these players was relatively straightforward (although extremely time-consuming), because most of them had been prominent high school football stars.[22]

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[20] The starting year is 2005, since that is the first available year for collegiate roster data. The ending year is 2022 to allow for the player two years after high school to make it to a NCAA Division I roster. Also, we excluded a small number of designated elite athletes from other countries, such as Canada.

[21] The matching process was long and tedious, requiring many iterations. Particular difficulties arose because many players shared names (9 named Jalen Williams, 8 named Chris Jones, and 8 named Chris Smith), and player names were not always spelled the same way across data sets (e.g., "DJ" versus "D.J."). In hundreds of cases, either 247Sports or CFBStats provided an incorrect spelling of the player's name.

[22] We searched using several combinations of the player's name, high school, hometown, committed university, and universities with scholarship offers, as well as various search terms such as "academics," "academic issues," "grades," "arrests," "football," and "recruiting," etc. The primary news sources include local newspapers, players' social media pages (primarily X or Hudl), and college fan websites and forums.

Our search revealed 932 elite players (i.e., 3-star or above) who received offers from at least one FBS football program, and often accepted offers (presumably made before a player's final high school grades were available) but were unable to enroll due to academic or disciplinary problems.[23] Regarding academic standards, the NCAA upholds strict admission rules for student-athletes, who must complete 16 NCAA-approved core courses in high school, graduate with a minimum core-course GPA of at least 2.30, and achieve a qualifying score on either the SAT or ACT.[24] In the "disciplinary problems" category, we include both players who committed an untoward act (e.g., a crime for which they were arrested and convicted) before enrolling in college, as well as a small number of players dismissed from their college team before the start of their first football season. Via Google searches, we determined that of the 932 derailed players, 772 failed to enroll in college due to academic issues, 118 experienced disciplinary problems, and 42 had a combination of the two.

Table 2 groups our entire data set of 33,848 elite high-school players by star rating and by whether they "transitioned seamlessly" to college or were instead "derailed." Column 1 presents the full data set, showing the relative abundance of 3-star athletes compared with 4- and 5-star players. Column 2 presents the set of players who transitioned seamlessly to Division I college football, which, not surprisingly, strongly resembles Column 1 because it contains most of the

[23] Column 2 includes all players who were not classified as "derailed." Most of these players joined a Division I roster immediately after high school. However, the category also includes 1238 players who appear to have met eligibility standards yet chose not to continue playing college football (often to pursue another sport in college). Excluding these voluntary withdrawals from the sample does not materially affect the empirical results.

[24] Student-athletes who met the GPA requirement but fell short on the test scores could still qualify as "academic redshirts," allowing them to receive athletic scholarships and practice with the team during their first year. However, they were ineligible to compete until they met the required academic progress standards. Because these players were immediately placed on a Division I college roster after high school graduation and appeared in the CFBStats data files, we have not included them among the sample of 932 players with academic and disciplinary issues.

players in our data set.[25] The derailed players, listed in Column 3, are slightly different in the expected direction: a bit more heavily weighted toward 3-star players and a bit less towards 5-star players.[26] Yet there are still a small number of 5-star players among them – players possessing nearly a one-in-three chance of at least a year in the NFL, *if* they can achieve the standards necessary to gain entrance to one of the college programs keen to have them. The proportion of 4-star players is nearly as high as in the full data set, and even the 3-stars among the derailed have an average rating in the "mid" category, making them probable starters for an FBS program.[27] All 932 derailed players had received offers from FBS programs, conditional on their academic record, and many had actually committed to particular programs before being ruled ineligible.

Failing to meet NCAA academic standards is not necessarily the end of the line for a derailed player. High school football players who do not initially meet NCAA Division I eligibility requirements may turn to junior colleges (JUCOs) or military colleges as an alternative route. If they perform well academically and on the football field, they may again receive college scholarship offers. This path often proves difficult, as successfully transferring from a JUCO to a Division I program requires multiple semesters of full-time coursework that leads to either an associate degree or roughly 48 transferable credit hours, while also maintaining a minimum GPA

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[25] Note that we include the 1238 "voluntary withdrawals" in the Column 2 grouping, as none of these represent "derailed" players per our online searches. We do so for conservatism, and the subsequent empirical tests are slightly sharper in distinguishing between "derailed" players and "seamless transition" players when we exclude "voluntary withdrawals" from the larger sample.

[26] The average numerical rating of the "derailed" players is 85.4 versus 85.7 for the "non-derailed" players.

[27] 247Sports divides its 3-star rankings into low, mid, and high. While a mid-3-star is projected as a starter for a top college football program, a low 3-star is likely a substitute or a starter for a lesser FBS program.

of 2.50. In short, the challenge is substantial, and as we will discuss later in this paper, the vast majority of derailed players fail to overcome it.

B. Chetty and Hendren (2018b) counties

We will employ the county-level mobility estimates developed by Chetty and Hendren (2018b), to explore whether elite players, derailed or not, are more likely to be found in low-mobility counties, consistent with our predicted investment effect. Our sample and theirs do not match perfectly: The Chetty and Hendren cohorts are children born 1980–1986 observed at age 26 from 2006 to 2012, while ours are high school students who graduated from 2005 through 2022. A high school graduate of 2005 might indeed have turned 26 in 2012, but most would have reached that age a decade or more later. If local mobility changes dramatically over short periods, the use of Chetty and Hendren's data would be difficult to justify. But of course, if local mobility changes rapidly, it would be of much less social concern. Therefore, documenting economically and statistically significant differences among our players that are consistent with Chetty and Hendren's county measures will speak to the causal mechanisms underlying the associations we document and the broader usefulness of the Chetty and Hendren measures.

For the players in our data set, we match the player-level zip code to counties and use Chetty and Hendren's online Table 2 to match counties to mobility.[28] The players in our data set are drawn from 1571 of the 2873 unique counties in the Chetty and Hendren data set, meaning that 1302 counties did not produce any elite players between 2005 and 2022.

[28] The source for the county causal effects is online_table2-2.xlsx available on Chetty's Opportunity Insights website in the Data Library section, labeled as "Preferred Estimates of Causal Place Effects by County." https://opportunityinsights.org/data. We attach a county FIPS code to each recruit's high-school location to merge the Chetty–Hendren county place-effect series, and are able to link over 99 percent of the elite players to a Chetty and Hendren county.

C. Attributes of High Schools and Neighborhoods

We intend to investigate whether school and neighborhood characteristics are associated with the likelihood that an elite high school football player is derailed, consistent with the resource effect described above. Our primary data source (247Sports) provides the names and locations of the high schools attended. We draw high school attributes from *U.S. News Academic Insights*, which collects detailed statistics on high schools. We use the high school zip code to draw U.S. Census data for the defined zone.

U.S. News Academic Insights data

As of 2024, *U.S. News Academic Insights* tracked nearly 25,000 public high schools across the United States, assigning rankings to 17,760 of them. *U.S. News Academic Insights* has collected annual data on public high schools since 2007 but greatly expanded its coverage in 2019. *U.S. News Academic Insights* changed its rating standards significantly in 2019, decreasing the focus on standardized test scores, and as a result, no longer provides data from before 2019. Furthermore, it does not report comparable statistics for private high schools, such as prep or religious schools. Therefore, any players attending private or religious high schools will be excluded from analyses that use the high school measures (though not from analyses using only the census measures), which affects a little more than 10 percent of the players in our data set.

U.S. News Academic Insights does not collect data directly from high schools; instead, it compiles information from sources such as state education departments. Due to delays in how states release and verify standardized assessment results, the *U.S. News Academic Insights* high school rankings typically reflect data from two academic years earlier.[29] Since the rankings are prepared for spring publication, the most recent dataset available as of early 2024 (when we compiled the data) was from the 2021-2022 assessment cycle. Therefore, we will utilize the 2024 ranking (corresponding to the 2021-2022 assessment cycle) for our 2022 high school cohort, the 2023 ranking for our 2021 high school cohort, and so forth. Given that 2019 is the earliest year for which rankings are available, we use the 2019 rankings for our cohorts from 2005 to 2016 (i.e., all earlier years), as well as for the 2017 cohort.[30]

In exploring the factors associated with derailment, we will employ the following three *U.S. News Academic Insights* measures: i) high school ranking score between zero and 100, ii) the proportion of the high school's enrollment eligible for a reduced price or free lunch program, and iii) the proportion of students in each high school who are black (across all grades).[31] To gauge the stability of the three measures across time, we compute the respective correlation coefficients between the 2019 and 2024 U.S. News ranking vintages. The correlation coefficients are: 0.82 for School Ranking (15,226 observations), 0.98 for Proportion Black (17,873 observations), and 0.86 for Free Lunch Program (14,992 observations). Overall, these correlation coefficients are relatively high. Once we extend the analysis back to 2005 using data from the

[29] This lag arises because most states publish official testing results several months after the school year ends—often in late fall—and the process of aggregating and validating data across all 50 states can extend into the following calendar year.

[30] Of the roughly 18,000 U.S. high schools for which the *U.S. News Academic Insights* provides a rating, about 6000 hosted an elite player between 2005 and 2022. More than 30,000 of the roughly 34,000 players in our data set attended a public high school. The mean public high school hosted 5.3 elite players (standard deviation of 8.4); the median hosted 2 elite players. In addition, nearly 700 of these schools hosted 855 of the 932 derailed players in our data set, representing 2.8 percent of all public-school players. Prep and religious schools not covered by *U.S. News Academic Insights* account for the remaining 3500 elite players (4.5 per school, standard deviation of 8.6), about 2.2 percent of whom were derailed.

[31] The high school score is based on weighting six school quality indicators: college readiness (30 percent), college curriculum breadth (10 percent), state assessment proficiency (20 percent), state assessment performance (20 percent), underserved student performance (10 percent), and graduation rate (10 percent).

2016-17 academic year, the correlation is likely lower, potentially creating measurement error that could bias regression coefficients towards 0.

U.S. Census data

Our second source of neighborhood measures is the U.S. Census, using data from the IPUMS National Historical Geographic Information Systems (NHGIS). We use annual census data from 2005 to 2022 for the following three variables corresponding to the zip code of the player's high school: i) household median income (measured in 2022 dollars); ii) the proportion of households with a single head, and iii) the proportion of the neighborhood's population that is black.[32]

V. EMPIRICAL ANALYSIS

The conceptual model in Section III delivers two central predictions that guide the empirical analysis. First, the *investment effect* predicts that lower-mobility areas will produce more elite football players, reflecting greater investment in athletics. Second, the *resource effect* predicts that, conditional on becoming elite, players from weaker environments will be more likely to fail to meet academic requirements and thus be derailed. Our empirical strategy is designed to map directly to these predictions. We first examine the relation between local mobility and the production of elite players using county-level data. We then investigate whether derailment is more prevalent in lower-mobility and lower-resource environments, both at the county level and at the player level.

[32] We do not have the home addresses of the players in our data set, so our implicit assumption is that either a player lived in the same neighborhood as his high school, or if he did not, he lived in a neighborhood with similar socioeconomic characteristics. This assumption is less convincing for those players who attended prep or religious schools. Such players comprise about 10 percent of our sample, but, in any case, are not included in analyses using high school measures (or combined high school and neighborhood measures), because the high school measures are available only for public schools.

A. Is There Evidence of an Investment Effect?

We begin by testing the model's *investment effect*, which predicts that lower-mobility environments induce greater investment in athletics and therefore produce more elite football players. To examine this prediction, we organize the data at the county level and relate the production of elite players to county-level measures of economic mobility from Chetty and Hendren (2018b).

Descriptive Statistics

Table 3a presents the descriptive statistics for the sample based on Chetty and Hendren's (2018b) county mobility data. Our measure of mobility will be Chetty and Hendren's estimate of the percentage gain (or loss) in annual household income for all children based on the 25th percentile of parent income.[33] The larger the measure, the greater the mobility. The mean causal effect value for "all children" at the 25th percentile is 0.23, with a standard deviation of 0.53. The magnitude implies that spending one more year in the average county increases the child's annual income at age 26 by 0.23 percent relative to the national mean.[34]

The top panel of Table 3a includes the full set of 2873 counties from the Chetty and Hendren (2018b) data set. The average county hosted nearly 12 elite players and one-third of a derailed player. The sample described in the middle panel of the table includes only the 1571 counties

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[33] The Chetty and Hendren measure is based on the relationship between a family's household income when the child is living at home and the child's subsequent income at age 26. Chetty and Hendren document a linear relation between the parent's and the child's income rank in the national distribution and focus on children growing up with parents at the 25th and 75th percentiles of the household income distribution. Based on the linear relation, they conclude that their estimates correspond to the average outcomes of children in below-median ($p < 50$) and in above-median ($p > 50$) families. We test the robustness of our results by also investigating the "boys only" version of the same measure. The apparent advantage of the latter is that our sample consists entirely of boys; however, use of the "boys only" measure reduces the number of counties in our sample by about 140. We will present results using the "all children" measure but note that those using the "boys only" measure are qualitatively similar. Chetty and Hendren (2018b) also provide several other measures of county causal effects.

[34] The national mean is a population-weighted estimate across all 2873 counties.

that produced at least one elite player from 2005 through 2022. The mean number of elite players per county jumps to 21, while the number of derailed players roughly doubles to 0.6. The mean value for the county mobility measure drops substantially from 0.23 to 0.06, indicating that elite players come from lower-than-average mobility counties.

Lastly, the sample described at the bottom panel of Table 3a includes only the 363 counties that hosted at least one derailed player. The number of elite players in these counties is substantially higher still, at nearly 70 per county, as is the number of derailed players, which jumps to 2.56 per county. In these counties, mobility is lower still – the mean values of the mobility measures is -0.18, implying that each year spent in the county by children *reduces* expected income as adults by 0.18 percent.

Empirical Analysis

As noted in our discussion of the Chetty and Hendren data set, the authors' measure of income mobility was calculated from a particular group at a particular time and thus cannot be applied to our set of players in a way that signifies a meaningful cardinal relationship. Therefore, we will transform Chetty and Hendren's "25th percentile, all youths" mobility estimates into an ordinal measure, ranking the counties from lowest to highest mobility; the higher the mobility in a county, the higher its rank. In transforming a cardinal measure into an ordinal measure, our analysis gains in coherence and in robustness to outliers; however, we also lose information because the magnitude of the distance between ranked observations is suppressed. Given that those magnitudes may not be meaningful when applied to the players in our data set, we judged the cost worthwhile.

We use the Chetty and Hendren mobility measure to rank the counties from 1 (lowest mobility) to 2873 (highest mobility). We then calculate the total number of ranked players and the total number of derailed players produced by each county and match their counties to the rankings. An important feature of the county-level data set is that 45 percent of all the Chetty and Hendren counties produced *no* elite football players (3-star or higher) between 2005 and 2022 (the span of our data set). We will therefore compare three sets of counties for the 2005-2022 period: i) counties with at least one derailed player; ii) counties with at least one elite player; and iii) counties with *no* ranked players.

We begin with the histograms shown in Figure 1, where counties are ranked from lowest to highest mobility. The top panel includes counties that produced at least one derailed player, while the middle panel includes counties that produced at least one elite player. In both cases, the distributions are tilted toward the lower end of the mobility ranking, with derailed-player counties exhibiting the strongest concentration in low-mobility areas. The bottom panel, which includes counties that produced no elite players, shows the opposite pattern, with a greater concentration in higher-mobility areas. Taken together, these patterns indicate that counties producing elite players—and especially those producing derailed players—are disproportionately drawn from the lower end of the mobility distribution.

We aggregate counties into mobility deciles, ranging from 1 (lowest mobility) to 10 (highest mobility), to summarize the patterns shown in Figure 1. Table 4A reports the number of counties in each decile, distinguishing among counties that produced at least one elite player, at least one derailed player, and no elite players. As mobility increases, the number of counties producing at least one elite player declines steadily, with a pronounced difference between the lowest and highest mobility deciles. The number of counties producing at least one derailed player also declines monotonically and falls to zero in the highest mobility decile. In contrast, the number of counties producing no elite players rises with mobility, exhibiting a pattern that closely corresponds to the decline in elite-player counties. These results reinforce the patterns shown in Figure 1 and indicate that counties producing elite players—and especially those producing derailed players—are disproportionately concentrated in lower-mobility areas.

Table 4B presents the data by number of players instead of by number of counties. The number of elite players per decile declines nearly monotonically as mobility rises, falling by a factor of over 60 (from 7,816 elite players in Decile 1 to 121 in Decile 10). The same pattern holds for the derailed players, with 253 in the lowest mobility decile and no players at all in the highest mobility decile. The third column in Table 4B shows the derailment rate, which also declines somewhat steadily as the decile mobility levels increase.

While the patterns in Figure 1 and Tables 4A and 4B are compelling, the large number of 0's suggest the use of a two-stage estimation. We will therefore employ a hurdle model—a two-part framework consisting of a binary response model and a truncated-at-zero count model (Mullahy 1986). Estimating a hurdle model allows the zeroes and positive counts to be generated by separate processes, with positive count values exceeding the zero-threshold "hurdle."[35] The hurdle model can be expressed as

$$(1) \qquad P(\text{y}) = 0 = f_1(0) = p$$

$$P(\text{y}=i > 0) = (1-p)\, f_2(i) \,/\, [1-f_2(0)] = (1\text{-p})\, f'_2(i)$$

where f_1 and f_2 are probability mass functions for non-negative values and f'_2 is the truncated normalization of f_2. Function f_1 dictates the initial hurdle process while f'_2 dictates the resulting count process for all values that surpass the threshold.

[35] The threshold can, in fact, be any value, but it is often set at zero.

We will employ a logit model in the first stage and a zero-truncated negative binomial (ZTNB) model in the second stage.[36] In each case, the covariates will be the county mobility deciles. The logit model will estimate how the probability that a county produces at least one player of the relevant type (elite or derailed) changes as we move up the mobility deciles. The ZTNB model measures how the *number* of players changes as we climb the mobility deciles, given that at least one player was produced in the specified county.

Table 5 presents the marginal effects from our county-level hurdle model estimations. Columns 1 and 2 report results for the total number of elite players, while Columns 3 and 4 report results for derailed players. All specifications adjust for county population to account for differences in scale across counties. For elite players, the logit stage (Column 1) is estimated using the full sample of counties, while the ZTNB stage (Column 2) is estimated on the subset of counties that produced at least one elite player. For derailed players, the logit stage (Column 3) is estimated on the 1,571 counties that produced at least one elite player, because derailment can occur only where elite players exist. The count stage (Column 4) is a ZTNB model estimated on the 363 counties that produced at least one derailed player. Because no counties in the highest mobility decile produced a derailed player (as shown in Table 4), decile 9 is the baseline category with both the logit stage and the ZTNB stage of derailed players.

We begin with the elite player results. The logit estimates in column 1 indicate that counties in the lowest mobility decile are 27.3 percentage points more likely to produce at least one elite player than counties in the highest mobility decile. The marginal effect declines to 19.8 and 12.8 percentage points for Deciles 2 and 3 but are still highly statistically significant. The remaining decile coefficients are close to zero, other than Decile 8 where a county is 8.1

[36] Our data is over-dispersed (the variance exceeds the mean, as Table 3a shows), making the negative binomial model preferable to the principal alternative, a Poisson model.

percentage points less likely, not more likely, to produce at least one elite player than counties in our baseline, Decile 10. Overall, the logit results indicate that the likelihood of producing at least one elite player is concentrated in lower-mobility counties, controlling for population.

Column 2 displays the ZTNB marginal effect estimates for elite players. Counties in Deciles 1 through 8 produce significantly more elite players than counties in the highest mobility decile, with a difference not statistically significantly different from 0 for Decile 9. The magnitudes can be large; The average county in the lowest mobility decile produces over 24 more elite players than the average county in the highest mobility decile, conditional on producing at least one elite player. Moreover, the number of counties decline somewhat steadily as mobility rises, a pattern consistent with the proposed investment effect. Notably, Decile 8, despite the negative coefficient in the logit specification, shows a positive and statistically significant effect in the count estimates, indicating that conditional on producing elite players, counties in this decile generate more of them than those in the highest mobility decile. When economic mobility is low, alternative paths to advancement are limited, increasing incentives to invest in football-specific human capital.

We then conduct the same analysis for derailed players, restricting the first-stage estimation to counties that produced at least one elite player. It should be noted that the magnitudes of the marginal effects cannot be compared to those estimated for elite players, because the derailed player estimates are relative to the 9th decile, while the elite player estimates are relative to the 10th decile. The Column 3 logit results that the probability of producing at least one derailed player is sharply higher in low-mobility counties. A county in the lowest mobility decile is 32 percentage points more likely to produce a derailed player than counties in the combined two highest mobility deciles. The likelihood of derailment declines somewhat steadily as mobility rises. The fact that *no* counties in the highest mobility decile produced a derailed player illustrates the slope of the underlying gradient.

Column 4 reports the ZTNB results for derailed players, estimated with the 363 counties that produced at least one derailed athlete. Counties in the lowest mobility decile produce an average of 1.8 more derailed players than high-mobility counties, conditional on producing at least one derailment, and the estimate is highly statistically significant. Deciles 1 through 6 exhibit positive and economically meaningful effects, while estimates for Deciles 7 and 8 are smaller and not distinguishable from zero relative to the baseline of deciles 9 and 10. Because no counties in Decile 10 produced a derailed player, the effective comparison group in this specification is again Decile 9 counties. These results again indicate that low-mobility counties are not only more likely to produce a derailed player but also produce them in greater numbers per county.

B. Looking for Evidence of a Resource Effect

While the results above show that derailed players are concentrated in low-mobility counties, they do not distinguish between two possibilities: whether these counties produce more derailed players simply because they produce more elite players overall, or whether derailment is more likely conditional on elite status. The model's resource effect speaks directly to the conditional relation. To examine it, we estimate the association between county mobility and the proportion of elite players who are derailed.

Table 6 reports results from an OLS regression of the percentage of elite players in a county who are derailed on the county mobility deciles. The estimated coefficients decline sharply as mobility increases. The derailment rate falls by roughly half between the lowest mobility decile and the middle of the distribution and continues to decline thereafter. Although statistical significance is concentrated in the lowest deciles, the loss of significance reflects shrinking point estimates rather than rising uncertainty, as standard errors are similar across deciles. These results suggest that structural disadvantages in low-mobility environments impede academic development, even after accounting for the greater production of elite athletes driven by the investment effect. If low-mobility counties are also low-resource counties (as is plausible), Table 6's estimates provide preliminary evidence of a resource effect.

We turn now to our player-level data to more directly examine the mechanism underlying the resource effect. The model predicts that environments with weaker academic resources reduce the probability that an elite player satisfies academic requirements. We therefore relate the likelihood of derailment to measures of school and neighborhood characteristics. As discussed, we will draw school measures from *U.S. News Academic Insights* and neighborhood data from the U.S. Census.

Descriptive Statistics

Table 3b presents descriptive statistics for the school and neighborhood variables, for the full data set (top panel) and for the set of derailed players (bottom panel). As compared to the full data set, derailed players went to high schools with average ratings 9.5 points lower (16 percent less), had 10 percentage points higher proportion of the student body eligible for free lunches (24 percent more), and in which black students made up an additional 10 percentage points of the student body (37 percent more). In neighborhoods that hosted derailed athletes, the average black proportion of the population was 8 percentage points higher (40 percent), the single-parent percentage was three percentage points higher (20 percent more), and the average median income was $10,000 lower (15 percent less). Finally, black players make up 69 percent of the full sample but account for 94 percent of the derailed sample.

A comparison of the mean values suggests substantial differences between the underlying environments of derailed players versus those of the full sample of elite football players. In all cases, the differences in means are highly statistically significant, with p-values less than 0.01. Because these high school and neighborhood variables are highly correlated, we will estimate their joint association with derailment.

<u>Empirical Analysis</u>

To examine the effect of the school and neighborhood variables on the likelihood that an elite high school athlete is derailed – fails to progress smoothly to college – we will estimate a probit model

$$(2) \qquad \Pr(y_i = 1 \mid X_i) = \Phi(X'_i\beta)$$

where i denotes a player, X_i is the matrix of player level covariates, and Φ is the standard normal CDF. The variable y_i equals 1 if the player was derailed and 0 otherwise. We estimate three versions of Equation 2: the first with the matrix X containing only the high school variables, the second with matrix X containing only the census variables, and the third with the matrix containing both sets of variables.[37] Before presenting the estimates, we should again point out that derailed players account for only about 3 percent of the observations in our sample (932 players in total), so we are asking a lot of the data. Our goal is to examine whether school and neighborhood quality are nonetheless significantly associated with the likelihood that a player falls into this unfortunate category.

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[37] We estimate three versions of Equation (2) because the underlying data sources differ in coverage. *U.S. News Academic Insights* reports high-school characteristics only for public schools. In contrast, our Census variables are available for all ZIP codes, including those corresponding to private schools. Estimating separate models allows us to use the full sample of players when possible (Census-only specification), while also examining the school-level variables in the subsample for which they are available.

Table 7 displays the marginal effects and standard errors (clustered at the zip-code level) from the probit estimations. The first column shows the results of an estimation that includes only the high school measures. All three estimated marginal effects are statistically significant at the five percent level or better. A sensible way to evaluate the magnitudes is to scale the marginal effects by the standard deviations shown in Table 3b. Beginning with the high school estimates shown in columns 1, a one-standard deviation increase in the U.S. News high school score implies a 0.36 percentage point decrease in the likelihood of being derailed, equal to roughly 13 percent of the 2.75 percent derailment rate. Similarly, a one-standard-deviation increase in the percentage of students eligible for free lunch implies a 0.55 percentage-point increase in the probability of being derailed (20 percent of the mean), while a one-standard-deviation increase in the proportion of the student body that is black implies a 0.46 percentage-point increase in the probability of derailment (17 percent of the mean).

Column 2 shows the marginal effects of the census variables. A one standard deviation increase in the proportion of the neighborhood that is black and in median income leads, respectively, to a 0.52 percentage point increase (20 percent of the mean) and a 0.82 percentage point decrease in the likelihood of a player being derailed (30 percent of the mean). The proportion of single-parent households does not contribute in a statistically significant way to the likelihood of derailment, although it is highly correlated with the other two variables.[38]

Column 3 combines the high school and census measures in a single probit estimation. The largest and most significant change in the marginal effects of the various variables is with

[38] See the Online Appendix for the correlation matrix. In a univariate regression, the coefficient on single-parent households is highly statistically significant. Moreover, the economic significance is high as a one-standard-deviation increase in the percentage of single-parent households implies a 0.84 percentage-point increase in the derailment probability, over 30 percent of the baseline derailment rate. The sign change for the single-parent household variable and its loss of statistical significance is likely due to its high multicollinearity with the other two Census variables in Column 2.

the neighborhood proportion of black residents. The sign of this variable switches and the statistical significance disappears, which is not surprising considering that its correlation with the proportion of high school students who are black is 0.81.

In short, there is a strong, statistically significant association in the expected direction between school and neighborhood characteristics and the likelihood that an elite high school player will be derailed. As discussed earlier, we make no claims of causality but note that the more disadvantaged the school and neighborhood characteristics, the more likely that a player will be derailed. These patterns appear whether we rely solely on school measures (available only for public schools) or solely on neighborhood measures (available for all players). When both sets of measures are included simultaneously in Column 3, the school variables and neighborhood median income remain statistically significant, while the other neighborhood coefficients do not, indicating the strong correlation between school and neighborhood characteristics. The overall pattern of evidence is consistent with the resource-effect mechanism.

VI. THE PATH FOLLOWING DERAILMENT

Our paper has documented that elite football players who failed to transition successfully from high school to an FBS program disproportionately came from disadvantaged neighborhoods in low-mobility counties. This section analyzes their paths afterwards. First, we explore the subset of derailed players who attempted to meet university requirements (and thereby make it into an FBS program), either via a junior college (JUCO), a postgraduate school, or another academic route.[39] Second, we investigate the NFL success rates of derailed players who did eventually make it to an FBS roster.

[39] There are also several non-derailed players who chose to attend a postgraduate school before enrolling in a FBS program, arguably to better their chances of success at the upper echelon of FBS programs.

In an attempt to remedy their academic shortcomings, nearly three-quarters of the derailed players enrolled in a JUCO, while a little more than 10 percent opted to attend a postgraduate school, often a military academy. Given that 247Sports tracks elite football players who are in JUCO or at a postgraduate school, it was relatively straightforward to identify these 781 players.[40] Of the residual 151 players who chose not to attend either JUCO or postgraduate school, a handful took remedial courses at their intended university and were able to join an FBS team the following season, or the season afterwards. As for the rest, we found little information, other than that they never managed to play for an FBS program.

Derailed athletes who went to a postgraduate school fared best, with 68 percent (65 of 96 players) eventually transitioning to an FBS program, versus only 36 percent of players who first entered a JUCO program.[41] (The choice was endogenous, of course.) In all, 351 of the 932 derailed players, eventually landed on an FBS team. Thus, the derailment was permanent for a supra-majority of derailed players.

The damage went further: Even those derailed players who eventually made an FBS roster reached the NFL at lower rates than similarly rated players who transitioned to college immediately after high school. As shown in Table 1, 6.4 percent of elite (3-to-5-star) players managed at least one season in the NFL, with the highest rates among the 5-star players and the lowest among the 3-stars. Table 2 showed that the set of derailed players (as compared to players who went straight to college) was slightly lighter in 5-star and 4-star players and slightly

[40] Several of the derailed players who started at a postgraduate school switched to a JUCO for their second season after high school. Also, many of the players who began at a JUCO took two years to complete what they could have completed in one, and thereby joined an FBS program a year later than would have been possible otherwise.
[41] The difference is not entirely surprising: Those enrolled in postgraduate schools such as military programs may have had better academic preparation or have been more disciplined (or more willing to be disciplined).

heavier in 3-star players.[42] Adjusting for those differences, we calculate that had the derailed players who eventually made it to a college program reached the NFL at the same rates as non-derailed players, 6 percent of them would have enjoyed at least one NFL season, at an annual salary of close to one million dollars. But of the 351 derailed players who eventually made it to major college football, only 13 of them, 4 percent, ever appeared on an NFL roster.

VII. CONCLUSION

This analysis began with a straightforward question: Why do some of the most talented high school football players fail to transition to major college football programs despite evident ability and extensive interest from college teams? Such players are acutely aware of the value of their human capital and of what they need to do to cash in on it – something that is patently untrue of their non-athlete peers. Yet failures occur and are correlated with factors specific to the neighborhoods the players grow up in, such as bad schools, low-income levels, and high levels of segregation, all of which may be expected to contribute to low mobility.

Our study covers a period during which compensating a college player in any form other than a scholarship plus a small stipend resulted in the suspension of the player and the sanctioning of the football program. Today, the best players receive millions of dollars and no one blinks an eye.[43] How is this change likely to affect derailment rates? Given that the opportunity cost of missing out on college football has now risen substantially (even college players on the bench today receive tens of thousands of dollars annually), ceteris paribus, we would expect to see a

[42] In addition to providing a star rating, the 247 Sports Composite provides a numerical rating for each elite athlete. The average numerical rating of the derailed sample of 932 players was 85.4 versus 85.7 for all elite athletes; thus the difference is very small and not explanatory of the eventual success in the NFL.

[43] After years of litigation, the Supreme Court ruled in *National Collegiate Athletic Association v. Alston* (June 21, 2021) that NCAA restrictions on payments to players violated federal antitrust laws, and paying college football players is now the norm. See, e.g., Noll (2022) for a discussion of the case.

decline in derailments. But the size of the decline depends on the nature of the underlying mechanism.

In relating derailment to poor school and neighborhood quality and a corresponding lack of mobility, we have emphasized what we call the "resource effect," suggesting that certain locations simply lack the resources necessary to equip players with the academic and social skills required for college. The immediacy of NIL payments may spur more effort on the part of the individual player, but given the poor resource base, whether that will be enough remains to be seen.[44]

An alternative explanation for derailment is that derailed players simply have a high discount rate, with future NFL payments being too distant and too uncertain to motivate unpleasant investments in academic advancement (such as studying), even in a rational individual who is fully aware of the costs and benefits.[45] In that case, one should see an immediate response to NIL payments, which are far less distant and not-at-all uncertain for those players who can make it to a college campus.

Investigating whether and how quickly derailments decline subsequent to the paying of players is a promising research project, once sufficient time has passed. Such research notwithstanding, the existence of derailed players puts lie to universities' claims that via a "free" college education, they were adequately compensating the players whose skills undergirded the nation's top football programs.

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[44] A promising possibility is that, with the large sums of money involved, agents may have stronger incentives to seek out derailed players, perhaps even making that a speciality. Football academies are proliferating, and some of them could specialize similarly – or at least be more inclined to accept derailed players, particularly with an agent's prodding. For example, the famous sports agency IMG runs a football academy (see https://www.imgacademy.com/sport-camps/football-camp).

[45] Of course, this begs the question as to what produced the high discount rate; it is conceivable that neighborhoods influence player discount rates, which influence in turn player choices.

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Table 1: Star Ratings and NFL Success (2005-2024)

	% >=1 Year Played	% >=3 Years Played	% >=5 Years Played
5-star	33.9	24.2	15.7
4-star	13.2	9.1	5.1
3-star	4.5	2.8	1.6
3-5 star	6.4	4.2	2.4
Other	0.10	0.06	0.04

Notes: Star ratings from 247Sports, 2005-2022 for 33,848 high school seniors. NFL data source is Pro Football Reference (Sport Reference, LLC) which tracks all NFL players. We focus on players who played at least part of one year in the NFL between 2008 and 2024. A total of 6667 NFL players met the requirements. We match these 6667 NFL players to the 33,848 football players in our 247Sports dataset with a three, four, or five-star rating during 2005 through 2022. The table displays the proportion of players who made it to the NFL level by each star rating. For example, there were a total of 587 five-star players: 33.9% played at least one season in the NFL, 24.2% played at least three seasons, and 15.7% played at least five seasons. The "Other" category consists of high school football players who made it to the NFL without a three, four, or five-star rating.

Table 2: Star Ratings by Enrollment in College Football Programs

	Total Elite Players	Not Derailed	Derailed: Academic / Disciplinary Problems
5-star	587 (2%)	583 (2%)	4 (0.4%)
4-star	5,703 (17%)	5,561 (17%)	142 (15%)
3-star	27,558 (81%)	26,772 (81%)	786 (84%)
Total	33,848 (100%)	32,916 (100%)	932 100%

Notes: This table displays the distribution of 33,848 elite football players by star rating and by college enrollment outcome. The first column displays the full sample of 33,848 players by their rating status. The second column includes all players who were not classified as "derailed." Most enrolled immediately on a Division I roster, but the category also includes 1238 players who appear to have met eligibility standards yet voluntarily left football. Omitting these 1238 players from Column 2 has no impact on the overall conclusions reached. The third column displays the "derailed" players by star rating status.

Table 3a: Descriptive Statistics (County-level Measures)

Variable	*Mean*	*Stdev*	*Min*	*Max*	*#Obs*
Full Set of Counties					
Number of elite players	11.69	49.58	0	1005	2873
Number of derailed players	0.32	1.49	0	39	2873
P25 income – all youths	0.23	0.53	-1.86	2.03	2873
Counties with at Least One Ranked Player					
Number of elite players	21.37	65.50	1	1005	1571
Number of derailed players	0.59	1.98	0	39	1571
P25 income – all youths	0.06	0.47	-1.10	1.84	1571
Counties with at Least One Derailed Player					
Number of elite players	69.90	123.10	1	1005	363
Number of derailed players	2.56	3.46	1	39	363
P25 income – all youths	-0.18	0.37	-1.10	0.80	363

Notes: Table 3a reports descriptive statistics for county-level variables from Chetty and Hendren's (2018b) causal place effects dataset. The first panel includes all 2,873 counties for which Chetty and Hendren report mobility measures; the second restricts the sample to the 1,571 counties that produced at least one 3- to 5-star high school football player between 2005 and 2022; and the third restricts to the 363 counties that produced at least one derailed player. "P25 income" denotes the estimated causal effect of spending an additional year in the county on a child's expected income at age 26, expressed as a percentage difference relative to the national population-weighted mean. The panel shows that counties producing elite players, and especially those producing derailed players, have substantially lower average mobility levels than the full set of U.S. counties

Table 3b: Descriptive Statistics (School and Neighborhood Measures)

Full Data Set

Variable	*Mean*	*Stdev*	*Min*	*Max*	*#Obs*
U.S. News					
High school score	60.93	27.12	0.26	99.92	28,067
Proportion free lunch	0.42	0.25	0	1	26,741
Proportion black	0.27	0.28	0	1	28,538
Census tract (zip code)					
Proportion black	0.20	0.23	0	1	33,704
Proportion single parent	0.15	0.08	0	0.96	32,971
Median income ('000s)	67.2	31.2	9.0	250.0	33,732

Derailed players only

Variable	*Mean*	*Stdev*	*Min*	*Max*	*#obs*
U.S. News					
High school score	51.44	28.20	1.56	99.10	812
Proportion free lunch	0.52	0.26	0	1	773
Proportion black	0.37	0.30	0	1	821
Census tract (zip code)					
Proportion black	0.28	0.25	0	1	932
Proportion single parent	0.18	0.09	0	0.96	927
Median income ('000s)	57.1	25.3	9.0	189.3	931

Notes: Table 3b reports descriptive statistics for high school and neighborhood variables for the full sample of 33,848 elite high-school football players and for the subset of 932 players who were derailed due to academic or disciplinary issues. All variables labeled as "Proportion" are measured on a 0–1 scale. High-school characteristics are drawn from *U.S. News Academic Insights* and include the school ranking score, the proportion of students eligible for free lunch, and the proportion of Black students. Neighborhood characteristics correspond to the ZIP code of the player's high school and include the proportion Black, the proportion with single-parent household, and the median income (in real dollars). Our comparisons between the full sample and the derailed subset show that derailed players attended significantly lower-rated schools, with higher proportions of low-income and Black students, and came from neighborhoods with lower median incomes and higher proportions of Black and single-parent households.

Table 4: Distribution of Players Across County Mobility Deciles

Panel A: Number of Counties by Decile, Lowest (1) to Highest (10) Mobility

	Counties with one or more elite players	Counties with one or more derailed players	Counties with no elite players
Decile 1	230	91	57
Decile 2	228	84	59
Decile 3	209	59	78
Decile 4	181	45	106
Decile 5	157	29	130
Decile 6	146	21	141
Decile 7	135	14	152
Decile 8	110	13	177
Decile 9	110	7	177
Decile 10	65	0	225
Total	1571	363	1302

Notes: Panel A reports the number of counties falling into each mobility decile, where Decile 1 represents the lowest-mobility counties, based on the ordinalized Chetty–Hendren (2018b) P25 mobility measure. The panel distinguishes among counties that produced at least one derailed player, at least one elite (3–5 star) player, and no elite players. Counties hosting derailed players are concentrated in the lowest mobility deciles, while counties with no elite players are disproportionately found in the highest mobility deciles. Counties producing elite players are distributed between these two extremes, with a noticeable tilt toward the lower-mobility end of the distribution.

Panel B: Number of Players by County Deciles, Lowest (1) to Highest (10) Mobility

	Elite players	Derailed players	Derailment rate
Decile 1	7816	253	3.24%
Decile 2	6995	239	3.42%
Decile 3	5007	160	3.20%
Decile 4	4695	127	2.71%
Decile 5	2628	53	2.02%
Decile 6	2842	49	1.72%
Decile 7	1238	19	1.53%
Decile 8	1330	20	1.50%
Decile 9	901	8	0.89%
Decile 10	121	0	0.00%
Total	33,573	928	2.76%

Notes: Panel B reports the number of elite players and derailed players in each mobility decile, where Decile 1 represents the lowest-mobility counties. The panel shows that both elite and derailed players are disproportionately drawn from low-mobility counties, but the concentration is much stronger for derailed players.

Table 5 Total Elite and Derailed Players by Decile (Marginal Effects)

	Elite Players		Derailed Players	
Dep Variable	Logit	ZTNB	Logit	ZTNB
Decile 1	0.273***	24.38***	0.328***	1.79***
(*lowest mobility*)	(0.035)	(2.75)	(0.039)	(0.35)
Decile 2	0.198***	16.88***	0.262***	1.68***
	(0.038)	(2.14)	(0.037)	(0.32)
Decile 3	0.128***	15.16***	0.203***	1.82***
	(0.037)	(2.12)	(0.037)	(0.40)
Decile 4	0.030	9.68***	0.153***	1.24***
	(0.036)	(1.82)	(0.037)	(0.33)
Decile 5	-0.034	5.81***	0.093***	0.64**
	(0.036)	(1.64)	(0.036)	(0.28)
Decile 6	-0.039	6.93***	0.069*	1.01***
	(0.035)	(1.75)	(0.036)	(0.39)
Decile 7	-0.037	5.24***	0.045	0.24
	(0.035)	(1.69)	(0.036)	(0.26)
Decile 8	-0.081**	7.32***	0.052	0.30
	(0.035)	(1.94)	(0.038)	(0.27)
Decile 9	0.003	1.90		
	(0.035)	(1.56)		
# obs	2873	1571	1571	363

Notes: Table 5 reports the marginal effects from logits and zero-truncated negative binomial (ZTNB) regressions estimating the association between county-level mobility deciles and the number of elite players and derailed players produced in each county, adjusted for population (log population in both the logit and ZTNB model). The first (second) two columns report the marginal effects from the logit and ZTNB estimations for the elite (derailed) players. The first logit estimation includes the full set of counties, and the second logit estimation includes only counties that produced at least one elite player (because derailed players are a subset of elite players). When the logit is estimated on derailed players, deciles 9 and 10 are combined, because decile 10 did not produce a single derailed player (see Table 5). The ZTNB regressions are estimated on the set of counties that hosted at least one elite or one derailed player, respectively. Because the highest mobility decile(s) serve as the omitted category, the marginal effects reflect the estimated difference in the expected count of players relative to the highest-mobility counties. Standard errors are in parentheses. *** = statistically significantly different than 0 at 1 percent; ** = at 5 percent, and * = at 10 percent.

TABLE 6: Proportion of Elite Players Derailed by Decile
(Counties that produced at least one elite player)

Dep var: proportion of total elite players derailed by county

Decile 1	0.050***
(*lowest mobility*)	(.014)
Decile 2	0.043***
	(.014)
Decile 3	0.035***
	(.014)
Decile 4	0.022
	(.014)
Decile 5	0.022
	(.014)
Decile 6	0.019
	(.015)
Decile 7	0.017
	(.015)
Decile 8	0.015
	(.015)
Decile 9	0.013
	(.015)
R2	.021
# obs	1571

Notes: Table 6 reports the coefficient estimates from an ordinary least squares regression examining the relation between county-level mobility deciles and the proportion of derailed players within the sample of elite players in each county, using the subsample of 1571 counties that produced at least one elite player between 2005 and 2022. The explanatory variables are the mobility deciles 1 through 9, with the highest mobility decile (Decile 10) omitted. Standard errors are in parentheses. *** = statistically significantly different than 0 at 1 percent; ** = at 5 percent, and * = at 10 percent.

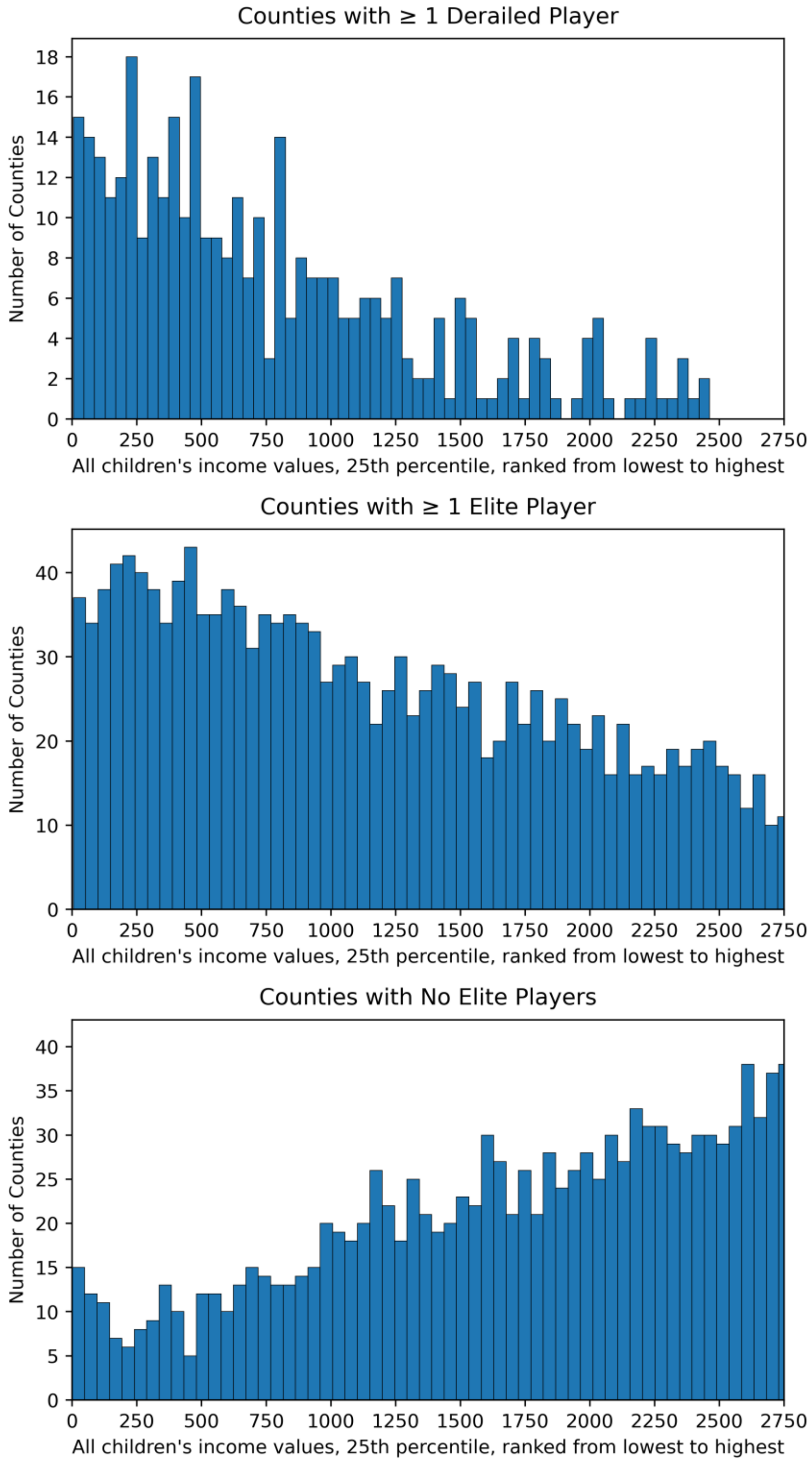
Table 7: Probability of Being Derailed (Probit Analysis)

Dependent variable = 1 if Player is Derailed and 0 Otherwise			
Variables		Marginal Effects	
	(1)	(2)	(3)
High school score	-0.0001**		-0.0001**
	(.00005)		(.00005)
Proportion free school lunch	0.0222***		0.0151**
	(.0058)		(.0064)
Proportion students black	0.0175***		0.0210***
	(.0045)		(.0068)
Proportion neighborhood black		0.0237***	-0.0057
		(.0050)	(.0088)
Proportion single parent HH		-0.0082	-0.0064
		(.0164)	(.0192)
Median income (1000s)		-0.0003***	-0.0002***
		(.00004)	(.00006)
Psuedo-R2	.022	.018	.026
# obs	26,301	32,964	25,612

Notes: Table 7 reports the marginal effects from probit estimations of Equation (2), where the dependent variable equals 1 if an elite player was derailed and 0 otherwise. Column (1) includes only school-level variables from *U.S. News Academic Insights*; Column (2) includes only Census variables at the ZIP-code level; and Column (3) combines both sets of measures. All "proportion" variables are scaled from 0 to 1. Standard errors are reported in parentheses and are clustered at the zip-code level.

Figure 1: Mobility Rank Histograms

Histograms of county mobility rank for: (i) counties with ≥1 derailed player, (ii) counties with ≥1 elite player, and (iii) counties with no elite players.



Appendix: A Two-Stage Model of Effort Allocation and Derailment[46]

Overview

We study why places with weak mobility produce many elite football players, yet those same players are less likely to convert athletic success into college enrollment. The model has two stages. In Stage 1, a player allocates time between athletics and academics. Athletic effort raises the probability of becoming elite, while academic effort builds the stock of academic capital carried forward into the next stage. In Stage 2, conditional on becoming elite, the player again allocates time between football and academics to determine whether elite status is converted into college enrollment. Two local conditions shape these choices throughout the model. Mobility, denoted by m, raises the level of the conventional fallback payoff through $\mu(m)$, with $\mu'(m) > 0$. Resources, denoted by w, raise the productivity of academic time.

The baseline model keeps Stage 2 focused on academic conversion. Once a player becomes elite, elite status is treated as secure, and the remaining question is whether his inherited academic preparation and new study effort are sufficient to clear the academic hurdle for college enrollment. The core trade-off is between raising the probability of clearing the academic bar and reducing football time, which lowers future athletic payoff. The extension allows elite status to remain fragile in Stage 2 as well, so studying more can help with academics but also reduce the time needed to maintain athletic standing.

The model delivers three main predictions. First, lower mobility reduces the value of the conventional fallback, so players tilt effort toward football in Stage 1; this raises elite production but lowers the academic capital inherited into Stage 2. Second, lower resources directly reduce academic-capital formation and therefore increase derailment conditional on elite status. Third, these two forces reinforce each other: low-mobility places can produce more elite players precisely because players invest more in football, but those same players arrive at Stage 2 farther from the academic threshold. In this case, shortage of resources generates more derailment there because those players need more academic progress to clear the enrollment hurdle. In the extension, when elite status is itself fragile, lower mobility reallocates effort toward whichever hurdle is locally more binding, academic or athletic.

[46] Jingyi Jia (University of Chicago) deserves special thanks for a primary role in the development of the formal model below.

Baseline Model

Stage 1: Becoming Elite

A player allocates a unit of time between athletic effort $e \in [0,1]$ and academics $1 - e$.

Athletic output.

$$A_1 = \alpha + e + \eta_1, \qquad \eta_1 \sim N(0, \sigma_1^2),$$

where α is baseline football talent. The player becomes elite if $A_1 \geq \bar{a}$, with probability

$$q_1(e;\alpha) = \Phi\left(\frac{\alpha + e - \bar{a}}{\sigma_1}\right), \qquad q_1'(e) > 0.$$

Players closer to the threshold have larger $q_1'(e)$ and therefore respond more strongly to changes in incentives.

Academic stock.

$$\beta = w(1 - e).$$

We do not include the baseline aptitude for academics for simplicity. Alternatively, we can think of α as capturing a player's baseline athletic talent relative to his academic talent, which determines his decision to invest in football versus academics.

Payoffs. If the player becomes elite, he proceeds to Stage 2 with continuation value $W(\beta,w,m)$, where $W_\beta > 0$. If he does not become elite, he enters the conventional labor market with payoff

$$\mu(m) + \beta = \mu(m) + w(1 - e).$$

The conventional payoff is increasing in the academic stock β and in mobility m: places with better mobility offer better conventional career opportunities, and additional academic capital further improves that outside option.

The Stage 1 problem:

$$\max_{e\in[0,1]} \quad q_1(e)W(\beta, w, m) + [1 - q_1(e)]\left[\mu(m) + \beta\right]. \tag{1}$$

The first-order condition is

$$\underbrace{q_1'(e)\left[W(\beta,w,m) - \mu(m) - \beta\right]}_{\text{MB of athletic effort}} = \underbrace{w\left[q_1(e)W_\beta + [1 - q_1(e)]\right]}_{\text{MC of athletic effort}}. \tag{2}$$

MB. More athletic effort raises the probability of becoming elite; elite status is worth $W - \mu(m) - \beta$ relative to the conventional route.

MC. More athletic effort reduces academic capital β. That lowers payoffs on both branches: on the elite branch through W_β, and on the conventional branch one-for-one.

Mobility and the Investment Effect

Let $H_1(e,m) = 0$ denote the Stage 1 first-order condition in (2). Then

$$\frac{\partial H_1}{\partial m} = q_1'(e)\left[W_m - \mu'(m)\right] - wq_1(e)W_{\beta m}. \quad (3)$$

The Stage 2 envelope derivatives are

$$W_m = (1 - p)\mu'(m), \quad (4)$$

$$W_\beta = p_\beta \Delta(s^*) + (1 - p), \quad (5)$$

$$W_{\beta m} = -p_\beta \mu'(m), \quad (6)$$

where $p_\beta = \varphi(z)/\sigma_2$ and $p_s = wp_\beta$. Substituting these expressions into (3) yields

$$H_{1m} = \mu'(m)\left[q_1(e)p_s - q_1'(e)p\right]. \quad (7)$$

Assumption 1 (Athletic Margin Dominance)**.** *At the relevant interior margin, reallocating time toward football changes the probability of becoming elite more than reallocating time toward study changes the probability of clearing the academic hurdle:*

$$\frac{q_1'(e)}{q_1(e)} > \frac{p_s}{p}. \quad (8)$$

Under Assumption 1 and the second-order condition $H_{1e} < 0$,

Proposition 1 (Investment Effect)**.**

$$\frac{de^*}{dm} = -\frac{H_{1m}}{H_{1e}} < 0.$$

When mobility falls, the conventional fallback becomes less attractive, so the player reallocates effort toward football.

The sign on effort immediately implies signs on the two main Stage 1 outcomes:

$$\frac{dq_1(e^*)}{dm} = q_1'(e^*)\frac{de^*}{dm} < 0 \quad (9)$$

,

$$\frac{d\beta^*}{dm} = -w\frac{de^*}{dm} > 0. \quad (10)$$

Equation (9) says that lower mobility raises the equilibrium probability of becoming elite. Equation (10) says that the same shift toward football reduces the inherited academic stock carried into Stage 2.

Two predictions follow:

1. **Elite production.** Lower-mobility places produce more elite players because athletes invest more in football.
2. **Weaker inherited preparation.** Those same elite players arrive at Stage 2 with less academic capital because they invested less in academics in Stage 1.

Stage 2: Converting Elite Status into Enrollment

Conditional on becoming elite, the player chooses academic effort $s \in [0,1]$. In the baseline, elite status is taken as secure once achieved; the only remaining hurdle is academic conversion.

Academic threshold.

$$K = \beta + ws + \varepsilon, \qquad \varepsilon \sim N(0, \sigma_2^2).$$

Define the inherited distance to the academic threshold at the start of Stage 2 as

$$d \equiv k - \beta.$$

The player clears the academic hurdle if $K \geq k$, with probability

$$p(s; d, w) = \Phi\left(\frac{ws - d}{\sigma_2}\right), \qquad p_s > 0, \quad p_d < 0.$$

Thus d measures how far the player begins Stage 2 from the academic threshold. When $d > 0$, the player begins below the threshold and d is an academic deficit. Larger d corresponds to weaker inherited preparation.

Payoffs. Let $a \equiv 1 - s$ denote football time in Stage 2. If the player clears the academic bar, he receives football payoff $V(a) = V(1 - s)$, with $V_a(a) > 0$. If he fails, he enters the conventional labor market with payoff

$$\mu(m) + \beta + ws = \mu(m) + w(1 - e + s)$$

This is the same conventional-payoff object used in Stage 1, now evaluated at total academic capital accumulated through both stages.

The Stage 2 problem is

$$W(\beta, w, m) = \max_{s\in[0,1]} \Big\{p(s; d, w)V(1-s) + [1-p(s; d, w)]\big[\mu(m) + \beta + ws\big]\Big\}. \tag{11}$$

Define the payoff gap

$$\Delta(s) \equiv V(1-s) - \mu(m) - \beta - ws.$$

Then

$$\Delta'(s) = -V_a(1-s) - w < 0,$$

so studying shrinks the gap by lowering football time and by improving the fallback.

We maintain the participation condition $\Delta(s^*) > 0$: conditional on being elite, football is worth pursuing at the optimum.

The first-order condition is

$$\underbrace{p_s\,\Delta(s)}_{\text{threshold effect}} - \underbrace{p\,V_a(1-s)}_{\text{athletic opportunity cost}} + \underbrace{(1-p)w}_{\text{fallback benefit}} = 0. \tag{12}$$

Three forces determine study effort:

- $p_s\Delta > 0$: studying raises the probability of clearing the academic bar.
- $-pV_a < 0$: studying reduces football time and lowers future football payoff.
- $(1-p)w > 0$: studying improves the conventional fallback.

The sign of W_β in (5) is positive under the participation condition $\Delta(s^*) > 0$. Better inherited academic preparation therefore raises continuation value. The rest of the Stage 2 analysis proceeds by variable: it first isolates the direct effect of resources, then studies the two channels through which mobility matters, and finally records the remaining behavioral responses of study effort.

Resource Effects

Resources (w) matter directly because they scale how effectively study time moves the player toward the academic threshold.

Holding inherited distance to the academic threshold fixed, let

$$z = \frac{ws - d}{\sigma_2}.$$

Then $p(s;d,w) = \Phi(z)$ and

$$\left.\frac{\partial p}{\partial w}\right|_{d,s} = \varphi(z)\frac{s}{\sigma_2} \geq 0, \tag{13}$$

where $\varphi(\cdot)$ is the standard normal density. The inequality is strict for interior study choice $s > 0$. Thus, better resources weakly raise the enrollment probability of elite players.

Using $\beta = w(1 - e)$, the same direct effect can be written in integrated form as

$$\left.\frac{\partial p}{\partial w}\right|_{e,s} = \varphi(z)\frac{1 - e + s}{\sigma_2} \geq 0. \tag{14}$$

The inequality is strict away from the corner $e = 1$ and $s = 0$. Equation (14) makes the mechanism transparent: resources raise academic capital accumulated in Stage 1 and Stage 2, so they weakly increase the probability that an elite player converts elite status into enrollment.

Mobility Channels in Stage 2

Mobility affects Stage 2 through two channels that work in opposite directions. The first is inherited distance from the academic threshold, which comes from Stage 1. The second is the gate logic, which operates through the value of failure once Stage 2 begins.

Inherited-distance channel. The Stage 1 investment decision affects Stage 2 through the inherited distance to the academic threshold $d = k - \beta$. Holding study effort and resources fixed,

$$\left.\frac{\partial p}{\partial d}\right|_{s,w} = -\varphi(z)\frac{1}{\sigma_2} < 0, \tag{15}$$

where $z = (ws - d)/\sigma_2$. Larger distance from the threshold lowers the probability that an elite player converts elite status into enrollment. Since

$$d^* = k - \beta^*,$$

equation (10) implies

$$\frac{dd^*}{dm} = -\frac{d\beta^*}{dm} < 0.$$

Lower mobility therefore raises the inherited distance carried into Stage 2. Players from low mobility places start farther below the academic threshold, which makes conversion less likely for any given s and w.

Gate channel. Holding inherited preparation and resources fixed, mobility affects Stage 2 through the conventional fallback inside $\Delta(s)$. Write the Stage 2 first-order condition as

$$H_2(s;d,w,m) \equiv p_s\Delta(s) - pV_a(1 - s) + (1 - p)w = 0.$$

Conditional on (d,w), the academic-threshold probability p does not depend on m, so

$$H_{2m} = p_s \Delta_m(s) = -p_s\mu'(m) < 0. \quad (16)$$

Under the second-order condition $H_{2s} < 0$, the implicit function theorem gives

$$\frac{ds^*}{dm} = -\frac{H_{2m}}{H_{2s}} = \frac{p_s \mu'(m)}{H_{2s}} < 0. \quad (17)$$

Thus, holding inherited preparation fixed, lower mobility increases study effort in Stage 2. This is the gate logic: when failure leads to a worse conventional fallback, the player studies more to clear the academic bar.

To see when this force is strongest, note that

$$p_s = \frac{w}{\sigma_2}\varphi(z), \qquad z = \frac{ws - d}{\sigma_2}. \quad (18)$$

The gate channel is therefore strongest for players near the academic threshold and weakest in the tails. The induced effect on the conversion probability is

$$\left.\frac{dp^*}{dm}\right|_{d,w} = p_s \frac{ds^*}{dm} = \frac{p_s^2 \mu'(m)}{H_{2s}} < 0. \quad (19)$$

So, conditional on inherited preparation, lower mobility raises the probability of clearing the academic hurdle through the behavioral response. But this gain is second-order in p_s: players far below the threshold have small p_s, so the gate channel does little to offset the inherited distance they bring from Stage 1.

Taken together, the Stage 2 effect of mobility is likely to be negative for players with weak inherited preparation, but the sign is ambiguous in general. Lower mobility raises inherited distance from the threshold, which pushes toward more derailment, but it also raises study effort conditional on inherited preparation, which pushes toward less derailment. For players far from the threshold, the gate channel is weak, so the inherited-distance channel is likely to dominate.

Behavioral Responses in Stage 2

The comparative static results above separate the direct resource effect from the two mobility channels. For completeness, the model also delivers two study-response derivatives.

Distance and study effort. Because both p and $\Delta(s)$ depend on d, inherited distance also affects optimal study effort:

$$\frac{ds^*}{dd} = -\frac{H_{2d}}{H_{2s}}.$$

Under the second-order condition $H_{2s} < 0$, the sign of ds^*/dd is the sign of H_{2d} and is generally ambiguous. Starting farther below the threshold can make study more necessary, but it can also make success less attainable for any given study choice.

Resources and study effort. Using the same first-order condition $H_2(s;d,w,m) = 0$, the implicit function theorem gives

$$\frac{ds^*}{dw} = -\frac{H_{2w}}{H_{2s}},$$

so the sign of ds^*/dw is the sign of H_{2w}. Differentiating the first-order condition with respect to w gives

$H_{2w} =$ $\underbrace{p_{sw}\Delta(s)}$ + $\underbrace{p_s\Delta_w(s)}$ − — — — —

$p_w V_a(1 - s)$ + $(1 - p) - p_w w$.

| {z } | {z }

study-productivity effect gap-compression effect opportunity-cost effect constraint-relaxation effect

(20)

Here $\Delta_w(s) = -s$, $p_w = \varphi(z)s/\sigma_2$, and $p_{sw} = \varphi(z)\left[1 - wsz/\sigma_2\right]/\sigma_2$.

Because H_{2w} contains forces that push in opposite directions, the sign of ds^*/dw is generally ambiguous. The paper's resource-effect prediction therefore relies on the direct positive sign in (13) or (14), not on a signed behavioral response of study effort.

The full equilibrium derivative of conversion can be written as

$$\frac{dp^*}{dw} = p^*_\beta \left[1 - e^* + s^* + w\left(-\frac{de^*}{dw} + \frac{ds^*}{dw}\right)\right], \qquad (21)$$

where $p^*_\beta = \varphi(z^*)/\sigma_2$. The first term inside the brackets is the direct stock-and-productivity effect and is unambiguously weakly positive. The behavioral term is generally ambiguous because resources may change both Stage 1 and Stage 2 effort choices.

Summary of the Baseline

The baseline delivers three central predictions:

1. **Investment effect.** Lower mobility raises football investment in Stage 1, which increases elite production and lowers inherited academic capital.

2. **Threshold-distance effect.** Lower inherited academic capital increases the player's distance from the academic threshold and reduces the probability of conversion, even holding Stage 2 choices fixed.

3. **Resource effect.** Lower resources reduce the probability that an elite player clears the academic hurdle, even holding inherited preparation and behavior fixed.

One conditional implication is the gate result in (17): holding inherited preparation fixed, lower mobility increases study effort in Stage 2 because failure becomes more costly. But this behavioral channel is strongest near the academic threshold and weak in the tails, so it does not overturn the inherited-distance channel from Stage 1 for players who arrive far below the hurdle. In the extension, the same logic applies to the joint conversion probability rather than to study effort alone: lower mobility reallocates time toward the hurdle that is locally more binding.

Extension: Fragile Elite Status

The extension models the richer case in which elite status remains fragile. The player must both clear the academic hurdle and maintain athletic standing.

Athletic threshold in Stage 2.

$$A_2 = \chi + \lambda(1 - s) + \eta_2, \qquad \eta_2 \sim N(0, \sigma_A^2),$$

where χ captures late-stage athletic quality and $\lambda > 0$ is the productivity of football time. The player maintains elite standing if $A_2 \geq \bar{a}_2$, with probability

$$q_2(s) = \Phi\left(\frac{\chi + \lambda(1-s) - \bar{a}_2}{\sigma_A}\right), \qquad q_2'(s) < 0.$$

The Extension Stage 2 problem is

$$\widetilde{W}(\beta, w, m) = \max_{s\in[0,1]} \left\{ q_2(s)p(s)V(1-s) + [1 - q_2(s)p(s)]\left[\mu(m) + \beta + ws\right] \right\}. \tag{22}$$

Using the same payoff gap $\Delta(s) = V(1 - s) - \mu(m) - \beta - ws$, the first-order condition becomes

$$[q_2'(s)p(s) + q_2(s)p_s]\Delta(s) - q_2(s)p(s)V_a(1-s) + [1 - q_2(s)p(s)]w = 0. \tag{23}$$

Relative to the baseline, the extension adds one more negative margin:

- $q_2 p_s \Delta > 0$: studying improves the chance of clearing the academic hurdle.
- $q_2' p \Delta < 0$: studying reduces the chance of maintaining athletic standing.
- $-q_2 p V_a < 0$: studying reduces football payoff by cutting football time.
- $[1 - q_2 p]w > 0$: studying improves the fallback.

Define the joint conversion probability

$$\Pi(s;d,w) \equiv q_2(s)p(s;d,w).$$

Then (23) can be written compactly as

$$H_{e2}(s;d,w,m) \equiv \Pi_s \Delta(s) - \Pi V_a(1-s) + (1-\Pi)w = 0.$$

Holding inherited preparation and resources fixed, mobility again enters only through the fallback inside $\Delta(s)$. Therefore

$$\widetilde{H}_{2m} = \Pi_s \Delta_m(s) = -\Pi_s \mu'(m). \tag{24}$$

Under the second-order condition $\widetilde{H}_{2s} < 0$, the implicit function theorem gives

$$\frac{d\widetilde{s}^*}{dm} = -\frac{\widetilde{H}_{2m}}{\widetilde{H}_{2s}} = \frac{\Pi_s \mu'(m)}{\widetilde{H}_{2s}}. \tag{25}$$

The sign of the study response is therefore no longer generally fixed:

$$\frac{d\widetilde{s}^*}{dm} < 0 \iff \Pi_s > 0 \iff q_2 p_s > -q_2' p. \tag{26}$$

If the academic-return term dominates the athletic-maintenance term, lower mobility raises study effort exactly as in the baseline. If the athletic-maintenance term dominates, lower mobility instead reallocates time toward football in order to preserve elite status.

Although the sign of study effort is ambiguous, the sign of the joint conversion response is not. Conditional on (d,w),

$$\left.\frac{d\Pi^*}{dm}\right|_{d,w} = \Pi_s \frac{d\widetilde{s}^*}{dm} = \frac{\Pi_s^2 \mu'(m)}{\widetilde{H}_{2s}} < 0. \tag{27}$$

Thus lower mobility always shifts effort in the direction that raises the joint probability of clearing both bars, conditional on inherited preparation. In the extension, the gate logic therefore survives in generalized form: lower mobility increases study when the academic hurdle is locally more binding and increases football time when the athletic-maintenance hurdle is locally more binding.

This comparative static is easiest to read from

$$\Pi_s = q_2(s)\frac{w}{\sigma_2}\varphi(z) - p(s)\frac{\lambda}{\sigma_A}\varphi(\zeta), \qquad \zeta \equiv \frac{\chi + \lambda(1-s) - \bar{a}_2}{\sigma_A}. \tag{28}$$

The first term is large when the player is close to the academic threshold; the second is large when he is close to the athletic-maintenance threshold. If he is far from both thresholds, both densities are small and mobility has little effect on effort allocation. If he is near the academic bar but safely above the athletic bar, the baseline gate logic dominates. If he is near the athletic bar, the opposite adjustment can occur: lower mobility may reduce study and increase football time because maintaining elite status is the locally binding hurdle.

The resource effect also survives in the fragile-status extension, but as a direct effect rather than an unrestricted equilibrium derivative. Holding inherited preparation and study effort fixed,

$$\left.\frac{\partial \Pi}{\partial w}\right|_{d,s} = q_2(s) \left.\frac{\partial p}{\partial w}\right|_{d,s} = q_2(s)\varphi(z)\frac{s}{\sigma_2} \geq 0. \tag{29}$$

Thus better resources weakly raise the probability of clearing both hurdles by raising the academic component of joint success. Using the integrated stock equation $\beta = w(1 - e)$, the direct effect holding Stage 1 and Stage 2 choices fixed is

$$\left.\frac{\partial \Pi}{\partial w}\right|_{e,s} = q_2(s)\varphi(z)\frac{1-e+s}{\sigma_2} \geq 0 . \tag{30}$$

The extension therefore preserves the resource effect: lower resources reduce joint conversion by lowering academic preparedness and academic productivity. Relative to the baseline, this effect is multiplied by $q_2(s)$, so it is attenuated when athletic maintenance is itself unlikely. Even holding inherited preparation fixed, the full behavioral derivative remains ambiguous,

$$\left.\frac{d\Pi^*}{dw}\right|_{d} = \Pi_w + \Pi_s \frac{d\widetilde{s}^*}{dw}, \tag{31}$$

because resources may change study effort, and study effort affects both academic conversion and athletic maintenance.

The Stage 1 structure is unchanged: replace W with W_f in (1). By the envelope theorem,

$$\widetilde{W}_\beta = q_2(\widetilde{s}^*)p_\beta \Delta(\widetilde{s}^*) + [1 - q_2(\widetilde{s}^*)p(\widetilde{s}^*)] > 0, \tag{32}$$

again under the participation condition $\Delta(\widetilde{s}^*) > 0$. Better inherited academic preparation therefore still raises continuation value. Relative to the baseline, the extension reports the same investment effect or the threshold-distance logic. It adds a second local hurdle and shows that mobility reallocates effort toward whichever hurdle matters more for joint success at the margin.