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Abstract

The strong version of the Coase Theorem suggests that in the absence of transactions costs, the distribution of resources is invariant to the assignment of the rights to those resources. While the theoretical work that underlies the Theorem is vast, the empirical work is less available. The obvious reason being the difficulty in finding real world examples of markets that have experienced "rights" changes. Such a change however has occurred in Major League Baseball. Starting in the late 1970s the "rights" of players were switched from owners to players. This allows us to examine if the distribution of players was impacted by the change. If players switched teams more or less at the same rate before and after the introduction of free agency, this would support the Coase Theorem. In the end, the characteristics of player movement do appear to have been impacted by the re-assignment of rights and therefore are inconsistent with the predictions of the strong version of the Coase Theorem.

JEL Codes: C22, D23, D30

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1 Introduction

Ronald Coase's seminal essay, 'The Problem of Social Cost' (1960), is among the most cited work in both economic and legal fields.[1] No more evidence on its impact is necessary then the Swedish Academy specifically singling out the article in awarding Coase the 1991 Noble Prize.[2] Within the field of economics one of the main reasons for the paper's popularity is due to Coase's revolutionary treatment of externalities and for what has been termed the Coase Theorem.[3] While a formal statement of the Theorem does not appear in the work, Coase does state "...the ultimate result (which maximizes the value of production) is independent of the legal position if the pricing system is assumed to work without cost. (1960, p.8)"

In the interpretations which followed there appear to be two versions of the Theorem. The first is generally referred to as the 'efficiency hypothesis' or it's weak version. The 'efficiency hypothesis' states that regardless of how property rights, i.e., the legal position, are assigned, the resulting allocation of resources will be efficient. The second has been called the 'invariance principle' or the Theorem's strong version. This proposition states that not only will the allocation of resources be efficient, under alternative legal positions, it will be identical.

Those who toil in the soil of sports economics like to point out that the 'invariance principle' was argued earlier in Rottenberg (1956). Rottenberg made essentially the same argument in the context of player rights assignment within professional baseball. Specifically, Rottenberg suggested that

> "(i)t seems. . . that a market in which freedom is limited by the reserve clause such as that which now governs the baseball labor market distributes players among teams about as a free market would. (1956, p. 255)"

[1] According to Shapiro (1997), this article was the most cited in judicial opinions and law-review articles with 1,741 citations, nearly 400 ahead of the runner-up.

[2] The Royal Swedish Academy of Sciences awarded Coase the prize "... for his discovery and clarification of the significance of transaction costs and property rights for the institutional structure and functioning of the economy."

[3] The term Coase Theorem appears to have been coined in Stigler (1966).

Rottenberg was examining the distribution of playing talent under two institutions: The first allocated the rights to buy and sell players to the owners of Major League Baseball teams, i.e., the reserve clause, while the second system allowed the players to freely choose their employer, i.e., free-agency.

Rottenberg's reasoning followed Coase's closely in relying on competitive markets and a lack of significant transaction costs. More specifically, the strong version of the Coase Theorem would argue that where resource markets work efficiently, the distribution of playing talent should flow to their largest revenue stream. In which case, whether the player or the team held the right to the athlete's services is theoretically immaterial. If a player could generate a greater stream of revenue in any one market, then franchises located elsewhere would have an incentive to sell the player to the team located in the higher revenue market. A similar result should occur if the player held his/her rights.

In order to more closely examine this version of the Coase Theorem, the present paper takes advantage of a natural experiment which occured in Major League Baseball (MLB) in 1976. As is described below, the rights of MLB players where transfered from MLB owners to MLB players in 1976. This rights change allows us a unique opportunity to examine to what extent the change altered the distribution of resources within MLB. Given the strong version of the Theorem, one would suspect that the re-assignment of the rights would have little impact on the distribution of players.

The specific data comes directly from Major League Baseball rosters and tracks player movement in MLB. A corollary of the 'invariance principle' would argue that if the assignment of rights are irrelevant than one would expect that player movement would not be impacted by the institution of free agency. The data suggest otherwise. The evidence from unit root and structural break tests indicate that the fundamental characteristics of the player movement series changed in the mid-1980s. Given the high initial transaction costs which came with free-agency, this finding suggests

that free-agency did impact the distribution of resources and therefore fails to support the strong version of the Coase Theorem.

The plan of the paper is as follows: section 2 provides a short history of player rights in MLB. Section 3 reports the data on player movement and the methodology. Section 4 reports the empirical results. Finally, section 5 provides a short conclusion.

2 A Natural Experiment

In order to maintain a degree of control over costs and stability in team rosters, an agreement was reached between Major League Baseball owners over the winter of 1878-79. The agreement allowed each owner to circulate a list of five players which the owner intended to keep on his roster for the following season. The other owners agreed to forgo the opportunity to sign any of these 'reserved' players. The collusive agreement was extend by the owners in 1883 to include the owner's entire roster.

Due to the inherent incentive to cheat, the agreement was made binding by introducing a reserve clause formally into players' contracts in 1889. Each player's contract contained a clause, quite similar to the following:

> "If, prior to March 1, . . . the player and the club have not agreed upon the terms of such contract, then on or before ten days after said March 1, the club shall have the right to renew this contract for the period of one year on the same terms, except that the amount payable to the player shall be such as the club shall fix in said notice. (reprinted in Quirk and Fort (1992), p. 185)"

The key phrase in this clause is the club shall have the right to renew this contract for the period of one year on the same terms. As written, the clause allowed owners a perpetual option on each player's services.

In a highly controversial decision, the legality of the clause was settled in the owners favor by the United States Supreme Court in *The Federal Baseball Club of Baltimore, Inc. v. National League of Professional Baseball Clubs et. al* in 1922. The Supreme Court's majority opinion argued that MLB games were intrastate events and therefore where not subject to Federal antitrust statues. The court noted that the National and American Leagues merely served as umbrella organizations whose main purpose was to arrange schedules and to set rules. The actual business of a MLB team was entirely local in the sense that all revenue came from their individual local market. At that time there was no revenue sharing, as there were no national radio or television and no national sponsors or licensing deals.

While sporadic attempts to invalidate the reserve clause occured over the ensuing period, all were unsuccessful including perhaps the most significant: *Flood Vs. Kuhn.*[4] After the 1969 season, Curt Flood, an outfielder for the St. Louis Cardinals, was traded to the Philadelphia Phillies. Rather than report to the team which now held his 'reserve,' Flood sued in Federal Court arguing that the reserve clause violated Federal antitrust laws and his civil rights.[5] While Judge Irving Ben Cooper ruled against Flood, he did recommend that MLB reserve system be modified through negotiations between players and owners. Finally, a reluctant United States Supreme Court upheld the lower court ruling in the summer of 1972.

Perhaps due to the lukewarm response by the courts and the growing strength of the players union under the leadership of Marvin Miller, Major League Baseball owners agreed to allow players' grievances with respect to owners to be arbitrated by a three-person panel in 1970. They further agreed to salary arbitration in 1972. These concessions lead, despite the legal presidents, to the negotiated end to the reserve clause.

[4]For example, George Toolson brought suit against the MLB's reserve system in 1953. A career minor leaguer, Toolson argued that the reserve clause restricted him from moving to another team and perhaps making the majors. The Supreme Court in *Toolson v. New York Yankees* continued as in the earlier case to maintain that baseball did not constitute interstate commerce. Furthermore, in rejecting Toolson's appeal, the court shifted the burden to Congress to overturn baseball's antitrust legislation (Scully (1973)).

[5]Flood argued that the reserve clause amounted to peonage and involuntary servitude.

The beginning of the end came in 1975 when both Andy Messersmith and Dave McNally played the season without signing their contracts. As the reserve clause stated that the player's rights were held for the length of the contract plus one-year, the players argued that despite the fact that their teams had automatically renewed their contracts from the previous season, since they did not sign these contracts the additional year requirement had been meet. In which case, both Messersmith and McNally were free to negotiate with any team. The players' grievance came before independent arbiter Peter Seitz, who on December 23, 1975 ruled in favor of the players.[6]

For Major League Baseball players, the Messersmith-McNally case cleared a path for players to become free agents and led to the current system of free agency. While Major League owners tried to overturn Seitz's ruling in court, these attempts were ultimately unsuccessful. Free agency, or the re-assignment of rights to players, was officially established in the collective bargaining agreement signed between the players and owners in 1976. The agreement allowed players with more than six years experience to sell their rights to the highest bidder. Players with less than six years' were still bound by the reserve system, although salary disputes could be submitted to independent arbitrators if the player had more than two years of service.[7]

As was mentioned earlier, the transition of legal rights from MLB owners to players described above allows us a unique opportunity to examine the 'invariance principle.' One might suspect, as in Rottenberg (1956), that the re-assignment of legal rights would have little impact on the distribution of players.

[6] In reality, Peter Seitz was chairman of a three-man panel with the other two member John Gaherin who represented the owners and Marvin Miller who represented the players.

[7] Eligibility for salary arbitration was extended to three years in the collective bargaining agreement of 1985.

3 Data and Methodology

3.1 Data

The specific data used is the percentage of MLB players who move from one MLB team to another within a period. Movement between teams may come about through several avenues: the player may be traded by a team, the player may be released by a team or the player, after the institution of free agency, may choose to leave. The question then is whether the addition of the third dimension altered the dynamics of player movement.

The collection of the data came from examining individual MLB team rosters and tracking whether individual players remain with the team, move to another team or leave MLB rosters over the period 1903-2004.[8] Those that left MLB are then removed and the percentage which move is produced from the remaining total. The player movement data are reported in Figure I.[9] Specifically, the top panel reports the percentage of total At-Bats which move to competing teams. The middle panel reports the percentage of total innings which move. Finally, the bottom panel tracks the total number of players.

There are several common features to these series. The first is the large upward spike during the mid-1910s. This period corresponds to the introduction of a competing league, the Federal League. The Federal League was formed in 1913 and initially respected MLB contracts. A year later, however, the Federal League attempted to entice some contracted players away from MLB. The increased competition for player services caused some players to sell their services to the Federal League. While this would not directly alter the measures, the players which left did need to be replaced. This increased the incentive for MLB teams to trade and purchase players from other MLB teams. This, in turn, would cause the increased movement. While the Federal League folded in 1915, their players needed to be re-assimilated into MLB. As players where released to make room

[8] The choice of sample period reflects the joining of the American and National Leagues in 1903

[9] The author would like to thank Tom Ruane for graciously providing a subset of the data

for these players, these measures remained abnormaly high.

The other striking feature is the increased movement since the late 1970s for all three series. Each of the series show an upward movement between the early 1980s and early 1990s. This period corresponds roughly with the institution of free agency. The slow adjustment upward is an outgrowth of the high initial transaction costs associated with free agency. Figure II reports the yearly total number of players which opted for free agency. The Figure highlights the fact that until the mid 1980s the average number of free agents per year was around 40. A part of the reason for the relatively small number of free agents initially was general uncertainty. However there were other reasons: the reaction of other players and of fans also initially retarded its growth. The following are descriptions of the difficulties faced by the initial crop of free agents.[10] Bobby Grich described the feeling of other players:

> "It wasn't spoken, but there was a definite sense of resentment by the other players, in that it wasn't them..."

Joe Rudi described the feeling of fans:

> "... (Finley) released that I got $2 million as a free agent and that turned the fans against me. I was instantly worried about my wife and family. Finley told the press and the fans that we were greedy and it was as if we were making 10 gazillion dollars. In 1977, we had people behind the dugout and in the stands screaming all this terrible stuff at us and it basically followed us everywhere we went."

Over time these costs declined as uncertainty diminished and the increased acceptance by players and fans.

Today, the average number of yearly free agency filings is close to 200. The impact that this had on the player movement data is highlighted in Table 1. Table 1 reports the pre and post-free

[10] The quotes come from an article by ESPN author Darren Rovell. (http://espn.go.com/mlb/s/2000/1121/893718.html)

agency means for the three series. As one can see, each of the series experienced an increase in their average value during the post-1976 period. Both the percentage of at-bats and innings increased by nearly 40% and 70%, respectively. While the data on total players movement has experienced a smaller rise, it still has risen by nearly 20%. This suggests that the largest impact has been on the relatively good players. This again is inconsistent with the strong version of the Coase Theorem.

3.2 Method

The empirical question, however, is whether the characteristics of the movement variables are different pre and post free-agency. As an initial approach we ask whether the individual series contain a unit root. Essentially, the existence of a unit root within a series suggests that the fundamental characteristics of the series are not constant. For example, consider the following univariate representation of Player Movement (PM_t):

$$PM_t = \mu + \alpha * PM_{t-1} + \epsilon_t \tag{1}$$

where PM_t represents the percentage of players which move to competing teams in period (t). The series is said to contain a unit root if $\alpha = 1$. In this case, individual shocks to ϵ_t would permanently impact PM_t and its value would be time dependent. Moreover, institutional changes may alter PM_t if they could impact ϵ_t.

In contrast, if $\alpha < 1$, then the series would be stationary around the estimated μ and any shocks to ϵ_t would fail to permanently impact PM_t, as their iterative impact would diminish to zero. In which case, the rejection of a unit root would suggest that our movement measures are constant. In the long run, the impact of any shock (ϵ_t) would diminish over time. None of the institutional changes therefore which have occured have had any impact on player movement or in the distribution of talent.

A possible alternative is that the series is trend stationary rather than mean-reverting. In this

case, PM_t would be constant around μ and a constant trend, i.e., β. Consider the following extension of equation (1):

$$PM_t = \mu + \alpha * PM_{t-1} + \beta * t + \epsilon_t \tag{2}$$

where (t) represents the time trend. The series would be trend stationary if both $\alpha \neq 1$ and $\beta \neq 0$. In the trend stationary case, the question is whether property rights can impact β. As the value of PM_t is a function of a time trend, a change in its sensitivity would impact the value of PM_t.

Finally, as was mentioned it is possible that the series are difference stationary, i.e., that $\alpha = 1$. In which case the series are estimated to be non-stationary and exogenous shocks may produce permanent effects and institutional changes, through ϵ_t, may impact competitive balance. As was mentioned earlier, in such a case, the iterative impact of shocks never decay and player movement has forever been changed.

4 Empirical Results

4.1 Unit Root Tests

As an initial pass through the data, Table 2 presents the results of performing various unit root tests for the three data series with and without trends. Specifically, Augmented Dickey-Fuller (ADF), Phillips and Perron (PP, 1988), Ng and Perron (2001), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS, 1992), and Elliott, Rothenberg and Stock (ERS, 1996) tests were performed with both constant and trend terms. In general, the tests fail to provide a clear picture for the series. Each of three series reject the presence of a unit root on the basis of ADF, PP and Ng and Perron tests. In contrast, both KPSS and ERS tests suggest a unit root process for each series.

One difficulty with these tests is that one or more shocks could be so large as to change the mean and/or trend relationship, i.e., there is a break in the mean or trend. Specifically, Perron (1989) argues that unit root tests may have low power when the true generating process is stationary around

a broken mean and/or trend. Moreover, Perron (1990) argues that:

> ". . . if the magnitude of the change is significant, one could hardly reject the unit-root hypothesis even if the series would consist of *iid* disturbances around a deterministic component (albeit one with a shift in mean) . . .(p.155)"

Interestingly, Leybourne et al (1998) find that when the true generating process is difference stationary, but with a break, routine application of unit root tests can lead to spurious rejections of the unit root hypothesis. In which case, there is no a priori way to predict the bias and any and all of the tests reported in Table 2 may be biased.

In Baseball's case, one might argue that Major League Baseball has been the subject of exactly these types of breaks. It is possible that institutional changes such as introducing free-agency would qualify as a significant operational change and, therefore, may have altered the mean and/or trend relationship.

4.2 Structural breaks

In order to test for such mean and/or trend breaks, Perron (1994) and Perron and Vogelsang (1992) propose a series of unit root test statistics which allow for two alternative forms of structural changes. One type, the additive outlier model, AO, captures a sudden and immediate change, while the other, the innovational outlier model, IO, models a gradual shift in the mean or trend of a series. Given the slow adoption of free-agency (Figure II), the latter option, i.e., the IO model, would seem more appropriate for the Major League Baseball experience.

The Perron and Vogelsang innovational outlier (IO) model assumes that a given mean or trend shock has the same effect on player movement as any exogenous shock, so that all have the same

dynamic representation:[11]

$$PM_t = \mu + \gamma * DU_b + \beta * DT_b + \alpha * PM_{t-1} + \sum_{i=1}^{k} \theta_i * \Delta PM_{t-i} + \epsilon_t \quad (3)$$

Within the IO model, the appropriate values of DU_b and DT_b, i.e., the breakpoint dates, and the choice of k, i.e., the autoregressive order, are unknown.[12] In our application, we search for the minimum t-statistic on γ and β.[13] Conditional on these choices the autoregressive order is chosen, as in Perron (1990), by a sequence of pairs of F-tests for the significance of lags, starting from an appropriately large maximum order.[14] Finally, the IO test statistic, i.e., the t-statistic for the $H_0 : \alpha = 1$, is similar in spirit to the common Augmented Dickey-Fuller (ADF) model and therefore yields an estimate which will be significantly less than one in the presence of stationarity.[15]

Perron and Vogelsang (1992) and Perron (1994) suggest several different versions of equation (4) depending upon the type of break. Specifically, model 0 introduces the break within the mean, assuming non-trending data, and model 1 introduces the break within the mean, assuming that the data has a trend. Model 2 introduces a possible break in both the mean and the slope of series. Finally, model 3 introduces a possible break in the trend where the segments are joined at the time of break

These results are reported in Table 3. In general, these tests estimate a break in the mean of each series. Specifically, all (4) models reject the presence of a unit root for each of the three movement series. Moreover, the tests generally suggest a break in the mid-1980s. This break is consistent with what we see in Figure I and suggests that the institution of free-agency fundamentally altered the

[11] The actual estimation removes a certain number (percentage) of observations from both ends of the data. The reason being that we cannot consider breakpoints too close to either ends of the sample because there are not enough observations around the break date too identify the subsample coefficients. The solution, generally, is to trim the data. There is a tradeoff as less trimming increases the critical values and more decreases sample size. In the present context, we follow Andrews (1993) and trim 15% of each side of the data. Other trimming choices of 10% and 20% produced qualitatively similar results.

[12] The search for DU_b and DT_b is resolved by estimating the model for each feasible breakpoint, and following one of several proposed rules to identify the optimal breakpoint.

[13] Perron and Vogelsang (1992) offer several other options, i.e., minimizing k or minimizing on the F-statistic. These all produced similar results

[14] This approach has recently been shown to have stronger sample properties (Ng and Perron (1995)).

[15] Perron (1994) provides the critical values.

dynamics of player movement.

In order to investigate the possible break more closely we followed the approach outlined in Bai, Lumsdaine and Stock (1998). Bai, Lumsdaine and Stock find that the estimation of break dates is more precise in the multivariate setting. Specifically, their approach is to analyze whether several series, either I(0) or I(1), break together. Given that institutional changes are generally determined at the Major League level and the estimated I(0) behavior of the three series, we applied their stationary multivariate break test to the movement series.[16] The results suggest a possible break at 1986, an estimate roughly consistent with the results of Table 2 and with the beginning of free agency in Major League Baseball.

Given that numerous institutional changes have occured over time, one might suspect that multiple breaks may have occured. We therefore estimated for multiple breaks by the method described by Bai and Perron (1998). These results are reported in Table 4. The Bai and Perron tests all suggest, at least, one break. For all series, the UD_{max} and WD_{max} reject the null of no breaks. Moreover for the at-bats and player movement measures, Bai and Perron's SupF(0|k) tests rejected the null of (0) breaks against the k alternative breaks, k = 1,...,5 and failed to reject the SupF(1|k) break tests for all $k > 1$. These then indicate that both of these series experienced a single break. The break was estimated in 1987 for both series, with a 95% confidence interval of (1982-1990) for the total at-bats and a 95% confidence interval of (1985-1995) for player movement.

The results for the total innings measure suggest that the data was subject to (2) structural breaks. One break was estimated, as with the other two series, in 1987 with a 95% confidence interval of (1984-1989). The second break was estimated in 1964 (1961-1973). The second break may correspond with expansion in MLB.[17] Over the period of 1960-1969, MLB expanded from 16

[16] Each series was trimmed by 20%

[17] The timing is roughly consistent with the introduction of the reverse-order draft in MLB. The draft was instituted in 1965. One might argue that draft allowed low revenue teams to draft young players and then sell them to high revenue teams later. The estimated date here seems a bit early for this explanation as teams would need to hold on to these players for a period for them to count in our measures.

teams to 24 teams. Expansion would alter player movement due to the opening of higher revenue markets which would increase trades.

5 Conclusion

Finally, what is one to make of all of these results? Well, first it appears that player movement in Major League Baseball is stationary. Moreover, there does appear to have been, at least, one break in each of the three series. Specifically, all three appear to have experienced an upward shift somewhere around during the mid 1980s. Given the slow acceptance of free agency by all involved, the break suggests that the re-assignment of 'legal rights' within Major League Baseball fundamentally changed the behavior of player movement and, therefore, the distribution of resources. In the end, these results are inconsistent with the strong version of the Coase Theorem.

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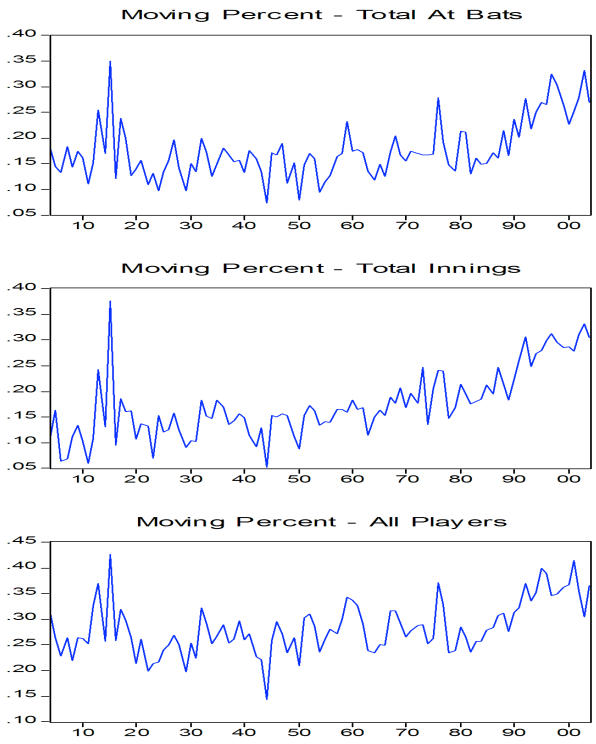

Figure I: *Player Movement*

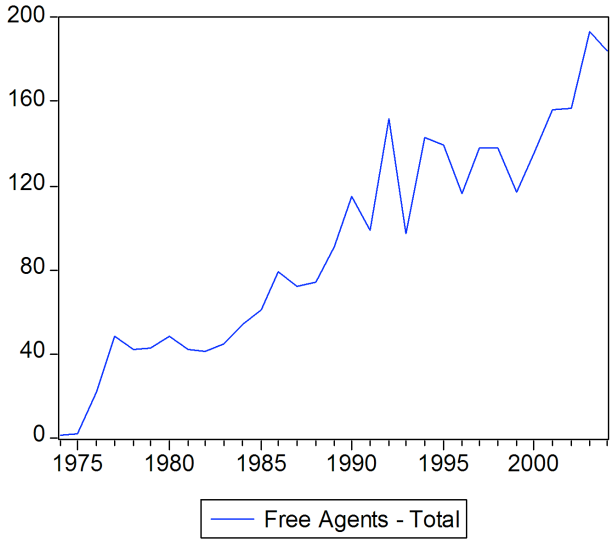

Figure II: *Free Agents*

Table 1: *Pre & Post Free Agency Means*

Institution	At-Bats	Innings	Player
Reserve Clause (1904-1976)	0.159	0.147	0.270
Free Agency (1977-2004)	0.220	0.245	0.318

Table 2: *Unit Root Tests - Basic.*

	ADF		PP		Ng & Perron		KPSS		ERS	
	constant	constant & trend	constant	constant & trend	constant	constant & trend	constant	constant & trend	constant	constant & trend
At-Bats	-2.943**	-3.902**	-6.026**	-7.135**	2.677**	3.052**	0.652**	0.237**	-1.650*	-2.063
Unit Root?	No	No	No	No	No	No	Yes	Yes	No	Yes
Innings	-2.304**	-4.786**	-5.146**	-8.313**	1.406	3.179**	0.938**	0.235**	-4.650	-1.702
Unit Root?	Yes	No	No	No	Yes	No	Yes	Yes	Yes	Yes
Players	-3.946**	-6.286**	-5.701**	-6.469**	-2.922**	3.263**	0.614**	0.155**	-1.288	-1.944
Unit Root?	No	No	No	No	No	No	Yes	Yes	Yes	Yes

Table 3: *Unit Root Tests - Perron & Vogelsang (1992) Structural Break.*

	Model 0		Model 1		Model 2		Model 3	
	$H_0: \alpha = 1$	$H_0: \beta = 0$	$H_0: \alpha = 1$	$H_0: \beta = 0$	$H_0: \alpha = 1$	$H_0: \beta = 0$	$H_0: \alpha = 1$	$H_0: \beta = 0$
At-Bats	0.104**	0.0729**	0.122**	0.090**	0.120**	-0.399**	0.067**	—
	(-9.757)	(4.525)	(-9.388)	(6.167)	(-9.967)	(-4.296)	(-9.990)	—
Break	1988		1988		1975		1985	
Innings	0.043**	0.075**	0.672**	0.029**	0.024**	-0.440**	0.0.038**	—
	(-11.910)	(5.366)	(-3.345)	(2.916)	(-11.925)	(-4.934)	(-11.707)	—
Break	1962		1989		1976		1983	
Players	0.302**	0.044**	0.325**	0.064**	0.318**	-0.316**	0.289**	—
	(-7.693)	(3.018)	(-7.243)	(4.563)	(-7.979)	(-3.644)	(-7.748)	—
Break	1989		1988		1975		1984	

Table 4: *Bai and Perron (1998) Sequential Structural Break (in means) Tests.*

Break Test	At-Bats	Innings	Player
UD_{max}	44.055**	167.523**	59.571**
WD_{max}	44.055**	167.523**	59.571**
sup $F(m=1\|m=0)$	44.055**	167.571**	59.571**
sup $F(m=2\|m=1)$	3.113	46.330**	2.691
sup $F(m=3\|m=2)$	10.055	6.890	7.429
BIC	1	2	3
LWZ	1	2	1
Break	1987 (1982-1990)	1987 (1984-1989) 1964 (1961-1973)	1987 (1985-1995)