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NBA PLAYER OUTCOMES FOLLOWING THE IMPLEMENTATION OF THE 'ONE-AND-DONE' RULE: DO TOP PLAYERS REALLY BENEFIT FROM ATTENDING COLLEGE FIRST?

Resultados de los jugadores de la NBA tras la implementación de la regla "uno y listo": ¿Se benefician realmente los mejores jugadores por asistir primero a la universidad?

Richard C. K. Burdekin, Cameron Van

Claremont McKenna College, USA; University of California, Davis, USA

ABSTRACT: Following the NBA's 2006 'one-and-done' rule, players have to be at least one year out of high school before being eligible for the annual draft. This study finds that, whereas an array of NBA player performance measures, often referred to as 'advanced statistics,' are strongly significant in explaining both minutes per game and draft order, there is no support for any additional impact on playing time associated with college basketball experience. Although those attending a top college basketball program do appear to get an extra boost in draft order, even after controlling for performance, there is otherwise no evidence that attending college confers any significant advantage for the players themselves.

KEYWORDS: NBA; one-and-done rule; college basketball; advanced statistics

RESUMEN: *Siguiendo la regla de la NBA de 2006 de "uno y listo", los jugadores tienen que estar por lo menos un año fuera de la escuela secundaria antes de ser elegibles para el draft anual. Este estudio encuentra que, mientras que una serie de medidas de rendimiento de los jugadores de la NBA, a menudo denominadas "estadísticas avanzadas", son muy significativas para explicar tanto los minutos por partido como el orden del draft, no hay apoyo para ningún impacto adicional en el tiempo de juego asociado con la experiencia del baloncesto universitario. Aunque aquellos que asisten a un programa de baloncesto universitario de alto nivel parecen recibir un impulso adicional en el orden del draft, incluso después de controlar el rendimiento, no hay evidencia de que asistir a la universidad confiera una ventaja significativa para los propios jugadores.*

PALABRAS CLAVE: *NBA; regla de uno y listo; baloncesto universitario; estadísticas avanzadas*

The authors thank Dave Berri, Bill Lincoln, John Weiss and two anonymous referees for helpful comments and are grateful to Elaine Song for assistance with the data.

Received/recibido: 04-12-2018 Accepted/aceptado: 20-02-2019

Contact information:

Correspondence author:

Richard C. K. Burdekin
rburdekin@cmc.edu
Claremont Mckenna College, 500 e. Ninth Street, Claremont, California 91711.

Cameron Van
cvan17@students.claremontmckenna.edu
University of California, Davis, School of Law, 400 Mrak Hall Drive, Davis, California 95616

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> *My sense is [the 'one-and-done' rule's] not working for anyone. It's not working for the college coaches and athletic directors I hear from … And I know our teams aren't happy either, in part because they don't necessarily think the players who are coming into the league are getting the kind of training they would expect to see.*
>
> (NBA Commissioner Adam Silver, 2017)[1]

1. Introduction

The NBA's controversial 'one-and-done' rule restricts eligibility for the NBA draft to those either at least 19 years old or one year removed from high school. This effectively means at least one year of college save for those coming from an international team or foreign country. Beginning with the 2006 draft, no US high school graduate could follow in the footsteps of Kobe Bryant, LeBron James or Moses Malone and go directly into the NBA. On the other hand, there is no requirement to actually finish college and anyone is free to enter the NBA draft after completing their freshman year. Using data on players drafted prior to the implementation of the 'one-and-done' rule, Rodenberg and Kim (2012) previously found no evidence that attending a year of college led to any performance advantage over those entering the NBA straight from high school. In this paper we find that data from years subsequent to the 2005 adoption of the NBA's age eligibility rule similarly offer little support for any benefits attached to the mandatory 'service time' in college basketball.

Following NBA Commissioner Adam Silver's (2017) recognition of concerns by college basketball programs and some NBA teams regarding the single year requirement, NBA owners discussed the possible future elimination of the 'one-and-done' rule at the 2018 Las Vegas meetings. The most important consideration, however, remains whether the college requirement actually confers any benefits on the players themselves. Top college basketball programs bring in hundreds of millions of dollars, with the University of Kentucky's program leading the way with a 2017 valuation of $246.6 million (Beaton, 2018). Given that the top college athletes generating such vast revenues receive nothing more than a standard scholarship in return, it is clear that each mandated year in college is highly advantageous to the academic institution. But is there any direct payoff for the players that gives them some edge in their future NBA careers?

Although US-born players have the option of playing overseas rather than going to college, the vast majority of players entering the draft directly from overseas are foreign born. This means that comparing the outcomes for college and non-college players after 2005 largely amounts to a comparison between US-born players and foreign players.

[1] See "N.B.A. Commissioner is ready for a change in the 'one-and-done' eligibility rule" (2017).

This would, however, only tend to overstate the advantages of attending college unless there is discrimination against US-born players in favor of foreign players. As it stands, outright discrimination against foreign players is suggested in Yang and Lin's (2012) findings of salary discrimination by nationality over the 1999-2000 through 2007-2008 NBA seasons. These differentials appear to have diminished over time, however, with Hoffer and Freidel (2014) arguing that wages for foreign players had caught up by the 2010-2011 season. Similarly, Hill and Groothuis (2017) find no consistent evidence of either wage discrimination or wage premiums for foreign players over the 2000-2013 period.[2]

Hill and Groothuis (2017) find that there was actually a wage premium for foreign players during 1990-1999 when such players represented only a small percentage of the NBA as a whole. Such scarcity certainly no longer applies today and 2017-2018 was the fourth consecutive season in which more than 100 foreign born players were included on opening night rosters and all 30 teams had at least one international player. Another qualification is that wage data themselves typically represent a return for expected future performance. Once the contract has been entered into it is fixed regardless of how well the player is currently performing. The returns to current performance may be more accurately reflected in playing time, with coaches likely having more incentive to put the best performing players on the court than to continue giving major minutes to an underperformer with a high salary.

In terms of draft position, Ichniowski and Preston (2017) find that unexpected team wins and player scoring in March Madness leads to a significant bump in participants' draft slot – obviously not something from which foreign players can benefit. More generally, Motomura (2016) finds some evidence of initial undervaluation of foreign players insofar as they outperformed relative to their draft position through 2001. Although no such undervaluation appears to have been present more recently, Motomura (2016) suggests continued inefficiencies in teams' drafting practices regarding international players – including some evidence of over-valuation with respect to first round picks. On the other hand, Berri, Brook and Fenn (2011) and Evans (2018) find that players entering the draft from top US college conferences and programs gain an edge in draft position relative to other players with similar performance metrics.[3]

[2] Berri, Deutscher and Galletti (2015) nevertheless find evidence of US-born players receiving more playing time than foreign-born players over the 2001-2002 through 2013-2014 seasons, even after accounting for performance. Interestingly, the apparent bias towards US-born players is identified in the Spanish Liga ACB as well as in the NBA.

[3] Evans (2018) also notes that players who enter the draft after completing the full four years at college not only are, on average, drafted later but also underperform later on.

In this study, we measure performance primarily in terms of an array of available 'advanced statistics' that attempt to capture a player's actual contribution to his team's chances of victory. We show that playing time is well explained by these advanced statistics but not significantly affected by whether the players have US college basketball experience or instead entered the NBA as an international player. Although this does not disprove the possibility that players derived some benefit from their college experience, it does not seem that this yields any special advantage over gaining experience playing abroad – and being paid to do so. At the same time, there appears to be a significant effect of the player's draft position on playing time that offers some continuing support for Staw and Hoang's (1995) finding that NBA teams gave significantly more minutes to their highest drafted players – even after controlling for player performance and other factors.[4]

2. Sample selection and properties of the data

There are 660 National Basketball Association athletes included in our data set. The player-specific data are from Basketball-Reference.com, which has all of the available statistics on every NBA, WNBA, ABA, D-League, college, and Euro basketball teams, leagues, and players from 1946-1947 to the present. This database holds all players, teams, seasons, leaders, scores, playoffs, drafts, and even a play index which provides details on individual games, winning and losing streaks, and a 'Head2Head Finder' where specific player matchups are reported. In terms of statistics, it is even more complete than the official NBA website itself, which does not have all the advanced statistics contained in Basketball-Reference.com.

This study includes performance data for players from the 2006 through 2015 NBA draft classes. Each draft class has a first and second round and consists of 60 players in total. The starting date is set to focus upon the period after the NBA enacted the 'one-and-done' rule, excluding those earlier years in which players could simply elect to go straight from high school to the pros. Performance data extends through the 2015-2016 NBA season and, in addition to conventional performance statistics such as points scored, rebounds, assists, steals and blocks (all aggregated over the player's career), we consider four sets of advanced statistics as computed over the 2015-2016 NBA season. Although not uncontroversial, each measure attempts to capture the player's overall contribution via a single statistic. Basketball-Reference.com includes Win Shares (WS), which estimates the amount of wins contributed by each player; Value Over Replacement Player (VORP), which is a box score estimate of the points per 100 team

[4] This finding is supported by Camerer and Weber (1999), but not by Leeds, Leeds and Motomura (2015) – who conclude that that there is no consistent support for extra playing time commitments for higher drafted players.

possessions that a player contributed over a replacement translated to an average team over an 82 game season; and Box Plus Minus (BPM), which is an estimate of the points per 100 possessions a player contributed above an average player, translated to an average team. Berri (2012) argues that a more consistent measure of a player's contribution to team wins is provided by 'Wins Produced,' which explicitly incorporates both offensive efficiency and defensive efficiency and assesses a player's production of wins via the estimated impact of that player's individual box score statistics on team wins.[5]

Table 1. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Draft Pick Number	660	30.50	17.33	1	60
Years in NBA	559	3.61	2.55	1	10
Games Played in NBA	499	216.37	184.75	1	768
Total Minutes in NBA	499	4948.49	5413.73	0	25802
Total Points Scored	499	2065.95	2606.38	0	17566
Total Rebounds	499	875.34	1080.15	0	6066
Total Assists	499	430.08	699.09	0	5614
Field Goal Percentage	496	0.43	0.09	0	1
Three-Point Percentage	456	0.27	0.14	0	1
Free Throw Percentage	484	0.71	0.13	0	1
Minutes per Game	499	17.69	8.68	0	37.8
Points per Game	499	6.89	4.75	0	27.4
Rebounds per Game	499	3.14	2.12	0	12.6
Assists per Game	499	1.42	1.45	0	9
Win Shares	499	10.10	14.94	-2.1	107.9
Box Plus Minus (BPM)	498	-2.37	3.52	-23.2	6.2
Value over Replacement Player (VORP)	499	2.28	5.90	-5.7	41.7
Wins Produced	495	1.71	2.50	-4.6	12.3
From ACC Conference	660	0.10	0.30	0	1
From Big 12 Conference	660	0.09	0.29	0	1
Salary	334	6304715.00	6472391.00	5000	2.65E+07
Top 5 Draft Pick	660	0.93	0.25	0	1
From Top 10 College	660	0.21	0.41	0	1
International Player	660	0.21	0.41	0	1
Domestic Player	660	0.79	0.41	0	1

[5] We are indebted to Dave Berri for providing us with the Wins Produced data.

Besides performance statistics, we compile available data on a player's yearly salary (for the ensuing 2016-2017 NBA season),[6] each player's original draft position (with lower numbers indicating earlier selections), and whether the player attended a college in one of the two consistently highest-ranked NCAA conferences (ACC and Big 12). We also consider a 'Top 10 College' measure to allow for a differential impact of attending a highly-rated program irrespective of whether it is in the ACC or Big 12. This set comprises Duke University, Michigan State University, Syracuse University, University of Arizona, University of Connecticut, University of Kansas, University of Kentucky, University of North Carolina, Villanova University, and Xavier University. Although arguments could certainly be made for adding other schools, those included in our list would generally be considered amongst the strongest college basketball programs over our sample period. Finally, we define an 'international' dummy variable that is equal to one for players coming from outside the United States who did not play in any US college basketball program.

Table 2. Correlation Matrix.

	1	2	3	4	5	6	7
1. Minutes per game	1						
2. Salary	0.048 (0.445)	1					
3. Win Shares	0.701 (0.00)	0.0572 (0.365)	1				
4. BPM	0.681 (0.000)	0.073 (0.246)	0.612 (0.000)	1			
5. VORP	0.598 (.000)	0.083 (0.188)	0.913 (0.000)	0.591 (0.000)	1		
6. Wins Produced	0.648 (0.000)	0.054 (0.396)	0.778 (0.000)	0.671 (0.000)	0.789 (0.000)	1	
7. International	-0.030 (0.510)	0.018 (0.741)	-0.028 (0.538)	-0.020 (0.654)	-0.020 (0.656)	-0.027 (0.547)	1

Note: *p*-values are in parentheses

The basic properties of each data series are provided in Table 1.[7] The correlation between an athlete's minutes played, salary, win shares, box plus minus, value over replacement player, wins produced, and international standing is presented in Table 2.[8] Table 2 shows that minutes per game is significantly correlated with players' advanced

[6] The information available when setting the 2016-2017 salary would generally be limited to performance data through 2015-2016 – making it more appropriate to use the later salary data rather than 2015-2016 salary levels that could generally have taken into account only performance achieved through 2014-2015.
[7] The advanced statistics include negative values that are in keeping with poor play actually hurting the team, whether assessed in terms of reduced chances of winning, lost points that damage the team's plus-minus, or poor individual contributions falling below those available from replacement players.
[8] Minutes per game and the advanced statistics are all from the 2015-2016 season, whereas salary data are as of 2016-2017 – thereby allowing for contracts incorporating performance data through 2015-2016.

statistics scores. WS, BPM, VORP and Wins Produced are all significant relative to minutes per game with correlation coefficients ranging from 0.59 to 0.70. This is consistent with the advanced statistics identifying better players who, in turn, play more minutes per game than their teammates. Minutes per game are not significantly correlated with the pending 2016-2017 salaries, however, suggesting that players who receive large salaries do not necessarily get heavy minutes. Salaries are also not significantly correlated with the advanced statistics.

Table 3. Advanced statistics vs. conventional statistics

	Win shares	***VORP***	***BPM***	***Wins produced***
Years in NBA	0.4421 (0.3063)	0.4668** (0.1922)	-0.1427 (0.1132)	-0.2307** (0.1035)
Games played	-0.0197** (0.0091)	0.0316*** (0.0058)	-0.0034 (0.0029)	-0.0048* (0.0025)
Total minutes played	-0.0001 (0.0006)	0.0002 (0.0004)	0.0003** (0.0001)	0.0003*** (0.0001)
Total points	0.0035*** (0.0010)	0.0010* (0.0006)	-0.0002 (0.0002)	-0.0928** (0.0370)
Field goal percentage	13.0857*** (4.7909)	5.5955** (2.4454)	26.7338*** (2.3227)	5.4937*** (1.4544)
Three point percentage	-1.2102 (1.5015)	0.5899 (0.8725)	2.6455** (1.1282)	0.4603 (0.7039)
Free throw percentage	2.4211 (1.6290)	1.0376 (0.9654)	6.2447*** (1.4352)	0.20392 (0.7506)
Rebounds per Game	0.0060*** (0.0009)	0.0032*** (0.0005)	0.0006*** (0.0002)	0.5263*** (0.0638)
Assists per Game	0.0038*** (0.0010)	0.0038*** (0.0007)	0.0011*** (0.0002)	0.0012*** (0.0002)
Constant	-7.9694*** (3.0342)	-3.6116** (1.5346)	-19.5019*** (1.6146)	-2.1670*** (0.8099)
Number of observations	449	449	449	444
R-squared	0.8989	0.7662	0.6579	0.5955

Note: As in all subsequent regressions, clustered standard errors are in parentheses.
***, **, and * denote significance at the 99%, 95%, and 90% confidence levels, respectively

The advanced statistics' relationship with conventional player performance statistics is addressed in Table 3, which shows the results of regressing the 2015-2016 values of the advanced statistics for each player on the following array of career statistics: years in NBA, games played, total minutes played, total points, field-goal percentage, 3-point percentage, free-throw percentage, rebounds per game, and assists per game. The R-squared values from these regressions for WS, VORP, BPM and Wins Produced of 0.90, 0.77, 0.66 and 0.60, respectively, suggest that the advanced statistics capture the effects of the conventional statistics quite well. Field-goal percentage, rebounds and assists are

significant across all four sets of advanced statistics, while games played and total points are significant for three out of the four. Total minutes played are significant with the expected positive sign for both BPM and Wins Produced. The mixed signs for games played, as well as years in NBA, may reflect the fact that these variables capture longevity effects over and above the impact of playing time itself. Whereas players who continue to perform at a top level should continue to rack up more minutes on the court, experience effects alone will include those playing out the balance of long-term contracts while on a downward trajectory.

3. Factors accounting for average playing time and draft order

The alternative advanced statistics may capture player performance, but are they as effective in explaining variations in minutes per game across our sample of post-2006 draftees? Assuming that coaches allocate the most minutes to the best players, there should be a significant, positive relationship between 2015-2016 advanced statistic values and 2015-2016 minutes per game. We also allow for an effect of draft position given that prior analysis by Staw and Hoang (1995) and Camerer and Weber (1999) suggests that higher drafted players continue to garner extra playing time even after controlling for performance. In this case, the expected sign would, of course, be negative: lower numbers for the draft pick should be associated with more playing time if teams favor players that went off the draft board first. Additional effects associated with prior college basketball experience are captured by dummies set equal to one in cases where the player either attended a top-rated college program or played in a top conference. A further dummy is set equal to one for instances where the player entered the NBA from overseas and never played college basketball at all. Finally, pending salary levels are included to allow for the possibility of more highly compensated players being awarded additional playing time.

Table 4 reveals that, as expected, players with higher scores on the advanced statistics consistently play more minutes. Owing to high degrees of correlation amongst the three advanced statistics (amounting to as much as 0.91), WS, BPM, VORP and Wins Produced are entered separately in the cross-section regressions. Each is significant at the 99 percent confidence level with the expected positive sign. There is also an impact of draft order and higher draft picks end up garnering significantly more playing time even after controlling for performance differences based on the advanced statistics. The international dummy is always insignificant, however, as are the dummies associated with attending colleges in the ACC or Big 12 or attending a top ranked program (with the exception of a single significant negative coefficient on ACC in the WS regression).

Finally, playing time is not significantly affected by pending salary levels and these two measures are actually quite independent of one another.[9]

Table 4. Minutes per game relative to advanced statistics and player characteristics.

Dependent variable: Minutes per Game *Right-hand-side Variables:*				
Win Shares	305.6493*** (9.901393)			
BPM		902.2156*** (84.85697)		
VORP			630.5296*** (36.75229)	
Wins Produced				1143.091*** (103.2254)
Draft Pick Number	-57.2928*** (9.60217)	-105.9437*** (17.28688)	-103.1743*** (13.80836)	-110.5487*** (16.91637)
From ACC	-1050.689** (514.5263)	-1420.773 (940.8856)	-1235.262 (766.6851)	-1192.803 (930.4458)
From Big 12	-486.6861 (474.6992)	17.70264 (867.9203)	-474.6116 (707.5804)	-219.3942 (858.4681)
Top 10 College	371.8379 (354.6541)	-286.5161 (647.311)	-41.8926 (527.703)	-176.6533 (640.6513)
International	81.19712 (459.4794)	-440.4252 (839.5099)	-104.0329 (684.6672)	-393.2814 (830.9785)
Salary	-0.000037 (0.000022)	-0.000037 (0.000041)	-0.000052 (0.000033)	-0.000029 (0.000040)
Constant	3634.009*** (406.6829)	10464.8*** (646.664)	6837.785*** (554.6801)	6459.197*** (710.1502)
Number of observations:	245	253	253	251
R-squared:	0.8419	0.4092	0.6387	0.4848

Note: Clustered standard errors are in parentheses.
*** and ** denote significance at the 99% and 95%, confidence levels, respectively

With draft order being significant in accounting for playing time even after controlling for performance, this begs the question of how strongly an NBA player's original draft order is connected to future realized performance in the NBA. Table 5 shows the results of regressing a player's original draft order on the 2015-2016 advanced performance statistics, plus the same array of dummies reflecting prior college basketball experience and domestic/international status. An obvious qualification is that, insofar as performance increases with experience, the performance levels ultimately achieved by more recently drafted players will not be fully represented in this analysis. Although this

[9] This is reflected also in additional analysis confirming that 2016-2017 player salaries are not significantly explained by any of the variables that are shown in Table 4 to account for playing time.

leaves it unsurprising that the advanced statistics do not explain draft order as well as they do playing time (based on overall goodness of fit), the advanced statistics nevertheless remain significant at the 99% confidence level in each case.

Table 5. Draft order vs. advanced statistics and player characteristics.

Dependent variable: Draft Pick Number Right-hand-side Variables:				
Win Shares	-0.382212*** (0.044644)			
BPM		-1.51619*** (0.191455)		
VORP			-0.700424*** (0.116810)	
Wins Produced				-1.814843*** (0.274172)
From ACC	-1.662508 (2.347578)	-1.62452 (2.367119)	-1.34183 (2.429251)	-1.302771 (2.407254)
From Big 12	0.2973331 (2.29382)	-1.112868 (2.336281)	0.0661975 (2.373355)	-0.483181 (2.354833)
Top 10 College	-5.707429*** (1.76177)	-4.948803*** (1.779293)	-5.620366*** (1.822972)	-5.243853*** (1.808241)
International	-0.814624 (1.985687)	-0.558389 (2.001369)	-0.0557657 (2.054207)	-0.443181 (2.061516)
Constant	32.25708*** (1.008047)	24.6722*** (0.998299)	29.92193*** (0.964218)	31.31807*** (1.037797)
Number of observations:	499	498	499	495
R-squared:	0.1412	0.1248	0.0898	0.1035

Note: Clustered standard errors are in parentheses.
*** denotes significance at the 99% confidence level.

As with Table 4, there continues to be no evidence of nationality effects, nor any significant impact of attending a school in the ACC or Big 12 conferences. In contrast to the minutes per game results, there is a strongly significant effect of attending a top college basketball program, however (cf, Evans, 2018). This suggests that, whereas attending a top program is no guarantee of greater playing time, it is associated with a more favorable ranking in the draft. This likely reflects initial benefits associated with the greater visibility of top college programs, even though it is not clear that there is any sustained benefit based on playing time and future success. Finally, the uniform insignificance of the international dummy implies no discrimination either for or against international players over the time since the one-and-done rule was enacted. There seems to be no discernible advantage to going to college over playing internationally first unless a player attends a truly top program.

4. Conclusions and implications

We identify strongly significant relationships between NBA advanced statistics and both minutes per game and draft order. Our findings are consistent across all four alternative statistics and offer some confirmation that playing time and draft selection indeed favor players who end up performing more strongly during their time in the NBA. There is no evidence of any direct relationship between playing time and college basketball experience, however. Regardless of where a player attended college, or indeed whether the player played college basketball at all, playing time remains determined solely by actual performance at the NBA level and original draft order. Players attending a top ranked college basketball program do appear to get a significant boost in draft order, however. This implies that, insofar as higher draft order is itself linked to greater playing time, there is still an edge for this group at the NBA level – and accompanying potential tradeoff between gains in draft position vs. salary foregone over each of year of remaining in college. Nevertheless, outside of the truly elite programs, there is otherwise no evidence that playing college basketball confers any advantage over those entering the NBA directly from overseas.

Prior to the implementation of one-and-done rule, domestic star performers like Kobe Bryant, LeBron James and Moses Malone could enter the NBA directly from high school. Their ability to succeed without playing college ball first begs the question of whether higher draft orders for players attending top programs really reflects advantages derived from the experience itself. Certainly, over the 1989-2000 draft classes, Rodenberg and Kim (2012) found no evidence that skipping college had any negative effect on subsequent success at the NBA level. On the contrary, Rodenberg and Kim's analysis suggests that better on-court performance accrued to players who were drafted at relatively earlier ages – thereby actually favoring high school entrants over 'one-and-done' players during this earlier period.

It remains quite possible that, with top programs naturally tending to recruit only the very best high school players, the significant effect of attending a top college found in this paper's statistical analysis is merely a proxy for the innate talent level of these individuals. For example, LeBron James was not only the number one pick in the 2003 NBA draft but, not surprisingly, the number one recruiting target for college basketball programs that year. Denying such players the choice of entering the NBA straight after high school exposes them to an involuntary increased risk of injury before their NBA career has even begun. In the absence of evidence that there are truly additional advantages stemming the college basketball experience itself, it also hardly seems appropriate to force top players to settle for a mere scholarship that vastly understates their value to the college or university concerned.

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