Inadvertent Inequality: The Unintended Consequences of the Major League Baseball Free Agent Compensation System

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Abstract

In this paper we demonstrate how the Major League Baseball (MLB) free agent compensation system (FA-CS), intended to achieve parity across MLB teams, has the unintended and adverse consequence of increasing inequality. The FA-CS compensates teams that release a Type A Free Agent by giving them a compensation pick – the highest draft pick from the team that signs the free agent. The cost of each lost pick decreases as teams sign multiple Free Agents. This characteristic lowers the cost per Free Agents, when multiple Free Agents are signed. However, such benefits are solely accessible to teams that are relatively resource unconstrained, giving rise to an inequality-increasing positive feedback. To explore the importance of the FA-CS positive feedback, we develop a dynamic model of the flow of Type A Free Agents through their MLB career, including their maturation from draft picks, to minor league, to major league, to free agency, and finally to retirement. Additionally, we model teams' free agent hiring process to understand free agent dispersion within the league. Isolating the FA-CS feedback from other scale effects and calibrating the model to MLB data we estimate the strength of this adverse inequality-increasing effect.

"The goal of a well designed league is to produce adequate competitive balance. By this standard, MLB is not now well-designed. In the context of baseball, proper competitive balance should be understood to exist when there are no clubs chronically weak because of MLB's structural features."

- Levin, Mitchell, Volker, and Will (2000)

Introduction

Disparity in baseball has been a chronic issue, and one that has been studied thoroughly since Major League Baseball's inauguration. In 1999, Bud Selig, the commissioner of Major League Baseball, put together a "Blue Ribbon Panel on Baseball Economics" to study whether the financial inequity among the thirty clubs was detrimental to competitive balance in baseball. The panel consisted of Senator George Mitchell, Richard Levin (former President of Yale), Paul Volker (former Chairman of The Federal Reserve), and Pulitzer Prize winner George Will. After 18 months of studying the economic state in Baseball, they concluded that Major League Baseball is not "well designed". Additionally, the panel found that large revenue disparities exist and that the problem has become substantially worse. This is not the first time that disparity in baseball has been addressed.

The 1981 Collective Bargaining Agreement featured a free agents compensation system designed to establish equality. In the past 30 years the system has evolved, but its mechanism and intended function has remained the same. Teams low on the economic totem pole, often times, cannot afford to keep their valuable players once they reach free agency (after 6 years of major league service). In order to ensure that richer teams do not enjoy too great of an advantage, they are charged with forfeiting their top draft pick in the form of a compensation pick when they sign a premier free agent, which is then awarded to the poorer team for giving up their "star" player. "Star" or Type-A players are defined as the top 20% of the league according to "A Statistical System for the Ranking of Players" (MLB CBA 2007) and calculated by the Elias Sports Bureau. This statistical system may also be referred to as the Elias ranking.

In this paper we examine whether the free agents compensation system in Major League Baseball achieves competitive balance within the sport, or whether the very system established to mitigate disparity exacerbates inequality. We utilize a dynamic model of MLB and the flow of Type A Free Agents and their contribution to team performance to estimate the effect of the FA-CS on team's success. We find that the FA-CS may be inadvertently contributing to inequality among MLB teams.

In the next section we describe the FA-CS, its history, and its limitations. We then present our conceptual model and explain the major components of the model. We perform parametric and structural sensitivity analyses. Following this, we outline the findings of our analysis.

Major League Baseball and the Free Agents Compensation System

The free agents compensation system emerged from a complex history between the Major League Baseball Players Association and the owners of the franchises. Over a century ago, in 1880 the owners enacted a reserve clause in the players' contracts (Staudohar 1996, p. 14-15). The 1880 reserve clause stated that when a player's contract expired, the rights of the player were retained by the team that had previously signed him. This had the effect of binding the player to a single team, establishing a monopsony that artificially deflated players' salaries by not allowing them to be valued on the open market. In addition to stunting players' salaries, the reserve clause made it nearly impossible for one team to stock pile premier free agents, thus inducing parity in a system that would otherwise be susceptible to the polarizing effects of the

Owners' financial inequalities. The reserve clause stood in baseball for nearly a century until it was challenged by the Major League Baseball Players Association.

In 1975 Andy Messersmith and Dave McNally declared themselves free agents. Their declaration was deemed invalid because of the reserve clause, and following this rejection they filed a grievance. The grievance went to arbitration, and the arbitrator, Peter Seitz, ruled that, "When that year comes to an end, the Player no longer has contractual duties that bind him to the Club." (Berry, Gould IV, & Staudohar, 1986). This decision set a dangerous precedence for the owners and set the stage for their next round of collective bargaining. In 1976 there was a lockout for 17 days. Following the lockout, a collective bargaining agreement was negotiated and the 1880 reserve clause was abolished. Players were now bound to their team for 6 years, after which they were able to become free agents.

In 1981, four years after signing the CBA, the owners felt they needed to address the issue of compensation to clubs that lost free agents. This issue became the focus of the 1981 CBA, and it was this year that the free agents compensation system was developed. The owners believed that new compensation system would deter free agency, and therefore keep wages lower. Additionally, the compensation system would encourage competitive balance by compensating poorer teams with draft picks for losing free agents that they couldn't afford to retain.

Prior to explaining the FA-CS we describe how the draft process works. There are 30 teams in MLB, each with 50 picks. The order of picks each round goes in opposite order of where the team finished the previous season. The team with the worst record picks first each round and the team with the best record picks last. The first 15 picks of the first round are protected, meaning that the first compensation pick forfeited due to signing a type A free agent for a team that finished in the bottom half of the league is a second round pick.

The FA-CS works as follows. If a team loses a player to free-agency, henceforth referred to as the "losing team", the losing team is compensated with one to two draft picks in the following rule 4 amateur draft, on the condition that 1) The player was offered salary arbitration and rejects the offer[1], and 2) ranks as a Type A or B free-agent (ranking system explained

[1] A team cannot receive compensation for losing a ranked free agent unless it offers that player salary arbitration and is subsequently rejected. Arbitration in baseball is final offer binding arbitration.

below). Compensation for Type A free agents is two picks, one in the first round (if the picks are unprotected) which is taken from the team that signs the Type A free-agent henceforth referred to as the "signing team", and another pick in between the first and second round of the draft called a "sandwich pick" or "Special Draft Choice". Compensation for Type B free agents solely consists of one "sandwich pick", meaning no draft pick is charged from the signing team (Law, 2006).

Picks during the sandwich round follow the same order as the normal draft. No team may pick a second player in the sandwich round before all teams with at least one sandwich pick have picked once, and no team may pick a third player before all teams with two sandwich picks have picked twice (Law, 2006).

In the case that a team signs multiple Type A free-agents, its draft choices are distributed to the losing teams in descending order of the respective free agents' rankings. For example in 2009 (2008-2009 off season) the New York Yankees signed three Type A free-agents; they signed Mark Teixeira from the Anaheim Angels, CC Sabathia from the Milwaukee Brewers, and AJ Burnett from the Toronto Blue Jays. Teixeira had an Elias ranking of 98.889, Sabathia had a ranking of 98.11, and Burnett had a ranking of 89.729, meaning that Anaheim received New York's first round pick, Milwaukee received their second round pick, and Toronto received New York's third round pick (Dierkes, 2009).

Overall, this draft system was designed to create parity in Major League Baseball. Another intended function of the system was to artificially deflate players' salaries. The owners believed that because teams would have to give up a valuable draft pick in order to sign a star player, teams would discount their offers accordingly (Berry, Gould IV, & Staudohar, 1986). While the intentions of the ranking system were focused in scope, the implications of such a system are vast.

Acknowledged Flaws in the Compensation Draft System

There are several acknowledged critiques of the FA-CS. The Blue Ribbon Panel identified that a major flaw in the system was that high revenue teams were exploiting the system in an unintended manner. The report states that high revenue teams take on expensive players on the verge of free agency, in an attempt to aggregate compensation picks. The end result is that the high revenue teams receive a disproportional number of picks in the amateur draft, counteracting the FA-CS's intended function.

There are also technical problems with the FA-CS stemming from the way in which Type A and Type B players are evaluated. The evaluations are based on the Elias rankings. The calculations currently used were designed twenty years ago, a decade before baseball's statistical proliferation. The statistics used in the calculation are dated to say the least. It is now well understood that batting average, runs-batted-in, fielding percentage, total chances, wins, losses, saves, and even earned run average are poor indicators of a player's value. Even if the statistics used were adequate indicators of a player's value (which they aren't), the calculation itself is flawed; the ranking only takes into account where a player stands in a given statistic, not by what margin he stands. For instance, if a pitcher led all of baseball in strike outs, it wouldn't matter if he struck out 200 batters or 400 batters, he would receive a score of 100 in the ranking for strike outs (Law, 2006). This incongruence between a player's "true" value (impossible to calculate, but possible to estimate) and the Elias ranking value is not a secret and looms as an issue of great concern for the upcoming collective bargaining agreement. For example, Michael Weiner, the general counsel to the union explained, "The bargaining parties at the end of this basic agreement should take a hard look at all issues related to draft-choice compensation, including the particulars of the Elias rankings… It's not in the interest of clubs or players for the Elias rankings to be out of touch with the way the market actually values players."(Passan, 2010).

Finally, the FA-CS creates incentives for teams to not pursue winning in a given year. It is often the case that a team would prefer to have one of its impending free agents be a Type B free agent as opposed to a Type A free agent. For example, if a player is past his prime and is coming off a contract where he was highly paid, his team may want to receive a compensation pick for him. In order to get compensation the team has to offer arbitration, meaning it must offer at the very least 80% of his previous year's salary[2]. If the player were a Type A free agent, then the signing team would discount his salary because of the loss of a draft pick. It would therefore be in the best interest of the player NOT to reject arbitration, because the chances of another team signing him for more than 80% of his previous year's salary is incredibly unlikely given the discount. This however is bad for the player's current team. Now the team is stuck with a player

[2] According to Article XXIII F c (i) of the 2007-2011 CBA "A Club may submit a salary figure for salary arbitration that is at least 80% of the Player's previous year's salary… and at least 70% of his salary… two years previous".

that is past his prime, getting overpaid, and receives no compensation. On the other hand, if this player were a Type B free agent, then the prospective signing team would not have to forfeit a pick, and therefore not have to discount his potential salary. In this case, the player would rationally reject arbitration to become a free agent, and the team that lost the player would receive one compensation sandwich pick. This is why many teams would prefer to have their marginal free agents be Type B free agents as opposed to Type A. Similarly, it follows that players might prefer to be Type B free agents because their next salary will not be discounted. Some players have gone as far as to insert a clause into their contracts that states that they may *not* be offered arbitration, in an effort to circumvent the compensation system all together. Such players include Orlando Hudson, Brad Penny, Justin Duscherer, Ben Sheets, Ivan Rodriguez, and Carlos Beltran (Dierkes, 2011). The phenomenon may explain why some teams do not use their "best" reliever as their closer, where he would be best suited (because saves are valued highly by the Elias ranking, closers have a significantly easier time ranking as a Type A free agent).

Modeling Dynamics of Free Agents and Team Performance

In this section we develop a stylized model to analyze the dynamics of the free agency compensation system. The model serves as an incomplete, but internally consistent, construct to analyze and explain the important dynamics of interest (Weber and Shils 1949), under a variety of circumstances. In developing our model to analyze the dynamics of the free agency compensation system, we deliberately ignore many factors important to the dynamics of MLB team performance. For example, we do not include Type B compensation, the sandwich round, or the way teams and players circumvent various intended functions of the system. Also we, optimistically, assume that the Elias ranking is a good proxy for a player's true value. Altogether, we develop a model of an idealized working of the free agency compensation system. Similarly, we ignore any heterogeneity across teams in terms of their individual markets or development styles. Hence all variation in performance derives from interactions between them and differences in their initial conditions. Our argument for this stylization is that qualitatively the insights from our analysis are not affected. We leave relaxation of those assumptions for later analysis.

The model is formulated in continuous time as a set of nonlinear differential equations. Simulation also allows researchers to infer dynamics from structure by varying a single factor, relaxing a single assumption, or comparing different initial conditions, all within one controlled environment. We specify conditions through well-defined variables to represent different ranges of unobservable parameters. We use the simulation to generate counterfactual analysis, by changing the returns-to-scale and compensation. The analysis of the formal model then allows development of consistent hypotheses around the working of this compensation system. We use the simulations as a powerful way of extending extant theory in useful ways (Davis et al. 2007).

Structure and dynamics of Type A Players

The central variable of interest is variation in firm performance. Since product differentiation within MLB is difficult, the main revenue streams come from the number of wins teams are able to generate, and from branding. Type A players are in expectation the main generators of "Wins above Replacement". Moreover, Type A players generate a stream of revenues that are independent of wins, such as through sales of merchandise, television rights, filled stadiums. While Type B players may play a significant role in achieving above average wins, they do not have the public stature, they contribute much less to such revenues. Hence, we simplify the model by assuming that only Type A players contribute to above average wins. Then, we simplify the model by focusing solely on the role of Type A players.

Figure 1 shows the core of the model, tracing Type A players as they flow through the MLB system, the feedback that drives inequality through economies of scale, and the intended FA-CS policy that seeks to mitigate this. We trace prospective Type A players from their drafting into the minor league, their development into the Major league as Type A players. After a fixed period, players become free agent and can sign with any team. Players retire after one renewal.

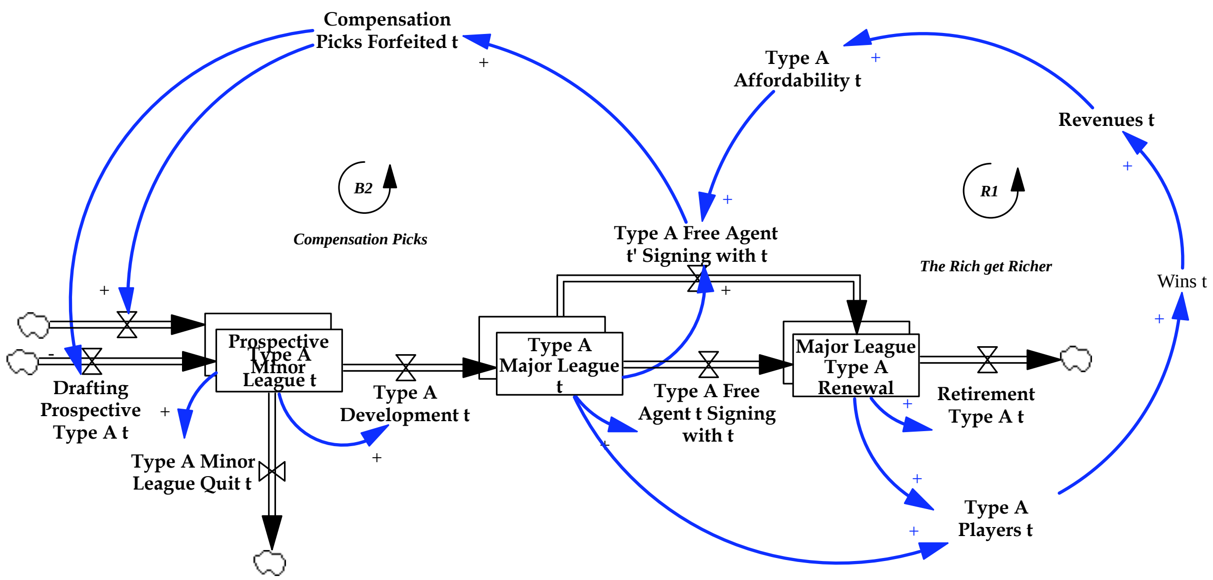

Figure 1. Conceptual Model with intended compensation policy

A central reinforcing feedback underlying the dynamics of MLB team segregation results from teams with more Type A players, increasing the average wins, as well as branding which increases their revenues. The larger revenues makes hiring of Type A free agents more affordable, which further increases the teams number of Type A players (R1, "*The Rich get Richer*"). The existence of these scale economy dynamics is well-known. To counteract this, the free agent compensation system was designed. As teams hire more Free Agents they compensate the teams that let the free agents go (losing teams), by giving up their first round prospects to those teams. As free agent signing teams (signing teams) receive fewer prospects, over time, fewer Type A players are expected to arrive through the minor leagues, reducing the future expected wins (B2, "*Compensation picks*"). We now describe our formalization of this structure.

We begin with describing how Type A Players flow through the system. We differentiate between t team tiers, whose only difference is found in their respective state of the system, that is, the number of Type A players they have. Within each tier we follow an average team.[3] The change of a team's pool of prospective Type A players in the Minor Leagues, A^{MiLB}, equals the

[3] Thus, we aggregate N/t teams over each category, with N being the total number of teams. Since we normalize all parameters, we just focus on the team types and do not have to worry about the number of teams per category.

prospects that are being drafted, a_t^d, minus the prospects that quit at rate q_t, and those that are developed into the major league at rate d_t, thus:

$$\frac{dA^{MiLB}}{dt} = a_t^d - q_t A_t^{MiLB} - \frac{A_t^{MiLB}}{\tau^{MiLB}} \tag{1}$$

Next, the stock of a team's players under team control in the Major league, A^{UTC}, increases with prospects being developed, minus the players that become free agent after one contract period of τ^{UTC} years

$$\frac{dA^{UTC}}{dt} = \frac{A_t^{MiLB}}{\tau^{MiLB}} - \frac{A_t^{UTC}}{\tau^{UTC}} \tag{2}$$

Finally, a team benefits from a stock of post free agency Type A players, A_t^{PFA}, which increase as free agents are being hired, with team t receiving the share σ_t^f of all free agents, but decrease as they retire after τ^{PFA} years.

$$\frac{dA^{PFA}}{dt} = \sigma_t^f \frac{A_t^{UTC}}{\tau^{UTC}} - \frac{A_t^{PFA}}{\tau^{PFA}} \tag{3}$$

We now specify the hiring of free agents. All free agents that enter on the market are being hired and distributed across teams according to their relative value v_t of hiring:

$$\sigma_t^f = \frac{v_t}{\sum_{t'} v_{t'}} \tag{4}$$

The value of hiring must be seen as the desired spending during the hiring period by a team t.

Firm profits

We now outline our formalization of firm performance. Profits π_t equal revenues r_t minus costs c_t:

$$\pi_t = r_t - c_t \tag{5}$$

Since both merchandise sales and wins are correlated with the number of Type A agents, we simplify the model by assuming that revenues depend on the number of wins W_t, thus $r_t = v^w W_t$, with v^w being the dollar value of a win. Similarly, then, all costs derive from contracts of Type A agents. We do not differentiate between Type A agents. Contract costs for players Under Team Control are a fraction of contract costs for player post free agency. This is because players do not reach the open market until free agency, and thus will not be valued by supply and demand, but rather by the minimum contract stipulated in the MLB CBA and arbitration cases. Then, costs are simply the contract costs times the total number of Type A agents in each cohort {UTC,PFA}, hence: $c_t = c^{UTC} A_t^{UTC} + c^{PFA} A_t^{PFA}$.

To relate the wins to the Type A players, we draw upon empirical regularities of the MLB. Team wins increase with the total number of Type A players within the team, A_t. Yet, absent Type A players, teams will always win a minimum number of games W_{min}. Beyond the minimum wins, the effect of Type A players on wins depends on the win exponent λ^w. Then, the Wins and the Wins due to good players, W_t^g are as follows:

$$W_t = W^{\min} + W_t^g$$
$$W_t^g = \left(G - 2W^{\min}\right)\left[\frac{1}{T}\sum_{t'}\frac{A_t^{\lambda^w}}{\left(A_t^{\lambda^w} + A_{t'}^{\lambda^w}\right)}\right] \tag{7}$$

with G being the total number of games and T being the total number of team types we differentiate between in the competition. It can readily be seen that if everybody has the same number of Type A players, or, alternatively if the win exponent is equal to 0, $W_t = G/2$, the average number of wins for all teams. On the other hand, if a team would have all the Type A players, it would win all its games minus those that are split, irrespective of the number of Type A players, $W^{max} = G - W^{min}$. The win exponent λ^w should be expected to be between 0 and 1, giving diminishing returns to the number of Type A players. However, for sensitivity analysis, realizing that Type A players have other ways to contribute to revenues, we can allow this parameter to go beyond one.

Firm's FA hiring decisions – absent compensation

Then, capturing the desired spending during the hiring period in a behavioral and empirically robust way, the value of hiring v_t is equal to the number of free agents aspired A_t^{f*} , adjusted with the expected value π_t^a of hiring per player:

$$v_t = \pi_t^a a_t^{f*} \tag{8}$$

Expected value per free agent is equal to the difference between the expected revenues r_t^* minus annualized contract cost c^f , $\pi_t^a = \left(r_t^* - c^f\right)$.

Expected revenues per Type A player depend on the number of wins W_t above replacement they are expected to generate by A_t^* players, thus:

$$r_t^* = v^w \left(\frac{W_t^{g*}}{A_t^*} \right) \qquad (9)$$

With the expected players $A_t^* = A_t + a_t^{f*} + \left(a_t^{MiLB} - a_t^{UPC} - a_t^{PFA} \right)$, where the terms on the right hand respectively represent adjustments in Type A players due to: aspired hiring from free agency, expected entrance from the minor league, entrance on the market as free agent, and retirement. The expected wins W_t^{g*} adjusts similarly for the expected player differential.[4]

MLB team growth is a major driver of performance, teams aspire to sign as many free agents as their budgets allow. Teams with more revenues due to good players can afford more free agents. Teams need to replace exiting free agents and want to expand their current base. Demand scales with the total flow of free agents available. Further, teams that receive more wins from their Type A players, seek to expand more. Thus:

$$a_t^{f*} = \frac{\left(W_t^g\right)^{\lambda^i}}{\sum_{t'} \left(W_{t'}^g\right)^{\lambda^i}} \frac{A^{UTC}}{\tau^{UTC}} \qquad (9)$$

where λ^i is the income exponent and δ is a demand scaling factor. An income exponent equal to 0 corresponds with teams aspiring an equal share. In this case, teams are converging towards the same number of players, as large teams are not likely to replace their exiting Type A players. An income exponent equal to 1 is also conservative, as this corresponds with each team approximately replacing their free agents. An income exponent significantly larger than 1 is more likely, where richer teams aspire a larger share of the net free agents. Note that the resulting feedback (rich get richer, R1) is particularly strong since the total number of Type A Free agents is conserved. Hence, as one team gets more Type A players, others get fewer. Similarly, the total number of wins is conserved.

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[4] A simpler model would ignore the adjustment terms in brackets. Our simulations suggest that qualitative results do not change as we do that. Nevertheless, with expansions pending, we left this term in.

Finally, without compensation each team has a similar probability to draft Type A players. Hence,

$$a_t^d = a^{d,AVG} \tag{10}$$

Where $a^{d,AVG}$ is the average prospective Type A players being drafted annually.

Base run: no compensation

Having specified the model we now generate a base run. Parameters are specified to resemble those that can describe the functioning of MLB (Table 1, Appendix).

We run the simulation with 5 different team tiers. We initialize the model in equilibrium with all Tiers endowed with the same number of Type A agents. In year 5 we shock the system through a one-time reallocation of Type A former free agents across teams. A tier 1 team receives one extra free agent, while a team from tiers 3 to 5 give up free agents increasingly. Figure 1 shows the results. Figure 1, top, compares the equilibrium wins for a low win exponent ($\lambda^w=0.5$) and a moderate win exponent ($\lambda^w=0.8$). The low win exponent is not sufficient to tip wins towards the temporarily well-endowed team. However, when the returns to increasing good players are sufficient, team 1 becomes the dominant team.

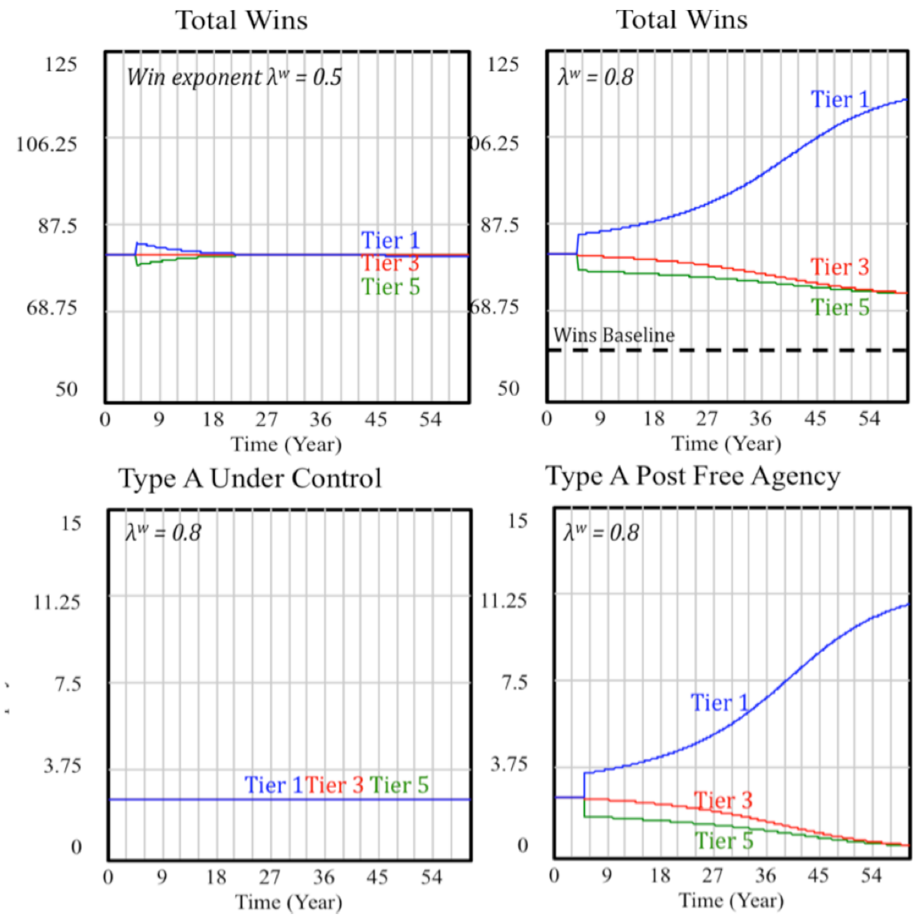

Figure 2. Base run with Total Wins, Total Type A Players, and Share of A teams players Under Control.

Figure 2, bottom, shows, left, the Type A players under team control, and, right, the Type A post free agency players, both per team. Absent compensation, all teams have the same probability of drafting Type A prospects. Hence, with each having the same Minor League development system, the number of players going through development is identical across teams. However, after the shock, the tier 1 teams having more Type A players now pursue however even more Type A free agents, and, in this way increase wins, generate more revenues and secure more free agents and the temporary endowment change gets reinforced and team 1 becomes the dominant team

The structure and Dynamics of Compensation

We now expand the model to capture more carefully the decisions. Figure 3 shows the intended and unintentional feedbacks at work in the compensation system. First,

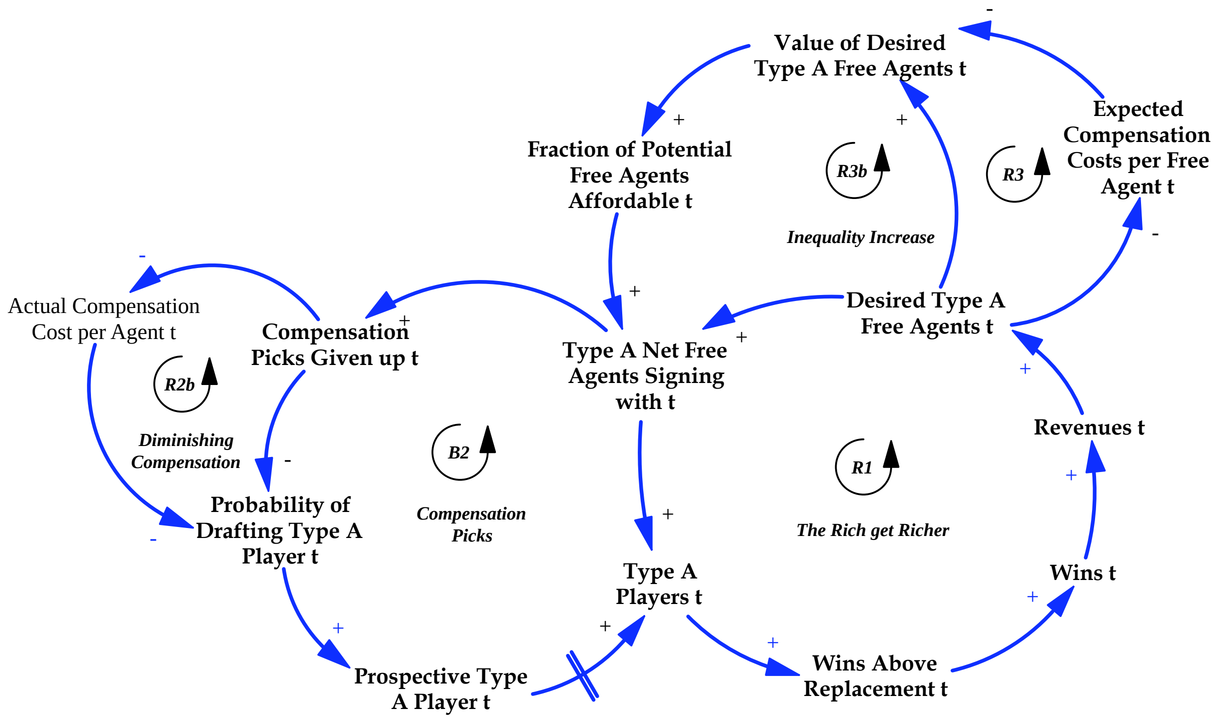

Figure 3. Dynamics of Compensation.

In order to introduce compensation, we now modify two equations compared to the base model. First, teams that sign free agents give up draft picks to compensate for the net free agents leaving from the other team, equation 10 is modified as follows:

$$a_t^d = a^{d,AVG} + c^+ - c^- \tag{10c}$$

Compensation costs for signing teams are a function of the net agents being hired beyond replacement. This is so, because teams do not forfeit picks for re-signing their own players, only free agents from different teams. Thus:

$$c_t^- = \begin{cases} f\left(n^{d*}\right); f' \leq 0 & n^{d*} > 0 \\ 0 & otherwise \end{cases} \tag{11}$$

The function *f(.)* links the number of expected prospects given up for the number of net free agents hired. $n^{d*} = a_t^{f*} - a_t^{UPC*}$. Since teams give up draft round picks for each net free agent hired, the correct specification for f, when using a continuous function, is the one that follows the cumulative distribution of expected draft picks per round. With n^d round picks, $f(n^d)=a^d$. Empirically, the f' is steeply downward sloping. However, we use a parameter to allow varying and generate counterfactual analysis. The analytical curve we use is:

$$f = a^d \frac{\left(\rho^{n^{a*}} - 1\right)}{\left(\rho^{n^d} - 1\right)} \tag{12}$$

Figure 4 shows an approximation of the marginal curve, using ρ=0.3. For illustration we show the hypothetical

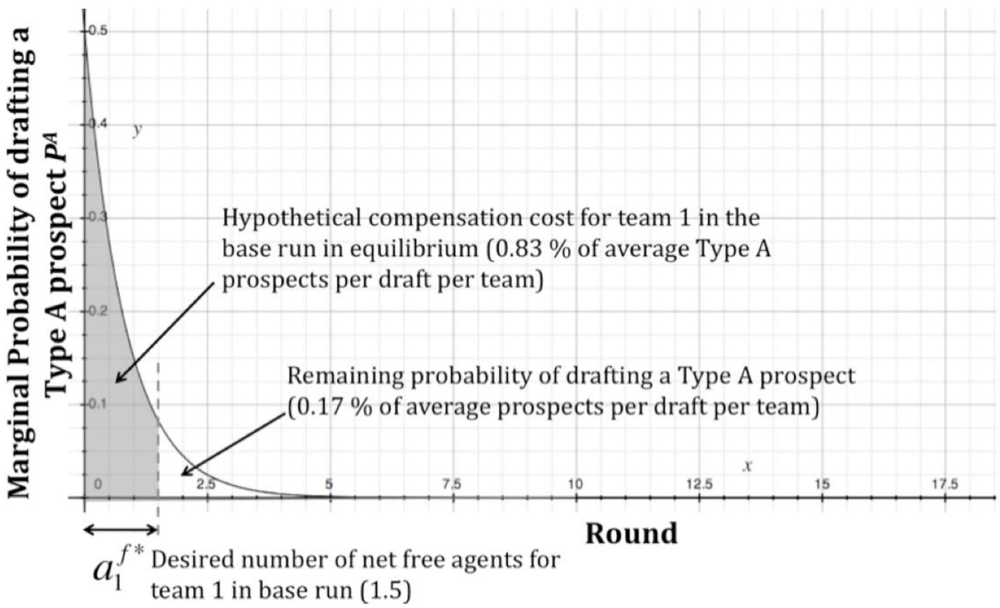

Figure 4. Distribution of Type A prospects across draft rounds, *f'(r)*, assuming *ρ= 0.3*. Also indicated hypothetical compensation costs for tier 1 teams in the (no compensation) run

Teams that give up free agents receive, from all that take, proportional to the net loss of free agents, hence. Thus:

$$c_t^+ = \frac{n_t^{d*+}}{\sum_{t'} n_t^{d*+}} \sum_{t'} f\left(n_{t'}^{d*}\right) \tag{13}$$

where n_t^{d*+} represents the absolute value of the net given up free agents, thus $n_t^{d*+} = \max(0, -n_t^{d*})$.

Finally, we adjust the value of hiring free agents v_t (equation 8) such that the expected value of free agents including the role of compensation v_t^c now also captures the giving up of draft picks, being:

$$v_t^c = n_t^{a*}\pi_t^a - c_t^-\left(r_t^* - c_t^{UTC}\right) \tag{8c}$$

Simulations with Compensation

We can see from both the graph of Total Wins (with compensation) and from equation 8c that as a team signs more free agents the cost associated with forfeiting a pick diminishes which results in an increase in v_t^c. This explains both why the number Type A players post free agency increases so rapidly for Tier 1. Additionally, the number of Type A players under control decreases for Tier 1, but that decrease is far outweighed by the aforementioned increase in post free agency type a player. Finally, the net increase in type players ultimately results in more wins for Tier 1.

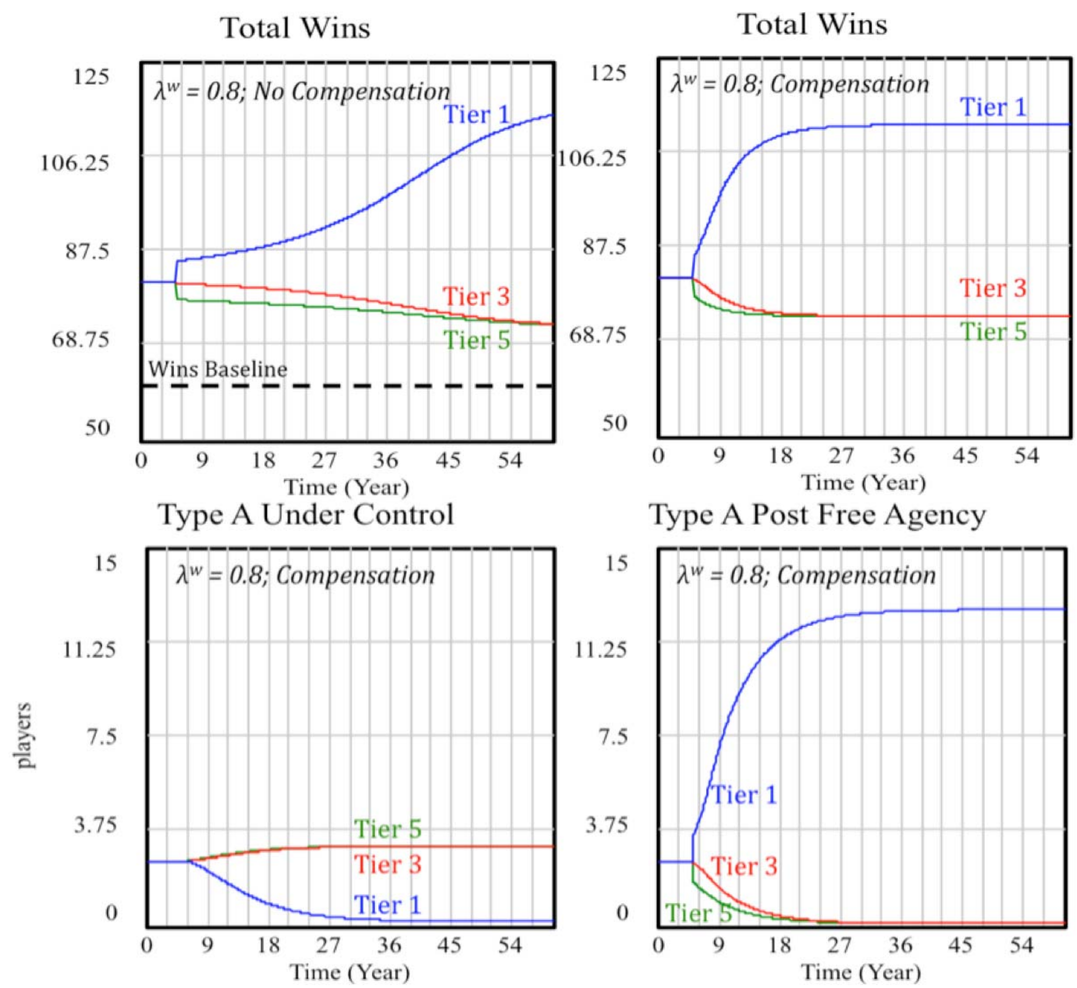

Figure 5. Compensation, parameters identical to those in Figure 3

Sensitivity Analysis

Parameter sensitivity analysis

We performed sensitivity analysis on a variety of parameters and now will discuss sensitivity analysis with respect to two key parameters: win exponent λ^w and the marginal change in likelihood of Type A prospect drafts across rounds, ρ. As an equality metric we select the time to reach 100 wins for tier 1 teams (as can be seen from Figure 5 and 6, this was 35 years for the non-compensation case and 5 years for the compensation case. Figure 6 shows how the value of this equality metric depends on ρ and λ^w. As the win exponent increases the number of years to 100 wins decreases. This is as expected. As ρ approaches zero, the time to 100 wins also decreases. The largest amount of time to 100 wins occurs when rho is large and λ^w is small.

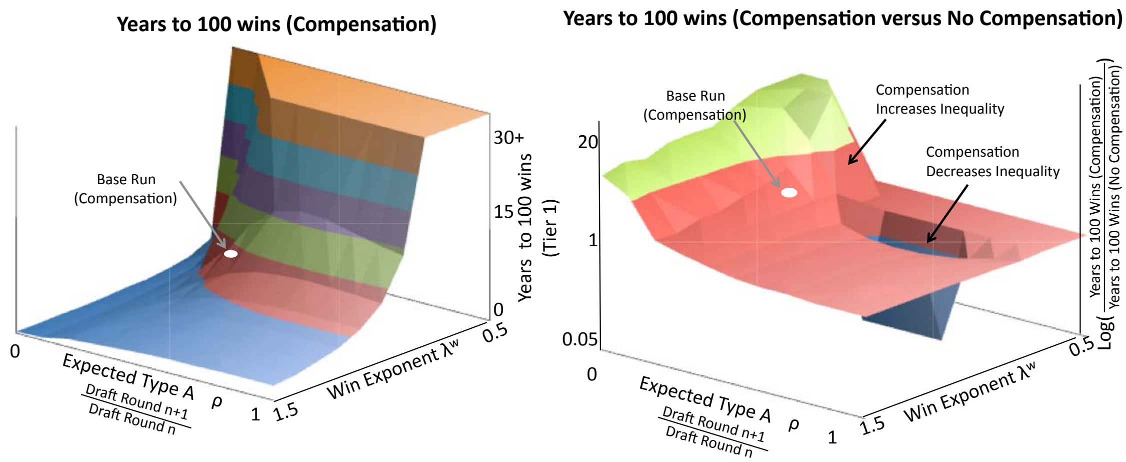

Figure 6. Sensitivity analysis of time to achieve 100 wins for top tier teams as a function of marginal change in Type A expectations per draft round, ρ, and the win exponent $\lambda^{win.}$. The right graphs compares compensation with non-compensation for the same parameters.

As can be seen from Figure 6 (right), the win exponent (λ^w) has very little affect on the ratio of years to 100 wins with compensation: years to 100 wins with NO compensation. From this graph you can see that there are conditions where compensation induces more parity than no compensation. This occurs when ρ is relatively high and the win exponent is relatively low and is marked by the cavity in the graph.

Structural sensitivity analysis

Besides parameter sensitivity, we also performed structural sensitivity analysis. In (De)creasing the team tier segmentation strongly increases(reduces) the effects. Interestingly, we also tested the dynamics with another decision structure. Under profit maximization, the free agency compensation policy works as intended. However, under the empirical situation of strong growth pressures, and the aspiration to have more free agents, that is, when the richer get richer loop is dominant, reinforced by the decision-making, the policy has perverse unintended consequences.

Findings Summary and Conclusion

When a rich team signs one Type A free agent, it costs them a first round pick. The second Type A free agent costs them a second round pick, and so on. This means that each additional Type A free agent signed costs them less and less, producing an economy of scale for the rich teams, motivating them to sign more and more Type-A free agents. As explained in the example with the Yankees, not only does the Elias Ranking System make it beneficial to sign multiple Type A free agents, but it makes it so the average compensation to the poor teams, the teams losing the free agents less on average. This has the effect of making the rich teams more competitive and the poor teams less, widening the gap, and counteracting the primary intentions of the system itself. Our analysis supported these suggestions. Further, we found conditions under which these side-effects are indeed active. In particular, when most Type A prospects are expected to be found in the early draft rounds, compensation increases inequality. This falls within the empirical regime. When in addition economies to scale (in wins) are moderate the inequality increasing effect is largest. Compensation decreases inequality only for moderate economies to scale and a relatively uniform distribution of Type A prospects across drafts. For low (high) scale economy, the tier 1 teams do not (rapidly) find dominance, which is relatively independent from whether there is compensation. These findings indicate that despite the intentions and attempts of the MLB, the FA-CS may exacerbate the very circumstance that is intended to treat. Instead of decreasing inequality among MLB teams, the FA-CS may increase inequality.

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Appendix

Table 1 – Model Parameters and Base Rune Values

Short	**Name**	**Base Value**	**Units**	**Justification**
τ^{MiLB}	Minor League Prospect Development time	6	years	Observed – (2000 pa per player, 500 pa per year) => 4 years on avg.
τ^{UTC}	Player under team control contract duration	6	years	Defined by MLB CBA
τ^{PFA}	Player Post Free Agency Lifetime in the league	6	years	(Witnauer, Rogers, Saint Onge, 2007) Table 1
v^{w}	Revenues per win	4M	$/win/ year	Fangraphs.com
c^{UTC}	Player under team control contract costs		$/year	Estimated from Cot's baseball contracts
c^{PFA}	Player post free agency contract costs		$/year	Estimated from Cot's baseball contracts
G	Total number of games	162	games /year	Defined as a Championship Season by current CBA
W^{min}	Minimum number of wins	55	games /year	Observed
λ^{w}	Win exponent	0.8	-	Must be sufficiently large to satisfy "Rich get Richer" reinforcing feedback
δ	Demand multiplier	0.8		
λ^{i}	Income exponent	4		
a^{d}	Average prospect inflow per team	5/12	player s/year	20% of players are defined as "type A" .20(25players per team)=5 players per team. They play for 12 years before retiring => 5/12 – Little's Law
ρ	Marginal change in probability of drafting Type A agent as draft rounds increase	0.3	dmnl	Converted from discrete version between round decrease in expected Type A prospects. Close to empirical value