Dodging the Draft: Analyzing the Competitive Impact of Baseball's Amateur Draft

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Abstract

Much has been made through the years in the media, literature and academia of Major League Baseball's infamous antitrust exemption, mostly through the prism of free agency, franchise relocation and television rights. But perhaps the most lasting and damning impact of the exemption resides in the annual Rule 4 Draft, in which MLB's 30 franchises alternate selections for the exclusive rights to select the top amateur players from Canada and the United States during the first week in June.

Yet as calls for reform of the draft have grown in recent years, whether to curb the growing bonuses spurred by two decades of savvy player agents or to include the league's growing talent sources in the Caribbean, the most pertinent questions typically are left unaddressed. First, are drafted players overpaid? (As a general rule, no.) Second, does the draft distribute talent more evenly than the amateur free agent market? (Probably.) Third, how do we fix it to reward effective management, not lucking into talent via consistent ineptitude or simply having the biggest pursestrings. (Shorten the draft, force teams to carry high-bonus players and drafted players on their expanded rosters, and limit the duration of teams' control of minor leaguers).

Introduction

One of the more unusual protests in recent history welcomed longtime baseball executive Sandy Alderson during an April 2010 visit to Santo Domingo. "¡No al draft!"---*No to the draft*---chanted the hundreds below his balcony at the Ambassador Hotel. The crowd was mostly young baseball players and their coaches, family and friends. Several told reporters they did not want the Dominican Republic to end up like Puerto Rico, the neighboring island whose storied baseball tradition had crumbled in recent years. The number and quality of major leaguers produced by Puerto Rico had declined rapidly in the two decades since its inclusion in the draft, as had the attendance at its ballparks, culminating in the cancellation of the 2007 season of its winter league. Alderson, then Major League Baseball's emissary to the Dominican Republic tasked with reforming its corruption-riddled player development system, said there were no expectations that the league would

attempt to include the nation's players in the draft anytime soon. But the Dominicans had reason to be suspicious. Michel Ynoa, a 16-year-old pitching phenom from Santo Domingo, had signed a $4.25 million contract with the famously cost-efficient Oakland Athletics two years prior, and baseball has used its draft to stop bidding wars for amateur talent since its inception almost five decades ago.

The Major League Baseball amateur draft became inevitable in the summer of 1964. An 18-year-old named Rick Reichardt had signed with the California Angels for $205,000, a figure 400% higher than the average player's salary of his time. Although the NFL and NBA had held drafts for more than a generation by that point, baseball had clung to its freewheeling system of affiliated farm clubs and independent leagues, intermittingly requiring high-dollar "bonus baby" players to take a spot on major league rosters until the implementation of the draft in 1965. The Kansas City Athletics selected Rick Monday with the first pick, and the draft did its job, as Monday signed for $100,000, less than half of Reichardt's bonus. Amateur bonuses remained suppressed for more than three decades, until clever player agents began finding new sources of leverage to exploit in negotiations with major league teams in the early 1990s. But the Rule 4 Draft, as the amateur draft is formally known, has proven time and again a useful cudgel in reducing player salaries, whether adding in American-educated foreign players in the mid-1980s, Puerto Ricans in 1989, Canadians in 1991 or Cuban defectors to the United States in 1993.[1] During the past decade, the boom in bonuses for top Latino prospects---who remain outside the draft's purview---and the effectiveness of superagent Scott Boras in securing large bonuses for American players has led to calls for a worldwide draft and a cap on bonuses, from management, the media, and veteran players themselves.[2][3]

Baseball's player acquisition process has been an endless source of fascination for the media and the legal academy for almost a century, as it took three unsuccessful trips to the United States Supreme Court and a series of acrimonious labor negotiations and work stoppages to allow its veteran players to achieve free agency. Yet very little focuses on whether the draft works on a competitive level, in the sense of improving the game's competitive balance and rewarding effective management. This paper attempts to address the incentives the current system provides, the results of the past two decades of the current hybrid international free agent/domestic drafting system, and what reforms could result in a more competitive sport while satisfying each distinct group of stakeholders---high-budget teams, low-budget teams, veteran players and the amateur players, foreign and domestic.

Part One: Does the Draft Create a Competitive Marketplace

In the "modern" era of baseball (roughly 1950-present), we can examine whether the draft aided competitive balance with a series of techniques. While some have argued that there is no competitive benefit of the draft,[4] others have shown a pro-competitive benefit.[5] Looking at the post-1950 histories of the four most prominent baseball leagues (MLB's American and National Leagues, NPB's Central and Pacific Leagues in Japan) a series of regression analyses indicated, all else equal, a draft corresponds with a better competitiveness while taking into account expansion, contraction, a luxury tax system and free agency (defined as the achievement of unrestricted free agency for some group of non-fringe players), and whether there had been a work stoppage (strike or lockout) that canceled at least one regular season game. My dependent variables, the traditional measure of competitive balance, Noll-Scully ratios (or the deviation from a league in which every game was a coinflip) and Gini coefficients (a traditional measure of inequality, with wins as a form of wealth), were used to see if the dispersion in on-field success suggested the draft fostered inequality or reduced it. In Appendix A, the results of the models are displayed, indicating the drafts and unrestricted free agency accompany a corresponding competitive benefit according to Noll-Scully ratios and Gini coefficients.

For amateur players, however, there might be a simpler method, as we have an ongoing natural experiment contrasting a free agency system for Caribbean and Asian players and the draft for American, Canadian and Puerto Rican players. In an effort to better understand whether smarter teams are able to maximize the benefits of this dual system, or whether the market for baseball talent was so ruthlessly efficient that no competitive advantages could be found, I constructed a rough guide to the marketplace. Using estimates from Victor Wang [6] for the value of a top-100 prospect, I created two separate lists, one for the players on the *Baseball America* Top 100 Prospects lists that were subject to the draft and the others for those that were not. I then estimated their value, based on Wang's calculations of the net present value of the prospects' production, and totaled the values of all the players in each basket to form the total "marketplace" that year. I then divided the sum of the value each team's prospects by the total marketplace value for the year, and this gave me market share and the basis for a Herfindahl-Hirschman Index---a measure of the size of firms in relation to the size of the industry as an indicator of competitiveness---analysis. While obviously there are glaring flaws in the methodology---for example, a player could remain a "top prospect" for much longer in one organization than another, player development systems could add value at markedly different levels, and the same players are featured on the lists multiple times in some cases for those who lingered in the minors---the HHIs should serve as a rough proxy to see if teams compete evenly for talent inside and outside the draft structure.

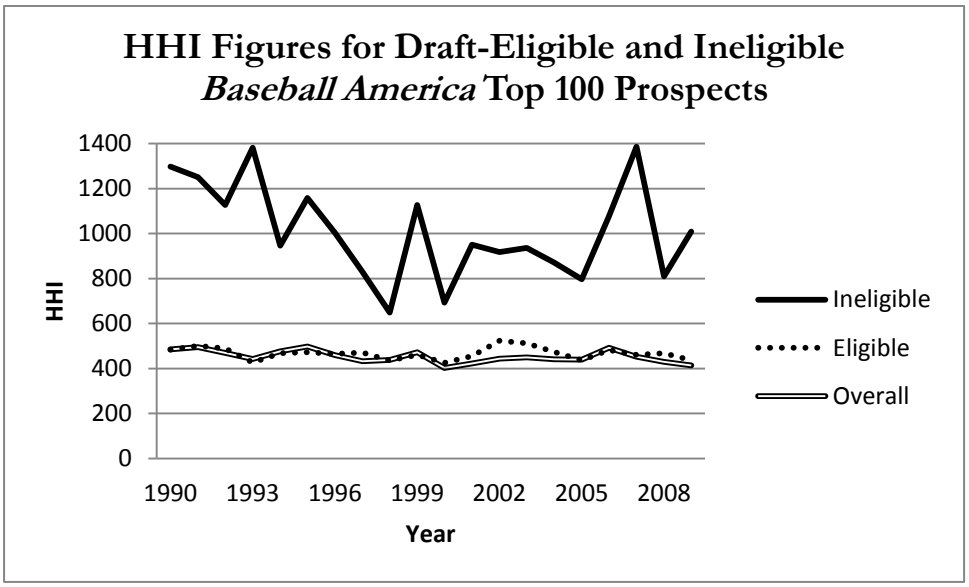

Figure 1

Figure 1 shows that while the international market is competitive by any reasonable interpretation of the HHI, it lags far behind the draft. This adds further credence to the argument that the draft does have pro-competitive benefits. Part of this might just be the sheer size of the draft---four to five times as many players enter the minor leagues each year from the draft relative to the international market. Among the top prospects, North American players have composed a relatively consistent 80% figure over the past two decades, meaning even one talented player can alter the "market" figures for the international market far more easily than the domestic market. While this

does seem inherently problematic, it actually is somewhat accurate: if a team was to sign a top Dominican or Venezuelan, it is taking a far larger share of the top end of that "market" than drafting a top-end North American player; the Caribbean market is more volatile due to the players' greater distance to the big leagues. Similarly, in Figure 2, a deeper analysis of the Top 100 prospects according to draft position (i.e., among the first 100 picks, roughly the first three rounds, or outside of it), shows that the draft does a better job of distributing talent evenly among the first 100 picks than the remainder of the draft; as the draft goes on, the HHI increases, and eventually begins to mirror the international marketplace. Similar to the international marketplace, drafting a high-end talent outside the first three rounds swings the concentration; only one-third of the drafted players in the sample were selected outside the first 100 picks, and just 21% of total players in the sample were not subject to the draft.

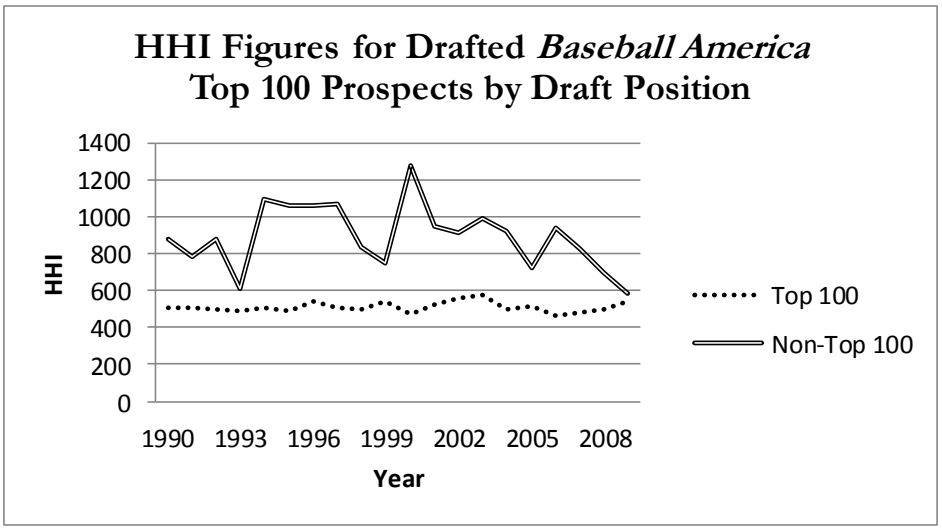

Figure 2

None of the markets show any real immediate danger signs of a lack of competition---the draft-ineligible market would be "moderately concentrated" by Department of Justice standards, and the overall and draft-eligible markets would be highly concentrated.

The simple addition of the market shares for the *n*-largest firms, they do serve as a "smell test" to see if there are anticompetitive elements in the marketplace. (Tables 1 and 2) The concentration among the top eight firms in the draft is a relative surprise, indicating that there is some measure of inequitable distribution of talent within the draft mechanism that the HHI analysis earlier did not uncover. While it is hard to argue that eight firms (among 30) comprise an oligarchy, it is worth noting that the draft likely could be improved upon in terms of ensuring top talent went to teams in a more evenhanded manner, assuming there are not vast differences in the quality of training and development among teams, which may not in fact be a safe assumption at all.

Table 1: Concentration Ratios for Largest 1, 4 and 8 Teams Among Top 100 Prospects from 1990-2009

	Overall		Draft-Eligible		Ineligible	
	Average	Diff.	Average	Diff.	Average	Diff.
CR1	0.145638		0.167212		0.27999	
CR4	0.42577	0.280132	0.440165	0.272953	0.701446	0.421456
CR8	0.649372	0.223602	0.657929	0.217764	0.910669	0.209223
Sources: www.baseballamerica.com, www.baseballcube.com, Wang [6]						

Table 2: Concentration Ratios for Largest 1, 4 and 8 Teams Among Drafted Top 100 Prospects from 1990-2009

	Draft-Eligible		Top 100 Picks		Non-Top 100 Picks	
	Average	Diff.	Average	Diff.	Average	Diff.
CR1	0.167212		0.100773		0.160867	
CR4	0.440165	0.272953	0.304696	0.203923	0.475524	0.314657
CR8	0.657929	0.217764	0.520481	0.215786	0.799466	0.323942
Sources: www.baseballamerica.com, www.baseballcube.com, Wang [6]						

What is more telling is that the international free agent market is far more concentrated, with the top four teams controlling 70%, and the top eight firms 91%, of the value in the market, and that the drafted players outside of the top 100 picks are similarly concentrated among the top four and eight firms, a similar reflection of the relatively smaller number of players that become top prospects from these pools and the volatility of these markets. Given that the bonuses for these sectors of the amateur marketplace tend to be far lower than those of the top 100 picks, there may be some element of selection bias here (as in, teams are more willing to nurture a player when there is a greater sunk cost of a high bonus), but it also could reflect that savvier scouting can reap rewards at the more inexpensive end of the talent pool. The teams willing to embrace the higher volatility outside the top 100 or so North American players may have the ability to reap larger dividends, utilizing some combination of more effective management and larger purse strings.

Part Two: Puerto Rico, and its corollary, Canada

Baseball in Puerto Rico predates the Spanish-American War; the San Juan daily newspaper *El Pais* has accounts of games as early as January 1898. The game grew as American soldiers played locals recreationally and within three decades, Puerto Ricans played in the Negro Leagues, and in 1942, Hiram Bithorn became the first Puerto Rican to play in the big leagues. The island boasts a 72-year-old winter league, a strong track record in the Caribbean World Series, the competition with the winter league champions of Mexico, the Dominican Republic and Venezuela. San Juan has been mentioned as a possible expansion city and received a trial run as the part-time home of the Montreal Expos for two seasons. Yet government officials, baseball officials and fans alike lament the "death" of the sport on the island. The reason, they say, is the draft.[7]

The implementation of the draft in 1989 came at the perhaps the high point for Puerto Rican baseball. A golden generation of talent had emerged in the late 1980s and early 1990s---the Alomar brothers, Carlos Baerga, Carlos Delgado, Javy Lopez, Juan Gonzalez, Ivan Rodriguez, Benito Santiago and Bernie Williams. Those players had all signed as amateur free agents in the mid-1980s. Only a handful of Puerto Rican stars have emerged since the late 1990s, namely Carlos Beltran, Jorge Posada and Javier Vazquez. This is not mere perception: the number of major league debuts by Puerto Ricans began a startling decline with players born in the late 1970s, even as MLB expanded by 25%, as illustrated by Figure 3.

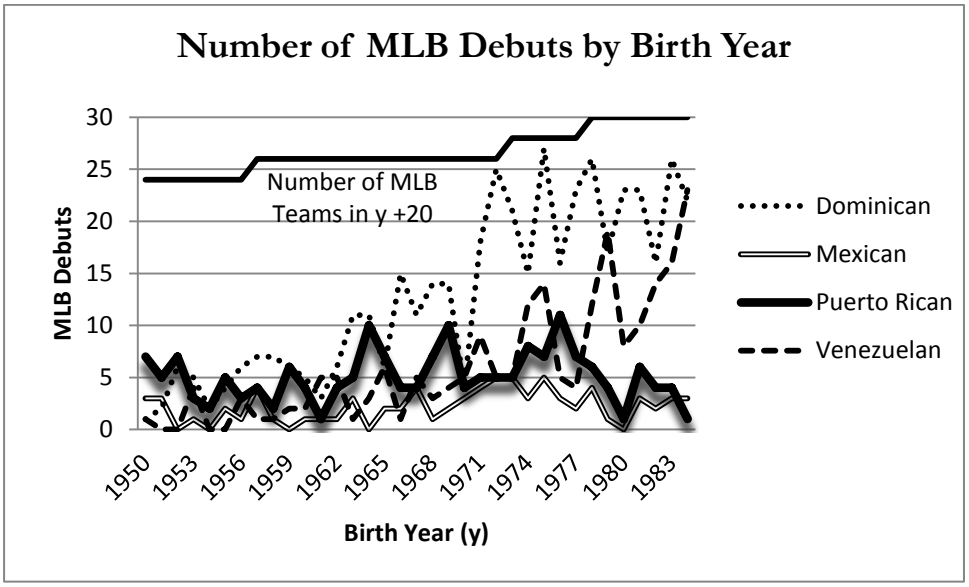

Figure 3

The explosion of Dominican talent predates the implementation of the draft on Puerto Rico, but there is a not-coincidental spike in Venezuelans beginning in the mid-1970s. As MLB took steps to curb the bonuses given to Puerto Ricans---first by including those who attended American schools, then including all residents---the number of Venezuelans skyrocketed. While the organizational budgets are unavailable for teams to see if the capital did flow from San Juan to Caracas, it is worth noting that the number of Venezuelans on major league rosters doubled between 1999 and the present. That is not accidental. The Houston Astros built the first Dominican-style "academy" in 1989; within 10 years, a dozen more teams had built similar camps and the MLB began an official summer league for under-18 prospects. The Astros signed 77 players out of their camp between January 1990 and January 2001, with an astounding 19 (25%) making the major leagues---and closed that academy in 2008 because the market had caught up; players that once cost $50,000 now cost $500,000.[8]

As teams no longer had incentives to pour money into Puerto Rico, the sport atrophied on the island. The island's game is more based in communities than the organized scholastic and youth league systems in the United States, offering scouts little more to watch than weekend games against competition whose strength can vary dramatically. Informal middlemen, whether they be coaches or agents, have less financial incentive to find and develop preteen talent than their equivalents in the

Dominican Republic, where these *buscones* often receive a large share of a players' signing bonus. The teams, as well, do not have reason to pour resources into Puerto Rico to identify players who are now two years older than their Dominican and Venezuelan peers (and also without the two years of professional training the others received) and also can only be signed through the uncertainty of the draft. "The investment in Puerto Rico is not a cost-effective one for Major League teams and has lost charm for the recruiter," wrote Dr. David Bernier, Puerto Rico's secretary for sport in a 2007 proposal to MLB asking for a 10-year moratorium on the draft. "This creates a domino effect, less players at the top, less enthusiasm at the base."[8]

The eroding teams' and agents' "property" rights in Puerto Rico and their subsequent disinvestment led to a decrease in the quality of Puerto Rican playerss as well as the quantity. Even if we consider the mid-1980s generation the outlier---it is hardly normal for a population of 4 million people to produce roughly one Hall of Fame-caliber player per year)---there is still a similar picture of decline when we examine the top end of the talent pool, as measured by players receiving Rookie of the Year votes and inclusion in the annual Top 100 Prospects lists from *Baseball America*, the closest thing to a trade magazine for the baseball industry. It is worth noticing in Figure 4 that the draft years have a markedly different effect on Canadian players, seemingly lifting Canada from irrelevance to become a consistent producer of top talent.

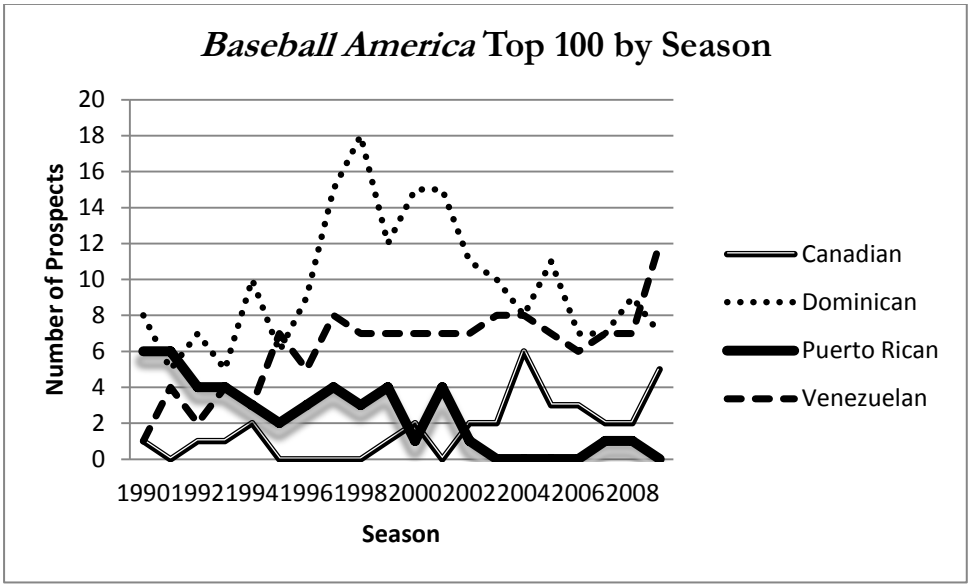

Figure 4

We see similar results in Figure 5; in the late 1990s (when the last of the undrafted Puerto Ricans were either retired or in the major leagues and the first of the drafted Puerto Ricans were in the minors and making their major league debuts), the number of Puerto Ricans decline to the point at which 2001 is the last season during which Puerto Rico produced more than one of the top 100 prospects in the game. There is a spike in Venezuelans in the mid-1990s, when the first products of the academies entered their early 20s, and Venezuela's success at producing top-tier talent approaches or exceeds the Dominican Republic by the end of this decade. There is a similar picture in rookie of the year voting.

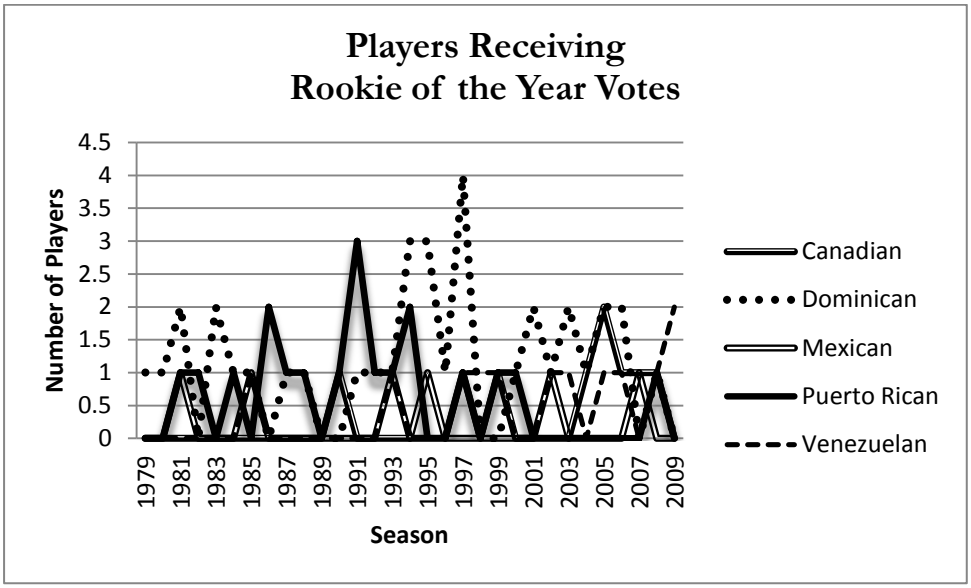

Figure 5

The number of players who had seasons sufficient to warrant at least one third-place Rookie of the Year vote from baseball writers serves as a crude proxy for the bare minimum level at which a first-year player can perform and make an impact. But similarly, we see the golden generation of the Alomars and Ivan Rodriguez in the early 1990s, and only one player receiving a vote after 2000. Venezuela produced one ROY vote-worthy player before 1997, and 10 since.

The rapid ascent of Canadian baseball is visible in both the Rookie of the Year and Top 100 Prospect lists. Canada produced just one ROY vote recipient prior to 1997; it had one each in 1997 and 1999 and then six between 2004-2008, more than any nation save the Dominican Republic. The prospects list tells a similar tale: more years with zero prospects (five) than one prospect (three) between 1990 and 1998. But since 1999, Canada has had at least one player make the list each year, and a minimum of two each season from 2002 onward including six in 2004 and five in 2009. This roughly coincides with when the first drafted players from Canada (which entered the draft in 1992) would be maturing into major-league ready prospects.

Canada, unlike Puerto Rico, has a relatively highly-structured amateur baseball apparatus that mimics the game in the United States. In particular, the development of the British Columbia Premier Baseball League in the late 1990s helped fill the need for a consistently high level of competition that put many of Canada's top prospects in the same place. The league already has produced an MVP winner in Justin Morneau and a World Series Game 1 starter in Jeff Francis. The league has the financial foundation to play a 100-game schedule with province-wide travel and use wood bats (far less durable and more expensive that aluminum, but better for scouts to gauge a player's pro prospects). The BCPBL, and its imitators across the country, have done much to alleviate the difficulties that plagued Canadian baseball for most of the 20th century: low levels of competition, weather-shortened seasons and vast travel distances.[9]

The suggestion that the draft has hurt Puerto Ricans is based mostly on very limited data; for example, Venezuela has almost seven times as many people as Puerto Rico, and the Dominican

Republic has 2.5 times more. Both economies are also far less developed than Puerto Rico's, a gap that only grew in the 1980s when the draft was being implemented. The players also lack U.S. visas without the help of teams, making them easier to control by teams and their agents. All of this creates greater financial incentives for Dominicans and Venezuelans to focus on baseball. "I think the kids in Puerto Rico have a lot of comforts," according to Javier Vazquez, among the most prominent Puerto Rican players to come through the draft. "They have computers, PlayStations, all types of things like that. A kid has a life outside of sports."[10]

In order to empirically test whether inclusion in the draft hurt Puerto Rican players, I formed a dataset of all players born in the Dominican Republic, Venezuela and Puerto Rico who made their United States-based minor league debut from 1998 to 2002 and tracked their progression through the MLB-affiliated ranks. I performed a series of logistic regressions on whether a player would advance to a particular level (MLB, AAA, AA, or Advanced A, which is the first rung at which players become more tangibly viable prospects) or would make the *Baseball America* team-by-team Top 10 prospect lists or its overall Top 100 lists. I also ran a series of linear regressions to determine what factors best estimated at what age a player would reach the above levels of competition. In addition to basic biographical data (country of origin, height, weight, age), I created a dummy variable to include whether the player had been exposed to the draft (to allow the possibility of treating Dominicans and Venezuelans who went to American schools the same as Puerto Ricans). In all, there were 1,519 players in my sample, including 152 Puerto Ricans, 426 Venezuelans and 941 Dominicans, and 202 made it to the major leagues for at least one game.

Unsurprisingly, while viewing the results of the cross-tabulation tables for my chosen predictors, there are no foolproof methods for determining upon a prospect's debut whether or not he will make the major league. There are general tendencies, however, visible in the model in Appendix B. Players who start out younger and at higher levels tend to advance at a higher rate; players honored by *Baseball America*'s ratings are more likely to make the majors. There is no statistical significance to nationality or exposure to the draft when it comes to making the major leagues.

The picture is far too muddy to draw any clear conclusions. A further study into the likelihood of making the Top 10 lists for *Baseball America* (which had a strong statistical relationship with making the major leagues, as obviously making the list is a reflection of talent) revealed that being Puerto Rican reduced a player's odds of reaching a Top 10 list by 84%, all other accounted for variables remaining the same, the equivalent of turning professional four years later or starting two levels of play lower. (Appendix C) While I have little doubt that the result is more likely to be the result of judicious data mining than a systemic bias on the part of the *Baseball America* staff or a clear indication of the draft's effect on Puerto Rico, the model may also (slightly) point to the same signs of decline in elite Puerto Rican talent the Top 100 and Rookie of the Year voting lists indicate.

Part Three: Suggestions and Conclusions

A free market for amateur players' services seems unlikely and even somewhat undesirable, given the reasonable competitive benefits evidence suggests the draft provides and the powerful politics keeping it in place. So the question becomes, how can we make it better? Any improved draft system would have to incorporate the following elements to satisfy the existing constituencies: rigorous cost controls on signing bonuses, a reduction in signability issues, incentives for savvy management, and enough free market aspects so as not to void all big-revenue teams' advantages.

There exists a model for player development in a highly professionalized major sport that has a significant base of talent in developing countries: hockey. Among the things the NHL largely has done right in recent years is its player entry draft, which includes all players between the ages of 18

and 20, and all foreign-born players over the age of 20, with the requirement that foreign players be drafted before joining the league, with limited exceptions. Players are drafted from the United States and Canada, but also from emerging Eastern European nations as well. Teams hold the rights to international players for two years; this is likely to be extended in the near future, and must pay the players' professional club team a flat transfer fee, though this may go become negotiable in the future. Additionally, while teams retain college players' rights until 30 days after their graduation, drafted college players retain their amateur eligibility to play college hockey. There are compensatory picks for teams who lose their restricted free agents (generally players in their early- to mid-20s, equivalent to arbitration-eligible MLB players) based on the average annual value of contract signed by the departing player, but none for unrestricted free agents.

An international draft would be a logistical nightmare, however. Most hockey-playing nations are industrialized Western or former Soviet countries with adequate to superb infrastructure. Baseball is popular in some nations that fit that profile---South Korea, Japan---but more that are not. The Japanese would balk because a draft would raid players from their existing leagues, while the Dominicans see warning lights in Puerto Rico's post-draft history. A better idea is a simpler return to an old plan---the bonus baby rule---with a few tweaks would serve the seemingly conflicted interests of all parties.

- Limit the draft to three rounds plus compensatory picks for lost free agents. Players picked outside the top 100 have little statistical chance of having a serious major league career, [11] and this would allow greater liquidity in the marketplace to better match player and team needs and reward good management. Players could be drafted only between ages 18 and 22.
- Drafted players who choose to turn professional would immediately receive major league contracts and thus be required to take a spot on the 40-man roster. Similar to the bonus baby rule, this creates a "tax" on roster space for taking high-profile young players. The requirements are far less onerous than the original version of the bonus baby, as keeping draft picks on the 40-man would force teams to either promote players or allow them to enter the free market far earlier than the current system.
- The draft picks would have hard-slotted bonuses and uniform entry contracts. Again, if there is going to be a draft, it should accomplish its goals by affording all teams the ability to sign the best young players.
- Undrafted players younger than 21 could sign with any team they chose, but bonuses would be capped at 95% of the final pick's slotted bonus. This allows teams such as the Yankees to exercise a quality-through-quantity approach without forcing bidding wars for players not among the top 100 of their draft class. Players older than 22 who went undrafted would be free to sign with any team they chose for any amount they could negotiate.
- Allow teams to retain players' rights if they attend college or play abroad. By maintaining players' rights, teams can avoid the "bonus baby" tax and take a wait-and-see approach, as a bonus, college baseball talent improves. Teams could sign players at any point during their collegiate career, similar to the setup in hockey, also preventing a professional-caliber player from having his skills atrophy against inferior competition. These players, while still in college or playing abroad, would not take up a spot on the 40-man roster.
- International players signed to bonuses over a certain threshold would take up spots on the 40-man roster and, more importantly, police the bonus amounts (and ultimate recipients).
- Limit the total number of players under contract to an organization at any given time; this prevents stockpiling and allows for greater liquidity among fringe players.

- Restore the Rule 5 draft to its pre-2007 status, allowing greater liquidity in the marketplace without markedly raising player costs.

The above reforms would help teams control costs by ensuring that they do not end up bidding against themselves for top young talent despite the draft's monopsony. With players outside the top 100 picks suddenly free agents, consistently unsuccessful teams would have greater incentives to seek out market inefficiencies in the domestic talent market and perhaps re-invest in places such as Puerto Rico or American inner cities. From the union perspective, it would help existing players who would gain a larger share of the current player expenditure pool while simply transferring near-term 40-man roster spots from one group of non-members (the current top minor league prospects) to another (the future draft picks). Greater free agency need not mean greater cost, however---consider how fungible a commodity the vast majority of baseball players represent, greater market mobility could actually have the effect of suppressing salaries when more replacements are available.

Inevitably, the current draft system's few advantages to amateur players will be whisked away---their representative in the process, the players' union, cares less about its future potential members than its current actual ones. But whatever reforms that do come should not be so shortsighted that they fail to consider their unintended but foreseeable consequences. Above all, incentives that reward competent, efficient management should be at the center of any moves, not knee-jerk reactions to headlines about rising bonuses and a dislike of Scott Boras.

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Baseball-Reference.com - Major League Baseball Statistics and History. 28 Apr. 2010. http://www.baseball-reference.com.
The Baseball Cube - Baseball Statistics, Draft and Player Information. 28 Apr. 2010. http://www.thebaseballcube.com.
"SABR Minor League Database." Society of American Baseball Researchers.

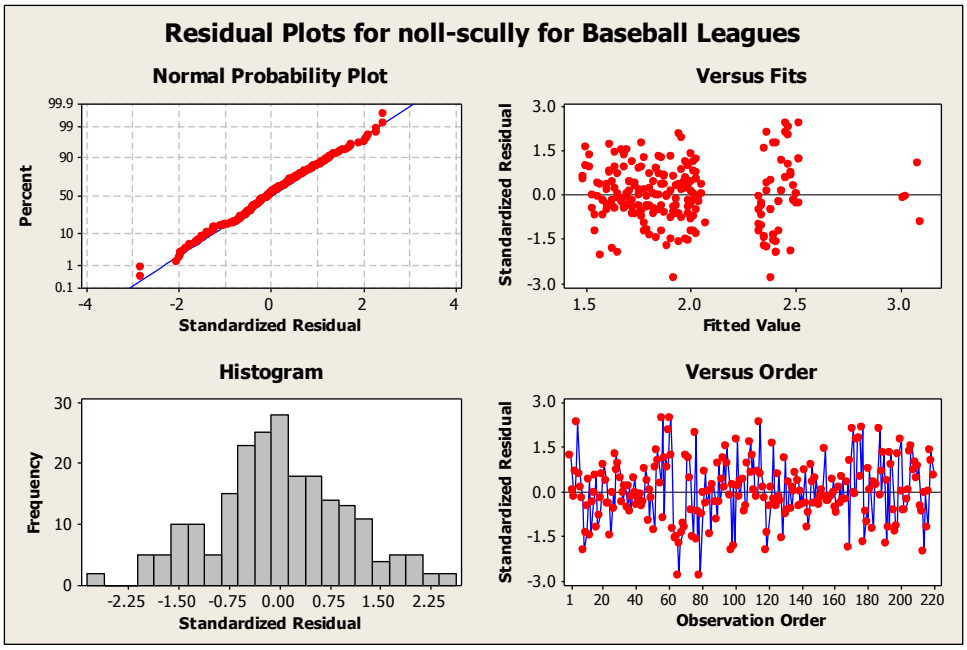
Appendix A

Researchers have developed metrics for measuring the competitiveness of leagues across sport types. Noll (1988), Scully (1989) and a slew of others furthered the discussion with articles on attendance and competitive balance, with Noll and Scully popularizing the use of measuring competitive balance via the ratio of standard deviation in winning percentage to the "idealized" standard deviation in a league with equally matched teams, or maximal competitive balance.

$$NS_{it} = \frac{\sigma(wp)_{it}^{actual}}{\sigma(wp)_{it}^{idealized}}, \text{where } \sigma(wp)_{it}^{idealized} = \frac{\mu(wp)_{it}}{\sqrt{N}}$$

The Noll-Scully ratio (*NS*) is the standard deviation of winning percentages (or percentage of possible standing points in leagues with ties) in league (*i*) in season (*t*) divided by the "idealized" winning percentage in a league. The "idealized" standard deviation Fort and Quirk [4] describe is a league in which every team has an equal chance of winning, rendering $\mu = 0.5$, essentially making the league a series of coin flips, building off El-Hodiri and Quirk.[12] By controlling for the number of games (*N*), Quirk and Fort argue that the comparisons across sports are valid. The lower the deviation of actual dispersion from the binomial modeled-"ideal" dispersion, prevailing theory suggests, the better the competitive balance and the more desirable the product. While some [13] have argued that the Noll-Scully method has problems---among others, it appears to be irrelevant to fans, and it takes the league in aggregate and thus ignores the consistent futility of the Pittsburgh Pirates, Detroit Lions and Los Angeles Clippers; the lack of understanding of the relationship between Noll-Scully ratios and fan behavior (*i.e.*, attendance, television ratings and revenue)---it has emerged as the industry standard for a reason: nobody's come up with a clearly better idea.

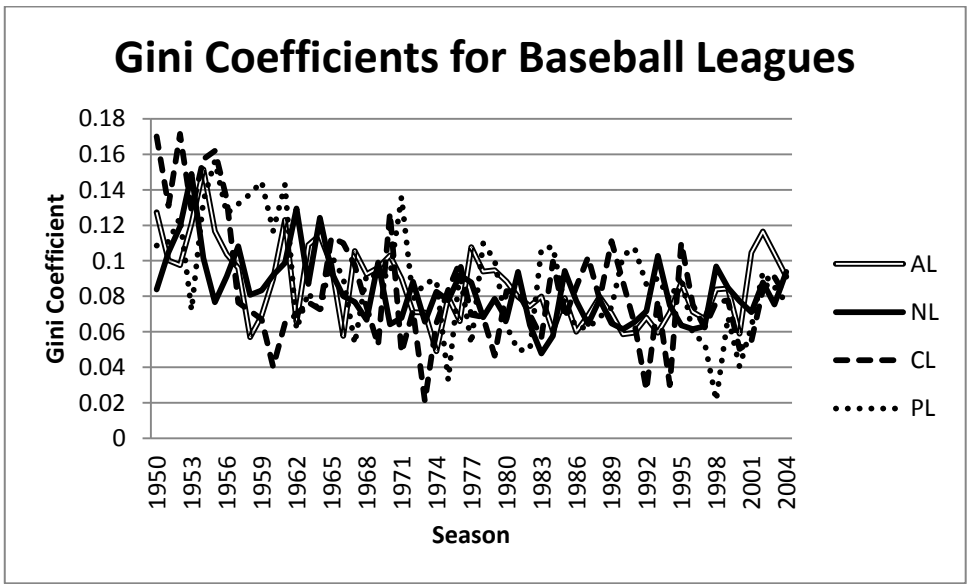
Model 1: Predicting Noll-Scully Ratios for MLB and NPB Baseball Leagues, 1950-2004



```
The regression equation is
noll-scully  =  29.6  -  0.283  draft  +  0.588  contraction  +  0.484
revenuesharing
             - 0.0139 year

Predictor            Coef   SE Coef      T      P
Constant           29.565     7.533   3.92  0.000
draft             -0.2829    0.1278  -2.21  0.028
contraction        0.5880    0.2678   2.20  0.029
revenuesharing     0.4844    0.1562   3.10  0.002
year            -0.013867  0.003848  -3.60  0.000

S = 0.516894   R-Sq = 30.0%   R-Sq(adj) = 28.7%

Analysis of Variance

Source           DF       SS      MS      F      P
Regression        4  24.6141  6.1535  23.03  0.000
Residual Error  215  57.4436  0.2672
Total           219  82.0577
```

Model 2: Gini Coefficients in MLB and NPB, 1950-2004

As a check on Noll-Scully, we can, by using "wins" as a form of wealth, use the Gini coefficients, a common economic inequality metric, taking a page from Schmidt and Berri.[14] The measure of dispersion is somewhat similar to the underlying analysis of the Noll-Scully, largely manipulating the same inputs. Though there are problems with using an unadjusted Gini coefficient (Utt and Fort 2002), such as interleague play, unbalanced schedules, and league expansion, I wanted to look at a more common economic metric used outside of sports to measure competitive balance.



The regression equation is
gini = 1.24 - 0.0124 draft + 0.0343 contraction + 0.0202 revenuesharing
- 0.000580 year

Predictor	Coef	SE Coef	T	P
Constant	1.2396	0.3271	3.79	0.000
draft	-0.012426	0.005548	-2.24	0.026
contraction	0.03435	0.01163	2.95	0.003
revenuesharing	0.020181	0.006784	2.97	0.003
year	-0.0005802	0.0001671	-3.47	0.001

S = 0.0224466 R-Sq = 30.9% R-Sq(adj) = 29.6%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	4	0.048412	0.012103	24.02	0.000
Residual Error	215	0.108327	0.000504		
Total	219	0.156739			

Appendix B

Cross-Tabulation Tables for Dominican, Puerto Rican and Venezuelan New Minor Leaguers, 1998-2002

I excluded older players who debuted in the minors during that time period (e.g., fringe free agents who had played in the independent leagues) because I wanted to examine the more "typical" development of young players. I included players who had played in the Dominican Summer League and Venezuelan Summer Leagues, but not the Mexican Summer League, because the former two are for development, while the latter is the fifth-best professional league in the world (after MLB and the Japanese leagues) and only tangentially affiliated with MLB. The categories "Top 10" and "Top 100" represent inclusion in *Baseball America*'s overall Top 100 prospects list or team-by-team Top 10 list.

Cell Contents: **Count**
% of Column

Rows: made_majors **Columns: birth_country**

	DO	PR	VE
0	819	132	366
	87.04	86.84	85.92
1	122	20	60
	12.96	13.16	14.08

Rows: made_majors **Columns: draft_eligible**

	0	1
0	1171	146
	87.26	82.95
1	171	30
	12.74	17.05

Rows: made_majors **Columns: draft_eligible / birth_country**

	0			1		
	DO	PR	VE	DO	PR	VE
0	809	0	362	10	132	4
	87.84	*	85.99	52.63	86.84	80.00
1	112	0	59	9	20	1
	12.16	*	14.01	47.37	13.16	20.00

Rows: made_majors Columns: top_10

	0	1
0	1272	45
	93.46	28.48
1	89	113
	6.54	71.52

Rows: made_majors Columns: top_100

	0	1
0	1308	9
	89.71	14.75
1	150	52
	10.29	85.25

Rows: made_majors Columns: pitcher

	0	1
0	693	624
	87.17	86.19
1	102	100
	12.83	13.81

Rows: made_majors Columns: leftypitcher

	0	1
0	1209	108
	86.79	85.71
1	184	18
	13.21	14.29

Rows: made_majors Columns: leftyhitter

	0	1
0	1100	217
	87.09	84.77
1	163	39
	12.91	15.23

Rows: made_majors Columns: switchhitter

	0	1
0	1156	161
	86.98	84.74
1	173	29
	13.02	15.26

Rows: made_majors Columns: debut_age

	17	18	19	20	21	22	23	24	25	26
0	49	224	379	339	191	81	35	12	7	0
0	77.78	82.96	87.33	89.45	86.04	91.01	92.11	85.71	87.50	0.00
1	14	46	55	40	31	8	3	2	1	2
1	22.22	17.04	12.67	10.55	13.96	8.99	7.89	14.29	12.50	100.00

Rows: made_majors Columns: entry_level (2=AAA, 7=Rookie League)

	2	4	5	6	7
0	2	54	28	72	1161
	100.00	73.97	73.68	81.82	88.15
1	0	19	10	16	156
	0.00	26.03	26.32	18.18	11.85

Rows: made_majors Columns: high_A_age

	18	19	20	21	22	23	24	25	26	27
0	11	36	70	100	95	86	58	24	10	6
	61.11	66.67	60.87	69.93	71.97	74.78	78.38	92.31	90.91	85.71
1	7	18	45	43	37	29	16	2	1	1
	38.89	33.33	39.13	30.07	28.03	25.22	21.62	7.69	9.09	14.29

	28	29	32
0	1	1	1
	33.33	100.00	100.00
1	2	0	0
	66.67	0.00	0.00

Rows: made_majors Columns: AA_age

	18	19	20	21	22	23	24	25	26	27
0	2	8	16	21	28	55	47	30	8	16
	66.67	53.33	45.71	35.59	35.44	59.78	59.49	73.17	80.00	100.00
1	1	7	19	38	51	37	32	11	2	0
	33.33	46.67	54.29	64.41	64.56	40.22	40.51	26.83	20.00	0.00

	28	29	30	32
0	4	2	1	1
	57.14	100.00	100.00	100.00
1	3	0	0	0
	42.86	0.00	0.00	0.00

Rows: top_10 Columns: birth_country

	DO	PR	VE
0	838	144	379
	89.15	94.74	88.97
1	102	8	47
	10.85	5.26	11.03

Appendix C

Predicting Success or Failure for Latino Minor League Player Sample to Reach *Baseball America*'s Top 10 Team-by-Team Prospect Charts

```
Link Function: Logit


Response Information

Variable     Value  Count
made_majors  1        201  (Event)
             0       1317
             Total   1518

Logistic Regression Table

                                                        Odds      95% CI
Predictor           Coef    SE Coef       Z      P  Ratio  Lower  Upper
Constant        0.742846    1.63683    0.45  0.650
debut_age     -0.0752544  0.0668159   -1.13  0.260   0.93   0.81   1.06
entry_level    -0.318900   0.107249   -2.97  0.003   0.73   0.59   0.90
pitcher         0.238930   0.216205    1.11  0.269   1.27   0.83   1.94
switchhitter   0.0829237   0.303582    0.27  0.785   1.09   0.60   1.97
leftypitcher    0.219026   0.337657    0.65  0.517   1.24   0.64   2.41
puerto_rican    0.431112   0.294260    1.47  0.143   1.54   0.86   2.74
top_10           3.58741   0.213499   16.80  0.000  36.14  23.78  54.92

Log-Likelihood = -416.306
Test that all slopes are zero: G = 354.296, DF = 7, P-Value = 0.000

Goodness-of-Fit Tests

Method           Chi-Square   DF      P
Pearson             278.042  168  0.000
Deviance            200.618  168  0.043
Hosmer-Lemeshow       5.048    7  0.654

Table of Observed and Expected Frequencies:
(See Hosmer-Lemeshow Test for the Pearson Chi-Square Statistic)

                                  Group
Value   1      2      3      4      5      6      7      8     9  Total
1
Obs    10      8      5     11     14     10     16     49    78    201
Exp   9.6    8.7    8.6   14.5   10.3   10.9   12.6   48.0  77.8
0
Obs   201    164    153    237    146    144    135    110    27   1317
Exp 201.4  163.3  149.4  233.5  149.7  143.1  138.4  111.0  27.2
Total 211    172    158    248    160    154    151    159   105   1518
```

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	210737	79.6	Somers' D	0.62
Discordant	46191	17.4	Goodman-Kruskal Gamma	0.64
Ties	7789	2.9	Kendall's Tau-a	0.14
Total	264717	100.0		

Regression for "Highest Level Achieved" (1 = MLB, 7 = Rookie League).

The regression equation is
high_level = - 6.77 + 0.156 height - 0.0245 weight + 0.655 entry_level

Predictor	Coef	SE Coef	T	P
Constant	-6.771	2.018	-3.36	0.001
height	0.15559	0.02949	5.28	0.000
weight	-0.024474	0.002858	-8.56	0.000
entry_level	0.65521	0.07032	9.32	0.000

S = 2.03342 R-Sq = 10.4% R-Sq(adj) = 10.3%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	3	730.29	243.43	58.87	0.000
Residual Error	1514	6260.07	4.13		
Total	1517	6990.37			

Variable	Value	Count	
top_10	1	157	(Event)
	0	1361	
	Total	1518	

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	4.42428	1.49622	2.96	0.003			
debut_age	-0.215915	0.0633580	-3.41	0.001	0.81	0.71	0.91
entry_level	-0.345973	0.0946796	-3.65	0.000	0.71	0.59	0.85
puerto_rican	-0.836757	0.375194	-2.23	0.026	0.43	0.21	0.90

Log-Likelihood = -491.961
Test that all slopes are zero: G = 25.686, DF = 3, P-Value = 0.000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	46.5675	56	0.811
Deviance	44.1380	56	0.874
Hosmer-Lemeshow	3.6407	5	0.602

Table of Observed and Expected Frequencies:
(See Hosmer-Lemeshow Test for the Pearson Chi-Square Statistic)

	Group							
Value	1	2	3	4	5	6	7	Total
1								
Obs	12	16	29	35	29	33	3	157
Exp	9.5	15.5	28.5	41.4	32.0	27.6	2.5	
0								
Obs	183	202	290	346	216	119	5	1361
Exp	185.5	202.5	290.5	339.6	213.0	124.4	5.5	
Total	195	218	319	381	245	152	8	1518

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	117161	54.8	Somers' D	0.22
Discordant	69744	32.6	Goodman-Kruskal Gamma	0.25
Ties	26772	12.5	Kendall's Tau-a	0.04
Total	213677	100.0		

Appendix C:
Link Function: Logit

Response Information

Variable	Value	Count	
top_10	1	157	(Event)
	0	1361	
	Total	1518	

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	4.42428	1.49622	2.96	0.003			
debut_age	-0.215915	0.0633580	-3.41	0.001	0.81	0.71	0.91
entry_level	-0.345973	0.0946796	-3.65	0.000	0.71	0.59	0.85
puerto_rican	-0.836757	0.375194	-2.23	0.026	0.43	0.21	0.90

Log-Likelihood = -491.961
Test that all slopes are zero: G = 25.686, DF = 3, P-Value = 0.000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	46.5675	56	0.811
Deviance	44.1380	56	0.874
Hosmer-Lemeshow	3.6407	5	0.602

Table of Observed and Expected Frequencies:
(See Hosmer-Lemeshow Test for the Pearson Chi-Square Statistic)

	Group							
Value	1	2	3	4	5	6	7	Total
1								
Obs	12	16	29	35	29	33	3	157
Exp	9.5	15.5	28.5	41.4	32.0	27.6	2.5	
0								
Obs	183	202	290	346	216	119	5	1361
Exp	185.5	202.5	290.5	339.6	213.0	124.4	5.5	
Total	195	218	319	381	245	152	8	1518

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Total	213677	100.0		