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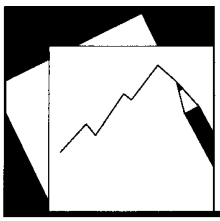

IMF Working Paper

What Can International Cricket Teach Us About the Role of Luck in Labor Markets?

Shekhar Aiyar
Rodney Ramcharan

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What Can International Cricket Teach Us About the Role of Luck in Labor Markets?[1]

Prepared by Shekhar Aiyar, Rodney Ramcharan

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Abstract

How important is luck in determining labor market outcomes? We address this question using a new dataset of all international test cricketers who debuted between 1950 and 1985. We present evidence that a player's debut performance is strongly affected by an exogenous source of variation: whether the debut series is played at home or abroad. This allows us to identify the role of luck—factors unrelated to ability—in shaping future career outcomes. We find that players lucky enough to debut at home perform significantly better on debut. Moreover, debut performance has a large and persistent impact on long run career outcomes. We also make headway in empirically distinguishing between competing explanations for why exogenous initial conditions exercise a persistent impact on career performance

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Author's E-Mail Address: saiyar@imf.org; rramcharan@imf.org

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I. INTRODUCTION

There has been much recent interest in the role of luck in labor markets. The basic issue is simple. A good first job appears to have a persistent positive impact on long-term career outcomes. If people were assigned first jobs randomly, this would imply that luck has a large role in determining career outcomes. But, of course, people are not assigned first jobs randomly. Those perceived to have high ability are likely to receive good initial job placements, and, to the extent that these perceptions are correct, are also likely to have good career outcomes. Since ability is unobserved, identifying the extent to which luck matters in labor markets is difficult. Nevertheless, public perceptions about the relative importance of luck versus ability can shape societal notions of social justice and "fairness," and significantly influence taxation and broader redistributive policies.[2]

To make progress in understanding the relative importance of luck versus ability in labor markets, this paper turns to a new dataset on international cricket—known as "test" cricket. Sport, and in particular, test cricket, provides an ideal, if novel, context to study this issue.[3] Performance is observable and easily measured. The stakes are high, positions in national teams are very scarce, and success can yield large payoffs. Moreover, in the case of test cricket, performance can depend not only on ability, but also on familiarity with local geographic and atmospheric conditions, which vary widely across test playing nations, but are orthogonal to ability. This fact drives our identification strategy.

Specifically, while atmospheric and surface conditions vary systematically across test cricket playing nations, a cricketer spends the bulk of his formative years playing "domestic" or "first class" cricket: matches between provinces, counties or states within his home country. Because of the importance of these conditions on the outcomes of the game, a domestic cricketer's skills are to some extent uniquely adapted to local conditions (Chappell (2005), Woolmer (2008)). Only the best performers from domestic cricket are selected to play test cricket for their country. A test "series," a set of five-day matches between two national teams, traditionally takes place entirely within one of the participant countries. Since the international cricket calendar is

[2] See Alesina and Angeltos (2005) and the references contained therein. These issues have also entered the popular discourse (Gladwell (2008)).

[3] There is of course a rich and idiosyncratic tradition of using sports to analyze issues of more general interest to economists. Recent contributions to the literature on soccer (football) include Palcios-Huerta (2003), who shows that penalty kickers and goalies follow von Neuman's Minimax theorem, Szymanski (2000), who tests for racial discrimination in the English football league. Studies on basketball include Price and Wolfers (2007), who finds evidence of racially biased refereeing in NBA games, Wolfers (2006), who tests for "point-shaving" in NCAA games, and Hausman and Leonard (1997), who estimate the positive externality conferred by "superstars" on other NBA athletes. On American football, Zuber et al (1985) test the efficiency of the gambling market for NFL games, and Gramm and Schnell (1994) examine within-union strike behavior using data on the 1987 NFL strike. On sumo-wresting Duggan and Levitt (2002) examine match-rigging in Japanese tournaments. Bhaskar (2009) is the only other paper of which we are aware that uses data from cricket to examine issues of broad economic importance.

typically decided years in advance, *where* a player makes his test cricket debut – at home or abroad – is plausibly exogenous. Thus a "lucky" player would debut at home, in familiar conditions, while an "unlucky" player would debut abroad, in unfamiliar and possibly hostile conditions.

In this paper we provide evidence that debuting at home can confer a significant performance advantage, increasing average productivity on debut by about 33 percent. We also find evidence of significant persistence. A player's performance in his debut test cricket series has a large and significant impact on career performance: a 10 percent higher debut score suggests a 5 percent increase in overall career productivity. Because latent ability can bias upwards these estimates of persistence, we instrument debut performance with the home-away debut indicator variable. The estimate of persistence declines by about third, but remains significant, suggesting that luck early in one's career, measured in this case by a locational advantage, can have long run consequences.

That said, given the difficulties in identifying the relative importance of luck versus ability in labor market outcomes, we consider a number of alternative estimators, as well as a different identification strategy based upon the quality of the opposition team that the debutant faces. These alternative approaches yield similar results. In addition, we also investigate the underlying mechanism behind the persistence of luck. First, a successful debut—analogous to a good initial job placement—may provide significant on the job learning and lead to an accumulation of skills (the human capital hypothesis).[4] Second, selection committees may not make efficient use of information on debut location, retaining in the team low ability players following a successful debut performance in friendly conditions, while dropping potentially high ability players debuting in unfriendly conditions abroad (signal bias). We find evidence of both. Selection committees do appear to systematically ignore the disadvantages of an away debut when making their retention decisions. And for those fortunate enough to debut at home, on the job learning appears to be an important factor in the persistence of luck.

The ability versus luck identification problem has not proved easy to resolve in broad labor market surveys. And as with the large literature on the returns to schooling, the small but growing literature in this area has tended to focus on narrow subsets of the labor market, such as investment bankers and professional economists, relying most often on a general measure of job

[4] Gibbons and Waldman (2006), Hayes, Oyer and Shaefer (2006), and Lazear (2003) provide models of on-the-job skill development. Milgrom (1988) models "influence activity," with people getting ahead because of their ability to influence colleagues; if colleagues at good firms are more important in a given profession than colleagues at bad firms, then this can lead to a persistent impact of initial job placement.

market demand conditions at the time of entry as an instrument (Oyer (2006, 2008)).[5] But these results might be specific to these professions, with little external validity for the broader labor market. Also, using macroeconomic conditions at the time of entry into the labor market as an instrument might suffer from the problem that the time of entry is endogenous to job market conditions, especially among the highly skilled, for whom entry into the workforce can be delayed by lengthening the time taken to complete a degree, or by acquiring additional degrees.[6]

By finding evidence of the persistence of initial luck in an area as different as professional sport, our study suggests that the results from this literature might more broadly inform our understanding of labor markets. This is particularly salient considering that the market for Test cricketers differs from other labor markets in ways that should *reduce* the role of luck, not increase it. For Test selection committees, player performance is easily measurable and differences in conditions between different countries well-known. Yet despite these facts, selection committees appear to systematically penalize players debuting abroad, suggesting that similar biases are likely to exist among employers of all kinds, especially when performance metrics are more ambiguous, and differences in initial conditions harder to judge.

But this study's scope also confers two additional advantages over the existing literature. First, biases associated with measurement error are significantly attenuated because performance is unambiguously measured. In contrast, wages alone may not be an adequate measure of compensation for college graduates, and publications in top journals may be only one measure of job performance for PhD economists. Second, the problem of endogenous entry is less severe. Domestic cricket is extremely poorly compensated compared to test cricket, in terms of both wages and prestige. And most places in the 11-member test side are reserved for incumbent players. With hundreds or thousands of domestic cricketers competing for the one or two remaining places in the side, rejecting an offer to play for one's country because an upcoming test series will be played abroad is unheard of.

The remainder of this paper is organized as follows. The next section presents the empirical framework and data. Section 3 discusses the main results, while Section 4 explores the underlying channel for the persistence of luck. Section 5 concludes.

[5] Neumark (2002) uses labor market conditions to identify the impact of early job stability on later wages. Some studies have focused on directly identifying cohort effects by linking wages later in people's careers to the stage of the business cycle in the year of entry: Kahn (2007) and Oreopoulos, von Wachter and Heisz (2006) do this for samples of US and Canadian college graduates respectively. In a different strand of the literature, Baker, Gibbs and Holmstrom (1994) look at within-firm data on managers and find that the average starting wage of a cohort is positively correlated with that cohort's wage years later.

[6] Initial conditions may also determine the choice of career for an entrant, as shown by Oyer (2008).

II. II EMPIRICAL FRAMEWORK AND DATA

This study employs a unique labor productivity dataset from test cricket, the version of international cricket that is historically the most prestigious and competitive, attracting the most skillful players from across the world. A test match is played between two countries with teams consisting of 11 players, and can last up to 5 days. The team scoring more "runs" over the course of the game wins. Importantly for our methodology, in a test series between two countries every match is always played within only one of the two countries (typically, the next bilateral series would be staged in the other country).

Player positions are highly specialized, and unlike soccer and most team sports, individual performance is both largely independent of other team members, and is easily observed and quantified. At any given time, one player bats or scores runs, while one player from the opposing team bowls the ball. Usually the first six members of each team are specialist batsmen—players who specialize in scoring runs—while the last four players are specialist bowlers.[7] These specialist bowlers bowl the ball onto the playing surface or "pitch" in order to get the batsmen "out."[8] The number of runs that a batsman scores before getting 'out" is a precisely observed measure of his contribution to the team's output. Both batsmen and bowlers are selected into teams based on their expected contributions.

Since the object of the game is to score more runs than the opponent, and players are highly specialized, the most universal metric for measuring productivity or performance among specialist batsmen is the batting average. This is defined as the number of runs scored in all innings played or times batted, divided by the number of times given out. Similarly, specialist bowlers are ranked according to their bowling average: the number of runs conceded per wicket taken.[9] We utilize these batting and bowling averages as our metric of productivity. Empirically, we proceed as follows. First, we establish the impact of a plausibly exogenous variable—debut location—on debut performance. Second, we show that debut performance is strongly correlated with career performance. Third, by instrumenting debut performance with debut location, we control for unobserved ability and identify the persistent impact of early luck in career outcomes. Finally, we consider two alternative hypotheses for the persistence of luck:

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[7] This is analogous to batters and pitchers in baseball. Occasionally, there are however players who are selected for their ability to both bat and bowl—"all-rounders." The 11th player is the wicketkeeper (analogous to the catcher).

[8] A batsman is declared out if his stumps (the three vertical sticks pegged into the ground behind him) are hit by the ball, or if he hits the ball in the air and it is caught by a player on the bowling side (known as "fielders").

[9] Of course other metrics are possible. In shorter versions of cricket, for example, the higher a batsman's "strike rate"—a measure of the speed with which he scores runs—the more valuable he is considered, while a bowler's "economy rate"—the number of runs conceded for every six balls he bowls—is also important. But in all forms of cricket, and especially in test cricket, batting and bowling averages are considered the best single measure of a player's performance over time.

human capital accumulation and signal bias. We attempt to distinguish between these hypotheses on the basis of data on which players were dropped from the test side after their debut series.

We are indebted for our dataset to Chris Godfred-Spenning. From him we received data on debut series and career statistics for every test cricketer in the world who debuted between 1950 and 1985. We chose 1950 as the starting point of our dataset so as to avoid any disruptions to cricketers' careers due to the World War. 1985 is chosen as the end-date so as to exclude any player still active in test cricket. We exclude all South African players from our sample, because of that country's interrupted status as an international test side over the period in question.[10]

Thus constructed, our dataset comprises statistics on 790 test cricketers from 7 nations. We know each cricketer's career and debut series bowling and batting average, his country of origin, and the location of his debut series. The table below summarizes the career statistics of players by country. The West Indian and Australian players lead, respectively, the career batting and bowling averages, while Sri Lankan players—the newest entrants to test cricket—are at the bottom of both lists. The number of players debuting for each country over the period differs quite widely, and largely reflects the variation in the number of test series played by each country over the period—see Table 1—all tables and figures in appendix.[11]

III. MAIN RESULTS

A. First Stage: The Impact of Location on Debut Series Performance

Our methodology requires debut location to (i) have a significant impact on debut series productivity, and (ii) be orthogonal to unobserved ability. We examine the plausibility of these propositions in turn before attempting to distinguish between the role of luck versus performance in career outcomes.

Why is debut location likely to be a powerful determinant of debut series performance?[12] Unlike baseball, but similar to tennis, a cricket ball makes contact with the playing surface or pitch

[10] South Africa was suspended from international test cricket in 1970 due to the apartheid policies of its government, under which its team fielded only white players and played only the "white nations." With the close of the apartheid era, South Africa was re-admitted to test cricket in 1991.

[11] Test series have become increasingly frequent over time. In the earlier part of this sample, a test series was a relatively rare event, apart from some established traditions such as the biennial "Ashes" series between England and Australia. In other words, the long-established test cricket nations were likely to play more frequently than relative newcomers. Thus countries exhibit a strong relationship between date of entry into test cricket and number of tests played during the sample period.

[12] Of course, to some extent playing at "home" is advantageous in every sport, due to supportive spectators, the likely presence of friends and family, etc. For example, teams in the NBA vie during the regular season to acquire home court advantage in the playoffs, despite the fact that physically the indoor basketball courts in different cities

(continued…)

before it reaches the batsman. As a result, the nature of the pitch and the prevailing atmospheric conditions can have a significant impact on the outcomes of the game.[13] For example, the ball decelerates more slowly off a harder surface, or deviates in line depending on the amount of grass on the surface. A harder surface typically generates more bounce, causing the ball to reach the batsman at a greater height. Atmospheric conditions can be equally important. High humidity and cloud cover can cause the ball to "swing" or deviate in the air more sharply. An accumulation of sunshine and heat over the five days of a test match can cause the playing surface to "crack," making bounce and line unpredictable.

Atmospheric and surface conditions vary systematically across test cricket playing nations. England is renowned for aiding swing bowling, while Australia's pitches tend to be particularly bouncy. Pitches in the Indian subcontinent are known to crack in the latter stages of a test match and thus to aid slow bowling. Since players from any given nation are much better acquainted with their own domestic conditions, we would expect playing at home to be advantageous to both bowlers and batsmen. Moreover, the advantage would likely be greater the smaller the proportion of international cricket the person has been exposed to. Debutants—who have spent their whole career to date playing domestic cricket—would, in most cases, be entirely unfamiliar with conditions away from their home country.[14]

We would also expect debut location to be orthogonal to ability, for several institutional reasons. Positions on a team are highly specialized and scarce, players' careers are short, and the international cricket calendar is typically decided years in advance. Among the hundreds or thousands of domestic professional cricketers, only the best performers in a particular position in the recent domestic cricket season are typically considered for the one or at most two remaining places in that position on the national team—most slots go to incumbent national players. In addition, domestic cricket is extremely poorly compensated compared to test cricket, in terms of wages, commercial endorsements and public prestige. For example, top players can earn upwards of $10 million a year with bonuses and endorsements, while domestic cricketers often work part time to support themselves. For these reasons, rejecting an offer to play for one's country because an upcoming test series will be played abroad is unheard of.

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are practically identical. These advantages of playing at home are equally true of cricket, but the disparity between home and foreign conditions are much starker due to atmospheric and pitch-related reasons.

[13] Joshi (2009) shows for example that because of its impact on surface and atmospheric conditions, El Niño Southern Oscillation (ENSO) may have affected cricket match outcomes between England and Australia over the last 100 years. See also Shipton et al (2006) and the survey in Shipton and James (2009).

[14] In recent years, test playing nations have begun fielding "junior" sides at the Under-19 levels to play against other international junior sides. If a test cricket debutant has previously represented his junior side abroad, he would have some experience of conditions away from home. However, this is a relatively recent trend, with the first Under-19 international tournament being held in 1988. To the best of our knowledge, bilateral Under-19 series were organized only after that date. Our sample includes only those test cricketers who debuted in 1985 or before, and therefore includes any who participated in the first Under-19 tournament.

Nor is it likely that selectors would differentially debut players with higher intrinsic ability at home—if selectors, for whatever reasons, were to differentially debut players of higher ability abroad, this would understate the role of luck, and strengthen our results. Instead, selectors are far more likely to simply debut an eligible player at the next available opportunity—opportunities that are themselves random events, as they are contingent on injury or weak performance by an incumbent. Also, since by definition the top one or two amateurs eligible for their first selection into the national team have never played abroad, selection committees have very little information to determine whether that debut should occur abroad or domestically.

Examining the debut locations of the very best or most productive cricketers in the 20th century further suggests that debut location and ability are orthogonal. If indeed selectors were being strategic and debuting players that they believed had higher intrinsic ability at home, then we would expect to find a disproportionate number of "great" players debuting at home. After all, these players comprise the top 1 percent of the performance and talent distribution, and their extraordinary ability would presumably have been more visible to selection committees than the ability of lesser players. To this end, we looked at Wisden Almanack's compilation of the 10 best batsmen and 10 best bowlers of the 20th century—the sport's main arbiter and keeper of performance and records.[15] The debut locations of the greatest players are perfectly symmetrical: exactly half the batsmen debuted at home and half abroad, and exactly half the bowlers debuted at home and half abroad.[16]

To wit, a more general look at the data also lends support to the identification strategy. As with most sports, exceptional ability is often signaled quite early, and in cricket for example, the age upon debut is negatively correlated with a player's career batting average: younger debutants turn out to have higher career productivity.[17] This suggests that the debut age of a player might be a good proxy for the selection committee's perception of that player's ability. Taking debut age as a signal of perceived ability, Figure 1 indicates that these committees do not

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[15] http://www.rediff.com/cricket/2002/dec/13wisden.htm. The batsmen are: Don Bradman, Sachin Tendulkar, Vivian Richards, Garry Sobers, Allan Border, Jack Hobbs, Ken Barrington, Sunil Gavaskar, Greg Chappell and Brian Lara. The bowlers are Mutthiah Muralitharan, Richard Hadlee, Sydney Barnes, Shane Warne, Clarrie Grimmett, Glenn McGrath, Dennis Lillee, Malcolm Marshall, Imran Khan and Courtney Walsh.

[16] Consider also the case of Sachin Tendulkar, an indisputably great batsman who was also a teenage prodigy. His singular ability was signaled to the world at the age of 15, when he scored 326 runs in a Lord Harris Shield inter-school game, and forged a partnership of 664 runs—a record in any form of the game— with teammate Vinod Kambli, So precocious were his talents that his test debut came at the age of 16. And yet, despite the widespread expectation that Tendulkar would someday be a great player, he was not accorded a home debut. Instead, he was debuted abroad, against the most potent of bowlers of the era: the Pakistani trio of Imran Khan, Wasim Akram and Waqar Younis. For further illustrations of the essential randomness of debut location, see the case studies in Roebuck (2006).

[17] The correlation coefficient between career average and debut age is -0.11, which is significant at the 5 percent level.

systematically debut younger, presumably higher ability players in friendlier home conditions: the distribution of debut ages across debut locations is identical.[18]

Similarly, having a blood relative who played the sport could also be a signal of innate ability. Influential relatives could also use their connections in the game to lobby selection committees in favor of a home debut for their family members. But regressing debut location on a blood relative indicator variable, we again find no evidence that having a former player in one's family significantly affects the probability of debuting at home (p-value=0.56). Thus, institutional features of the sport, general measures of latent ability, as well as the debut locations of those players who turned out to have been uniquely gifted, all suggest that debut location and ability are likely to be orthogonal.

Table 2 shows results from OLS regressions of the log of debut series batting averages on a debut series location dummy, which takes a value of one if the debut is at home, and zero otherwise. The coefficient on debut location is unbiased provided that any other factors affecting performance are orthogonal to location. Column 1 includes the full sample of players in our dataset with a well-defined debut series batting average.[19] The impact of debuting at home is large and significant at the 1 percent level. On average, those debuting at home would score 22 percent more than those debuting abroad.[20]

Column 2 includes dummy variables indicating a player's home country and the year of his test cricket debut. At different times over the thirty-year period considered here, different teams have been more dominant. Playing on a strong team could plausibly impact both career and debut series batting averages. In addition, many aspects of the game have changed over time. Bats have become more powerful, helmets and face-protection gear for batsmen have become more common, and pitch protection technology has evolved. These developments generally favor batsmen, so that over time we may expect batting averages to improve.[21] The inclusion of home country and year dummies do not change our substantive findings: the impact of debut location remains large and highly significant.

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[18] Non parametric runs test cannot reject the hypothesis that the distribution of debut ages between home and away are drawn from the same population (p-value=0.52).

[19] Players who did not bat at all, or who batted without being given out do not have well-defined batting averages.

[20] To put this in some perspective, the career batting average of Sunil Gavaskar, universally regarded as one of the greatest Indian batsman of the modern era, is about 21 percent higher than that of his competent teammate, Dilip Vengsarkar.

[21] An OLS regression of batting career averages on a time trend and home country dummies yields a positive coefficient of .007 on the time trend, which is significant at the 5 percent level. Thus on average two batsmen debuting ten years apart from each other would have batting averages that differed by 7 percent.

Columns 3 and 4 restrict the sample by excluding anybody who bowled and took a wicket in their debut series.[22] Since specialist bowlers are not judged on their batting performance, it is of interest to examine the relationship between debut location and the batting average only for specialist batsmen.[23] It turns out that the relationship for specialist batsmen is even stronger than for the full sample, with a player debuting at home averaging 32-33 percent more than one debuting abroad.

Table 3 repeats the analysis for debut series bowling averages. The sample size is automatically smaller than the batting sample, because while all players on a team normally get to bat, only the four or five specialist bowlers and all-rounders bowl and take wickets (and hence have well-defined bowling averages). Recall that the lower the bowling average the better. As with batting averages, the impact of debut location is highly significant. In our preferred specification including home country and debut year dummies, a bowler debuting at home would on average concede 18 percent less runs per wicket taken than a bowler debuting abroad.[24]

To check whether influential results are driving the relationship, Table 4 presents results from median regressions, run separately for batsmen and bowlers. The verisimilitude between the OLS and the conditional median estimates suggest that the relationship is not driven by outliers. Figure 2 provides a more complete picture of the impact of debut location by estimating two families of conditional quantile functions, one for batsmen and one for bowlers. The figure plots the quantile regression estimates of debut location for each decile, with the dashed lines representing the corresponding 95 percent confidence interval; the solid line is the OLS estimate, which is also shown in conjunction with its confidence interval in grey scale. There is some evidence of imprecision at the tails of the distribution, but the quantile estimates all lie within the 95 percent confidence band of the OLS estimate, suggesting that debut location appears to exert a pure location shift effect on the conditional distribution.

[22] In other words, only players with an undefined bowling average in their debut series are included.

[23] Our sample restriction strategy here is imperfect. Ideally we would like to exclude only specialist bowlers and not "all-rounders," who are supposed to be competent at both batting and bowling and are hence judged on their proficiency in both. Our sample restriction excludes not just specialist bowlers but also all-rounders and even specialist batsmen who happened to be given a bowl and picked up a wicket in their debut series. As a robustness check, we also ran this regression excluding all players with a batting average under 10 in their debut series (the disadvantage of the latter strategy is that it may exclude specialist batsmen who happened to perform very poorly on debut). The results remain significant at the 1 percent level.

[24] To aid perspective consider that the great Australian pace bowler Dennis Lillee's bowling average is only about 15 percent less than that of his supporting bowler Max Walker.

B. Second Stage: How Persistent is Luck?

Scatter plots of career performance against debut series performance illustrate a strong positive relationship between the two, for both batting and bowling. Moreover, the relationship holds for every test playing nation (Figures 3 and 4). We use this relationship to examine the relative importance of luck versus ability in explaining this persistence. Focusing on batting, the equation we would like to estimate is:

$$y_i = \alpha + \beta X_i + \beta_2 \theta_i + Z_i' \beta_2 + \varepsilon_i$$

Where y_i represents player i's career batting average, X_i represents his debut series batting average, θ_i denotes his ability, and represents a vector of other observable explanatory variables, which in our case will comprise home country dummies and year of debut dummies. Because ability is unobserved and embedded in ε_i, the econometrician estimates the following OLS specification:

$$y_i = \alpha + \beta_1 X_i + Z' \beta_z + v_i, \text{ where } v_i = \varepsilon_i + \beta_2 \theta_i$$

But because omitted ability, θ_i, is expected to be positively correlated with both the dependant variable and X_i, β_1 is expected to be upwardly biased. Therefore we instrument with debut location.[25] We follow the same procedure for bowling averages.

Column 1 of Table 5 above shows the results from an OLS regression of career batting averages on debut series batting averages. Unsurprisingly, the coefficient is large and highly significant. Performance on debut is an excellent predictor of career performance. As discussed, however, we are interested in the impact of that aspect of debut performance which is unrelated to ability and is instead entirely governed by luck. Column 2 shows the results of our IV regression. As expected—given the upward bias of OLS—the coefficient on the debut series batting average falls in size. But it remains large; indicating that a 1 percent higher batting average on debut is associated with a 0.46 percent higher career batting average. The story is unchanged when we focus on the sample of specialist batsmen (Columns 3 and 4), although both the OLS and IV specifications are somewhat less precisely estimated. Table 6 shows the corresponding results for bowling averages. Again, the impact of the debut series bowling average on the career bowling average is large and significant, even after accounting for unobserved ability; with a 1 percent higher debut series bowling average being associated with a 0.49 percent higher career bowling average.

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[25] The analogy to existing labor market studies should be clear. For example, in equations (1) and (2), allow X_i to denote wages in the first job, y_i to denote wages ten years later, and θ_i to denotes worker ability. Since OLS would be biased, macroeconomic conditions at the time of entry could be used to instrument for X_i.

Several features of this labor market suggest that debut location is plausibly exogenous. Nevertheless, if selectors systematically debuted high ability players at home, then the empirical strategy would conflate luck and ability, leading to an upwards bias in the IV estimate. Of course, given that away matches are more difficult, selectors would not be maximizing their odds of victory by debuting what they perceive to be less able players in more difficult conditions. Instead, selectors debuting and generally playing more able players abroad is the most logical threat to the identification strategy. But this bias would understate the role luck, making it even more difficult to observe these results.

As a robustness exercise, we turn to a very different identification strategy, using information on the quality of the opposition at the time of debut as an instrument. Building on the argument that the timing of debut, which is a function of both the amateur's current performance level, as well as the incidence of debut opportunities is random, the identity or quality of the opposition is also likely to be orthogonal to the debutant's ability. And, debuting against higher quality opposition—measured in terms of the percent of matches won in the last 5 Test series—should clearly be a sterner test of a debutant's skills than debuting against low quality opposition. Adding the quality of the opposition to the instrument set affords standard overidentification tests of the exclusion restriction.[26]

Table 7 shows the results from 2SLS regressions using both debut location and quality of opposition as instruments. Columns 1 and 3 show that the results for batsmen and bowlers are little changed compared to the single instrument case shown in Tables 4 and 5, and the Hansen J-statistic lends further plausibility to the identification assumption. To assuage concerns about weak instruments (Stock and Yogo (2005)) in columns 2 and 4 we show the results for batsmen and bowlers respectively using limited information maximum likelihood (LIML). The point estimates and standard errors remain qualitatively unchanged, but critical values for the Kleinberg-Paap statistic indicate that weakness of instruments may remain a concern for bowlers.[27]

[26] Why do we regard this result simply as an additional exercise and not as the main focus of the empirical results? Because our prior on the random assignment of the quality of opposition is somewhat weaker than for the random assignment of debut location. In particular, it is likely that better quality teams seek out and are able to obtain better quality opposition. Moreover, there are some established recurring bilateral series between sides, such as the Ashes between Australia and England. Since Australia and England were the dominant sides earlier in the sample, the regularity of the Ashes would mean that better quality sides played each other more frequently.

[27] In the first stage regression for bowlers, the quality of opposition is insignificant, while it is significant for batsmen. Debut location is strongly significant in first stage regressions for both batsmen and bowlers.

IV. ACCOUNTING FOR THE PERSISTENCE OF LUCK

We have provided a range of estimates suggesting that initial luck might have a persistent impact on career outcomes in this labor market. This result is consistent with several labor market studies, yet is derived from an identification strategy very different from existing approaches. In order to understand better the factors behind this persistence, and make it more difficult to attribute these results to unobserved heterogeneity, we focus on two broad categories of explanations for persistence.

First, human capital acquired in the first job could determine returns later in a person's career. Working in a better firm, or with more productive colleagues, could lead to greater human capital accumulation. To the extent that this human capital remained valuable throughout a person's career, there would be a persistent impact of initial macroeconomic conditions at the time of entry.[28] We call this the "human capital" hypothesis.

The second explanation observes that the market may take initial job placement as a signal of ability without adequately compensating for initial conditions. This could occur because adequately screening for ability is too costly. More simply, employers, such as university economics faculties, could behave in a persistently irrational manner, as suggested by Einav and Yariv (2006). We refer to this as the "signal bias" hypothesis. Of course, the two explanations are not mutually exclusive: some combination of human capital and signal bias could govern labor market outcomes.

In the case of cricket, the human capital hypothesis would suggest that those who perform well in their debut series—the analogue to a good initial job placement in our study—accumulate some skills as a result (skills not acquired by poor performers), and these skills bear fruit over the remainder of their career. For example, successful debutants may earn more playing opportunities, and on the batting side, these players may acquire more confidence and experience the more time they spend batting against higher quality international bowlers without getting out, and the more runs they score. This accumulation of confidence and experience could improve their batting skills in the future and thus boost their career average.

Doing well on debut could also cement the *order* at which a young player bats in the side, and the resulting stability could lead them to perform better on average.[29] Peer effects are also likely to be important. Doing well on debut could increase the amount of respect and advice young

[28] Relatedly, if human capital accumulation is firm-specific or task-specific, a first job at a good firm with high wages would make a person more valuable to that same high-wage firm many years later, compared to a person with the same innate ability who took a first job elsewhere.

[29] Von Wachter and Bender (2006) for example find that for some workers, initial labor market instability can have persistent effects.

players get from senior teammates, which could also lead to persistently better performances going forward. Much the same considerations apply to bowling performance on debut. If the human capital hypothesis holds, success on debut makes the player objectively better, and thus contributes to his future success.

What about signal bias? Unlike most labor market samples, in test cricket a large part of the sample—20-25 percent of the players—is "dropped" for poor performance after the initial job or debut series. That is, these players are not selected for any subsequent test series, and their career comprises only their debut series. The decision on which players are to be dropped is taken by national selection committees. If selection committees do not compensate for the fact that players debuting at home have a locational advantage over players debuting abroad, they exhibit signal bias. That is, they are more likely to retain low ability players based on a successful debut performance in friendly conditions, while dropping potentially high ability types unlucky enough to debut in hostile away conditions.

We have data on which players were dropped and which retained after debut—retained players—which we exploit to explore further the persistence of luck in career outcomes. In particular, for retained players we construct career batting and bowling averages *excluding* the debut series, which we term "retained career averages," and examine the reduced from relationship between retained career averages and debut location.

If the human capital hypothesis is true and there is no signal bias, then lucky players would debut at home and perform well; they would acquire skills by virtue of doing well, and therefore do better for the remainder of their career. Thus, given our previous results, we would expect to see a positive (negative) relationship between career batting (bowling) averages and debuting at home in the full sample of players, as well as for retained players' career averages.

In contrast, suppose that there is only signal bias and no human capital accumulation: selection committees simply drop the poorest debutants in terms of batting or bowling averages, without regard to whether the players debuted at home or abroad. In this case, when we examine the reduced form relationship for the restricted sample, we would expect to find a *negative* (positive) relationship between retained career batting (bowling) averages and debuting at home, i.e., a sign reversal from the relationship for the full sample. Why? Consider the set of retained batsmen. Due to the selectors' signal bias, the ability level of retained batsmen who debuted abroad would tend to be higher than the ability level of retained players who debuted at home. This is because, on average, a good debut performance by a player debuting abroad requires higher ability to compensate for the intrinsic locational disadvantage. Since ability continues to determine performance over the remainder of a player's career, the retained career batting average will be on average higher for the players who debuted abroad.

Of course, human capital accumulation can co-exist with signal bias. In this case, the human capital effect would tend to drive a positive (negative) coefficient on debut location for retained

batsmen (bowlers), while the signal bias would tend to drive a negative (positive) coefficient. Which effect dominates would depend on their relative strength and if they were of roughly equal magnitude, then the reduced form relationship for retained players would disappear. Finally, if there were no human capital effect and no signal bias, then we would expect any full sample reduced form relationship to disappear when we examined the restricted sample and looked at retained career averages.[30]

Column 1 in Table 8 below shows the reduced form relationship for all batsmen, while column 2 restricts the sample to retained batsmen and examines retained career batting averages. Restricting the sample leads to an increase in magnitude and significance of the coefficient. This is consistent with the human capital hypothesis. Players who debut at home appear to have better career averages, even after excluding their debut scores, suggesting that the advantages provided by debuting at home might allow for more on the job learning, and have a significant impact on career productivity.

Of course, the consistency of these OLS estimates depends on the assumption that players' debut location is orthogonal to their ability. Institutional features of this market and the statistical evidence thus far render the random assignment plausible, but it remains possible that any systematic attempt by selectors to match perceived ability with debut location could bias these results. To help assuage these concerns, we estimate the sample average treatment effect (SATE) of debuting at home on retained career outcomes using a simple matching estimator (Imbens (2004)). The matching estimator uses the indicators of latent ability such as age upon debut and a binary variable that measures whether a debutant was preceded by a blood relative in Test cricket.[31]

Along with these data, the matching estimator also uses nationality and year of debut information to construct the counterfactual career average for otherwise observationally similar players who debuted in different locations. Under the assumption that the selection of debut location is determined by these observables, this estimator provides an unbiased estimate of the average impact of debut location on career outcomes for our sample. And, unlike OLS, the SATE estimates are not sensitive to the local linear assumption (Rosenbaum and Rubin (1983)). From columns 3 and 4, the SATE is significant and slightly larger than the OLS results,

[30] We confirmed our intuition regarding the behavior of reduced form relationships for the full sample and for the sample of retained players using artificially generated data and performing Monte-Carlo simulations (available on request). Our data generating process (DGP) incorporated a role for ability in determining both debut and career performance, and a positive impact of debuting at home on debut performance. In addition, the DGP incorporated a human capital effect relating debut performance directly to retained career performance, and two possible selection committee rules, one which compensated for debut location (no signal bias) and one which did not compensate for debut location (signal bias). We used these artificially generated data to run reduced form regressions, the results of which inform the discussion here.

[31] Including these additional controls in the IV estimates—Tables 5 to 7—do not alter the estimates of persistence.

suggesting that any bias arising from selectors debuting more able players at home and / or the linearity assumption is small.

Moreover, the IV results for the restricted sample of retained players (column 6) is similar to that obtained earlier for the full sample (restated for convenience in column 5). This test also supports the human capital theory for batting averages; the instrumented relationship between career and debut series batting averages remains positive and increases in significance when only considering retained test players. Although we omit reporting the results for economy, the story is the same when we consider batting averages for all players (rather than just specialist batsmen). We should emphasize however that these results *do not* show that there is no signal bias. Rather, they indicate that the human capital effect is strong enough to dominate signal bias, if any.

Table 9 above repeats the procedure for bowling averages. Here the story is dramatically different. A comparison of the reduced form specifications in Column 1 and 2 show a sign reversal for the coefficient on debut location, together with a sharp reduction in its magnitude and significance. Although the coefficient for the full bowling sample in Column 1 is not significant at conventional levels, the p-value is a plausible 0.14. By contrast, when we restrict the sample to bowlers picked for at least one more series and examine the retained career bowling average, the relationship disappears. The estimates of the sample average treatment effect using the matching estimator in columns 3 and 4 reveal a similar pattern. And a comparison of the IV specifications in Columns 5 and 6 provides further evidence. The strong and significant results obtained when looking at the full sample of bowlers disappear completely when we restrict the sample.

Thus for bowlers it would appear that either (i) there is both human capital accumulation as well as signal bias among selection committees, with the effects being comparable in magnitude, or (ii) there is neither human capital accumulation nor signal bias. In our view (i) is far more plausible, for at least two reasons. First, we find strong evidence for human capital accumulation for batsmen, and there seems little reason for this not to hold for bowlers. Second, while the coefficients in Columns 2 and 6 are insignificant, they nonetheless exhibit the sign reversal that we would associate with signal bias.

Therefore, to better understand how selection committees use information and the potential importance of signal bias in the selection decision, we study the committee's decision on whether to retain a player for future matches or drop him altogether, conditioned on observing his debut performance. To this end, we create an indicator variable that equals 1 if a player's career ended after his debut series, and 0 if he was retained for future matches.

From column 1 of Table 10, the probit results strongly suggest that debut performance features prominently in the selection committee's decision to drop a debutant. The relationship between debut batting performance and the probability of being dropped is large and highly statistically

significant. For example, moving from the median debut batting average to the 75th percentile reduces the probability of being dropped by about 34 percent.

One test of the signal bias hypothesis among selection committees is to examine whether information about debut location enters into the committees' retention decision. We thus add debut location as an explanatory variable, together with a term interacting debut average with debut location. Given the previous evidence on the locational advantage of debuting at home, selection committees that do not exhibit signal bias should favor observationally similar players who debut abroad when making a decision on whom to drop. In other words, we should find that the conditional probability of dropping a player who debuts abroad is *lower* than the conditional probability of dropping a player who debuts at home with an identical average. The results are striking. From column 2, debut location is superfluous to the retention decision for batsmen. Information about debut location is individually and jointly insignificant, suggesting that selection committees likely exhibit signal bias. There is no difference in the probability of being dropped after debuting abroad relative to debuting at home.

For bowlers, too, there is a large and significant relationship between debut performance and the probability of being dropped (column 3). Recall that for bowlers a higher average suggests worse performance, and in this case, moving from the median to the 75 percentile debut average increases the probability of being dropped by about ten percent. But column 4 shows that for bowlers both the debut location and the interaction terms are significant, and have opposite signs, suggesting that despite the inherent locational disadvantage of debuting abroad, selectors appear to penalize some of those who debut abroad.

Specifically, for bowlers, averages around the 75 percentile (i.e., an average of about 60) and above generally imply a poor performance. Our results indicate that for such poor performers, a player debuting abroad is *more* likely to be dropped than a player with an identical average debuting at home. This is signal bias with a vengeance. Selectors appear to disproportionately penalize poor debut performances obtained in unfamiliar foreign conditions, compared to poor performances at home; yet poor performance obtained in familiar home conditions would seem a better indicator of low inherent ability.

To summarize, the reduced form and IV results presented in Tables 8 and 9 suggest that the human capital effect is dominant in the case of batsmen, while for bowlers the human capital effect co-exists with signal bias of a similar magnitude. This is consistent with the results presented in Table 10, which show that signal bias exists for both batsmen and bowlers, but is much more pronounced in the case of bowlers.

V. CONCLUSION

This study has used a new dataset on performance in international cricket to study the importance of luck in labor markets. We find that luck plays an important role through the

medium of better debut series performances for players debuting at home. We also show that in part because selection committees use information inefficiently, initial luck can shape long run career outcomes. Our methodology has the advantage that entry into the cricket test side is not likely to be endogenous to whether the debut series is played at home or abroad, whereas in the broader labor market, the entry decision is likely to be endogenous to job market conditions. That said, we have considered different estimation strategies to gauge the robustness of these results.

Because of the difficulty in identifying luck versus ability in labor market outcomes, research in this area has focused on narrow subsets of the labor market. Thus, the fact that we have obtained these results using a profession and identification strategy very different from those previously used in the literature suggests that luck might figure more widely in labor market outcomes than commonly believed. Further, the evidence of signal bias when assessing critical and easily measurable performance in a multi-billion dollar global industry indicates that cognitive limitations on the part of employers or talent assessors may be a significant and widespread determinant of market outcomes.

Finally, perceptions of the role of luck and ability in performance and compensation can have important public policy implications. But as with the large literature on the returns to education, there are inherent difficulties in indentifying the role of ability in outcomes. Thus, progress is likely by exploiting unique institutional features of more and different types of labor markets to help identify the roles of luck and ability in outcomes, and future research along these lines would be useful.

Table 1. Summary Statistics by Country

Country	Year of First Test Match	Number of Players Debuting 1950-85	Career Statistics Across Players Debuting 1950-85			
			Batting		Bowling	
			Mean	*Std Deviation*	*Mean*	*Std Deviation*
Australia	1877	152	21.1	14.7	18.9	28.2
England	1877	168	21.1	14.2	23.3	39.6
West Indies	1928	115	21.7	15.7	22.5	35.7
New Zealand	1930	105	18.3	12.8	24.8	41.2
India	1932	120	18.3	14.8	22.6	39.0
Pakistan	1952	98	20.8	16.0	21.7	31.7
Sri Lanka	1982	32	16.1	12.9	28.3	61.1
All Countries		790	20.1	14.6	22.4	37.4

Figure 1. The Distribution of Debut Ages, by Debut Location

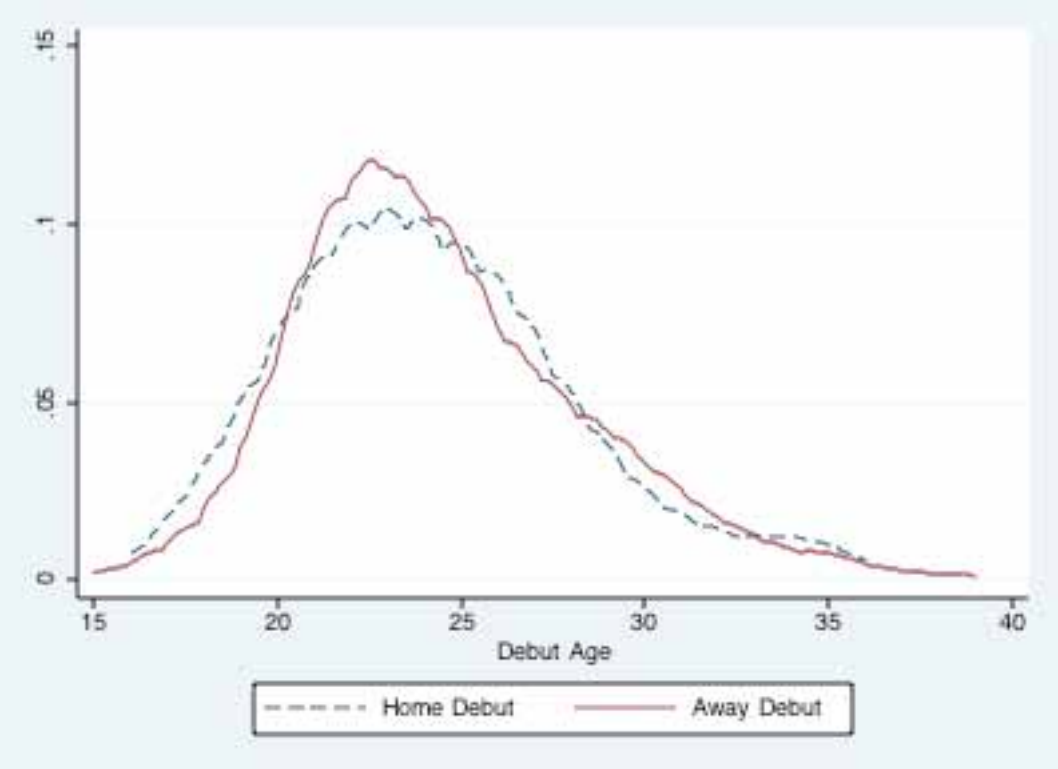


Table 2. Dependent Variable: Debut Series Batting Average

	(1)	(2)	(3)	(4)
	All Players		Only Batsmen	
Debut Location	0.221***	0.245***	0.324***	0.331***
	(0.0796)	(0.0831)	(0.102)	(0.111)
Home Country Dummies?	No	Yes	No	Yes
Year of Debut Dummies?	No	Yes	No	Yes
Observations	710	710	407	407
R-squared	0.011	0.113	0.024	0.171

OLS estimates. Robust standard errors in parenthesis: *,**,*** denotes significance at the 10, 5 and 1 percent respectively. Debut Location equals 1 if debut is at home, and 0 otherwise. Debut average is measured in logs.

Table 3. Dependent Variable: Debut Series Bowling Average

	(1)	(2)
	Bowlers	
Debut Location	-0.136**	-0.180**
	(0.0643)	(0.0698)
Home Country Dummies	No	Yes
Year of Debut Dummies	No	Yes
Observations	359	359
R-squared	0.012	0.185

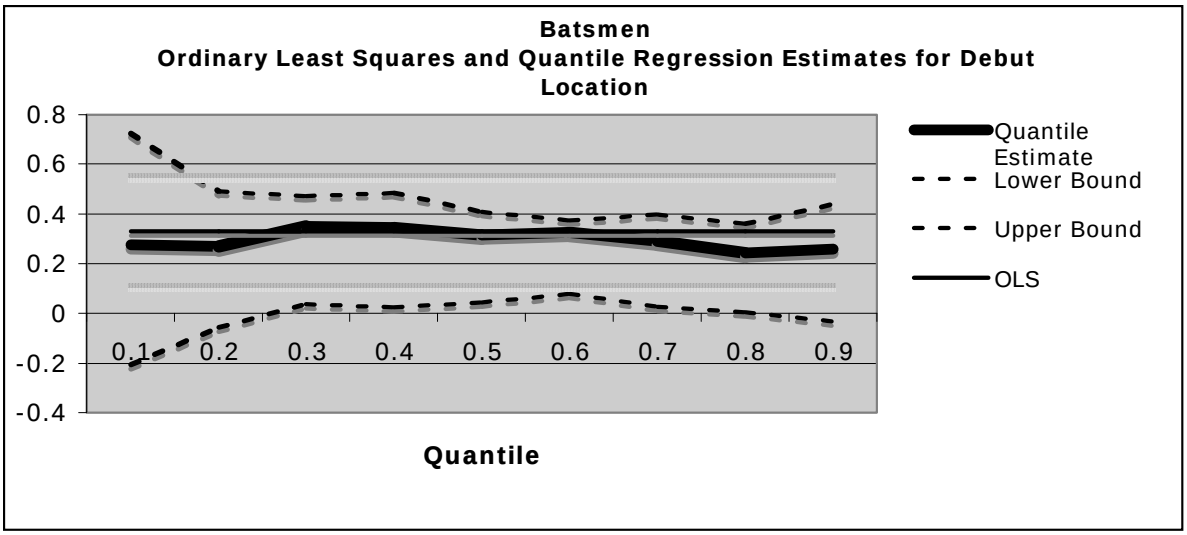
OLS estimates. Robust standard errors in parenthesis: *,**,*** denotes significance at the 10, 5 and 1 percent respectively. Debut Location equals 1 if debut is at home, and 0 otherwise. Debut average is measured in logs.

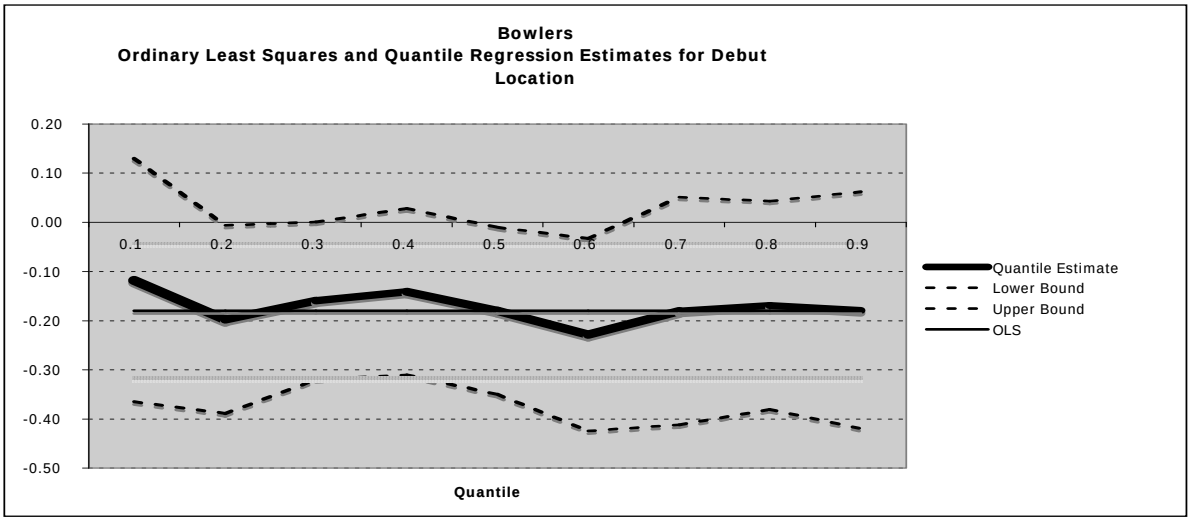
Table 4. Median Regression

	(1) Debut Series Batting Average	(2) Debut Series Bowling Average
Dependent Variable		
Debut Location	0.315**	-0.180*
	(0.129)	(0.105)
Observations	407	359

Bootstrapped standard errors in parenthesis: *,**,*** denotes significance at the 10, 5 and 1 percent respectively. Debut Location equals 1 if debut is at home, and 0 otherwise. Debut average is measured in logs. Home country and year of debut dummies included.

Figure 2. Quantile Regressions





Dashed lines represent 95 percent pointwise confidence intervals for quantile estimate, based on bootstrapped standard errors. OLS confidence band shown in grey scale.

Figure 3. Career Batting Average vs Debut Batting Average

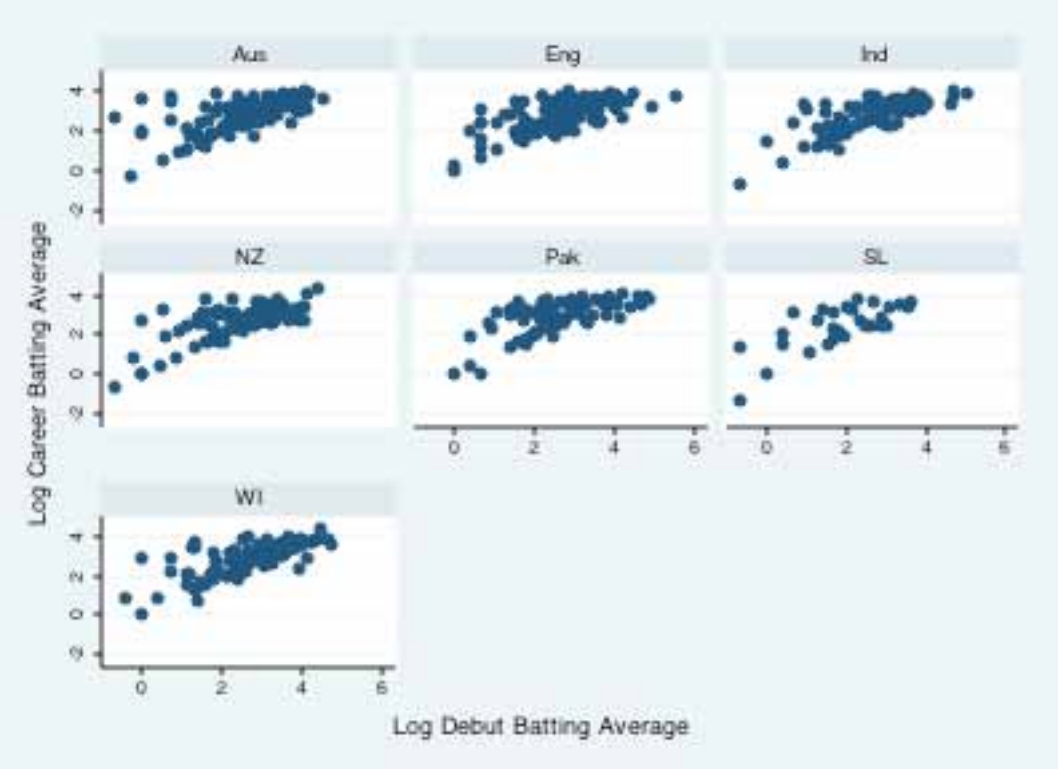


Figure 4. Career Bowling Average vs Debut Bowling Average

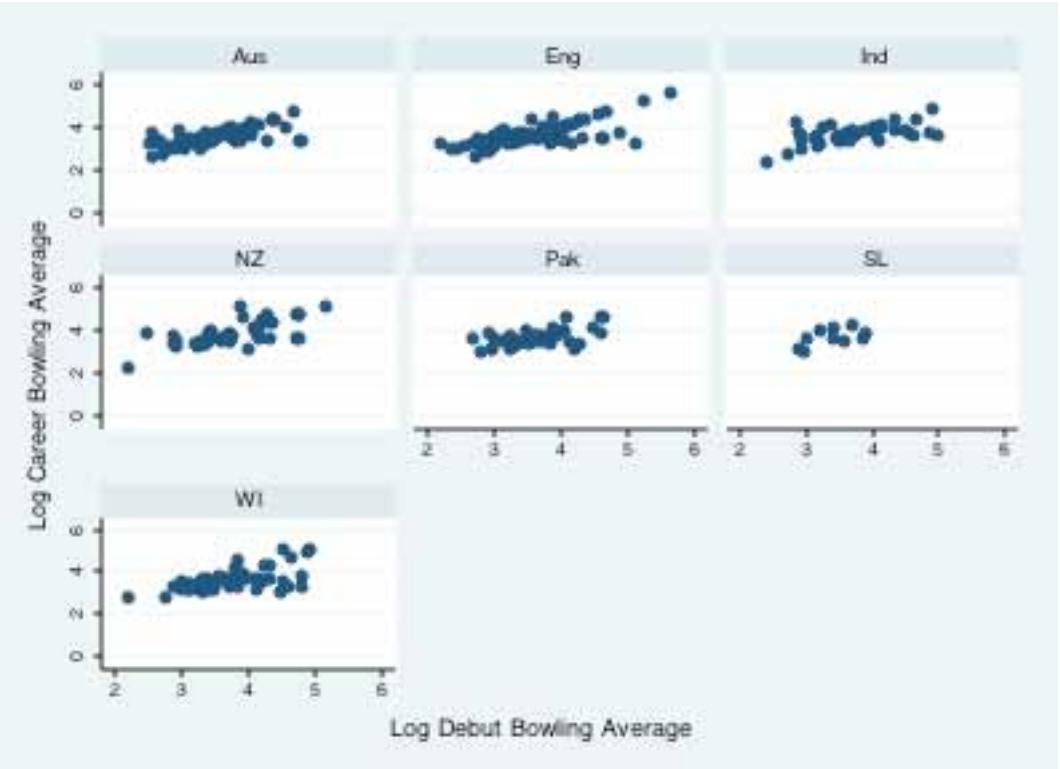


Table 5. Dependent Variable: Career Batting Average

	(1) OLS	(2) IV	(3) OLS	(4) IV
	All Players		Batsmen	
Debut Series Batting Average	0.564***	0.494***	0.457**	0.332*
	(0.0301)	(0.0474)	(0.197)	(0.197)
Observations	710	407	710	407

Robust standard errors in parenthesis: *,**,*** denotes significance at the 10, 5 and 1 percent respectively. Debut and career averages are measured in logs. Debut location is the instrument in columns 2 and 4. All specifications include home and year of debut dummies.

Table 6. Dependent Variable: Career Bowling Average

	(1) OLS	(2) IV
	Bowlers	
Debut Series Bowling Average	0.506***	0.488*
	(0.0507)	(0.251)
Observations	359	359

Robust standard errors in parenthesis: *,**,*** denotes significance at the 10, 5 and 1 percent respectively. Debut and career averages are measured in logs. Debut location is the instrument in column 2. All specifications include home and year of debut dummies.

Table 7. Alternative Identification Strategy: Quality of Opposition

	(1) 2SLS	(2) LIML	(3) 2SLS	(4) LIML
	Batsmen		Bowlers	
Dependent Variable	Career Batting Average		Career Bowling Average	
Debut Series Batting Average	0.387***	0.385***		
	(0.135)	(0.137)		
Debut Series Bowling Average			0.578**	0.587**
			(0.232)	(0.261)
Observations	403	403	357	357
Hansen J-Statistic	0.29	0.29	0.773	0.773
(p-value)	(0.59)	(0.59)	(0.37)	(0.37)
F-statistic 15% Critical Value (Stock-Yogo)	8.60	8.60	3.75	3.75
	(11.59)	(5.33)	(11.59)	(5.33)

Robust standard errors in parenthesis: *,**,*** denotes significance at the 10, 5 and 1 percent respectively. Debut and career averages are measured in logs. Debut location and quality of opposition are the instruments All specifications include home and year of debut dummies.

Table 8. Reduced Form and IV Specifications for All Batsmen and Retained Batsmen

	Reduced Form				Second Stage: Persistence	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependant Variable	Career Batting Average	Retained Career Batting Average	Career Batting Average	Retained Career Batting Average	Career Batting Average	Retained Career Batting Average
	(OLS)	(OLS)	(Matching)	(Matching)	(IV)	(IV)
Debut Location	0.12	0.15**	0.16*	0.21**		
	(0.798)	(0.070)	(0.090)	(0.121)		
Debut Series Batting Average					0.332*	0.32*
					(0.196)	(0.171)
Sample	All Batsmen	Retained Batsmen	All Batsmen	Retained Batsmen	All Batsmen	Retained Batsmen
Sample Size	420	318	420	318	407	308

Columns 1, 2, 5 and 6 include home country dummies and dummies indicating year of debut. Columns 3 and 4 estimate the sample average treatment effect of debut location. The matching covariates include age upon debut, a blood relative in test cricket and home country and year of debut dummies. Robust standard errors are reported.

Table 9. Reduced Form and IV Specifications for All Bowlers and Retained Bowlers

	Reduced Form				Second Stage: Persistence	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependant Variable	Career Bowling Average	Retained Career Bowling Average	Career Bowling Average	Retained Career Bowling Average	Career Bowling Average	Retained Career Bowling Average
	(OLS)	(OLS)	(Matching)	(Matching)	(IV)	(IV)
Debut Location	-0.087	0.026	-0.12**	-0.02		
	(0.058)	(0.059)	(-0.060)	(0.047)		
Debut Series Bowling Average					0.488**	-0.23
					(0.251)	(0.561)
Sample	All Players	Retained Players	All Players	Retained Players	All Players	Retained Players
Sample Size	359	264	359	264	359	264

Columns 1, 2, 5 and 6 include home country dummies and dummies indicating year of debut. Columns 3 and 4 estimate the sample average treatment effect of debut location. The matching covariates include age upon debut, a blood relative in test cricket and home country and year of debut dummies. Robust standard errors are reported.

Table 10. The Retention Decision

(Dependent Variable: 1 if player is dropped after debut, 0 otherwise)

	Batsmen	Batsmen	Bowlers	Bowlers
	(1)	(2)	(3)	(4)
	Probit	Probit	Probit	Probit
Debut Average	-0.0223***	-0.0225***	0.00866***	0.0168***
	(0.0041)	(0.0073)	(0.0024)	(0.004)
Debut Location* Debut Average		-0.000451		-0.0137**
		(0.0092)		(0.0056)
Debut Location		0.240		0.834**
		(1.085)		(0.327)
Observations	431	431	359	359
R-squared	0.143	0.147	0.158	0.174

All columns include home country dummies and dummies indicating year of debut. Recall for bowlers that a higher average indicates worse performance. Robust standard errors in parentheses.

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