

The Democrats' Dilemma: A Game Theory Analysis of Joe Biden's 2024 Presidential Campaign

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The 2024 Presidential Campaign of Joe Biden was very abnormal. Not only was he the first incumbent president since Lyndon B. Johnson not to seek reelection for a second term, but he only decided not to run for president after a catastrophic presidential debate against Republican rival Donald Trump hurt his popularity and led congresspeople from within the Democratic party to call for him to end his campaign. The purpose of this paper is to use a Game Theory framework to analyze this internal conflict, modelling the campaign as a game in which two actors, the Democratic Party and Joe Biden, each pursued their own interests. This methodology reveals that Joe Biden's poor performance in the presidential debate was a turning point that altered the risk-averse strategy of the Democratic Party and led to a new equilibrium that resulted in the end of Biden's campaign. The outcome of the game represents an important principle in partisan politics: when people prefer to avoid conflict within their party, they help preserve the status quo, even if they find that status quo undesirable.

Introduction

On June 27, 2024, President Joe Biden and his challenger, Donald Trump, met for the first presidential debate of the electoral cycle. Rather than calm voters' concerns about the President's cognitive decline, the debate "reignited fears among Democrats" that Biden's fitness to lead was even worse than they feared (1). Biden regularly lost his train of thought and failed to speak clearly. After he trailed off while discussing immigration policy, Trump simply responded by saying, "I really don't know what he said at the end of that sentence, I don't think he knows what he said, either" (2). This underperformance led to key Democrats, including Barack Obama and Nancy Pelosi, pushing for Biden to step down (3). Just 24 days after the debate, on July 21, Joe Biden announced that he would be ending his campaign for reelection. By August 5, Vice President Kamala Harris had officially become the Democratic nominee for the presidency, a turnabout that almost no one had thought possible just a month before.

However, what is most interesting about Biden's withdrawal is that many Democrats were unsatisfied with him and concerned that he was incapable of winning his campaign long before the debate even happened. A poll by AP-Norc found that 78% of adults, including 62% of Democrats, did not want to see Joe Biden run for a second term (4). It is reasonable to assume this discontent concerned many Democratic congresspeople, but despite this, Biden did not face any significant challenge in the primaries, nor did any influential figures in the Democratic party demand he step down to the extent they did after the debate. Why did Democratic congresspeople not speak out

in favor of their own preferences? This analysis seeks to answer that question by framing the campaign as a game in which the Democratic party must decide whether to support Biden, and Biden must decide whether to run for reelection despite concerns about his age.

Analysis

This situation can be modeled using a normal form ordinal game. In game theory, a normal form game is one where each player chooses from multiple strategies simultaneously, and the combinations of these strategies are represented as a payoff map, with a payoff for each player assigned to each outcome (5). This payoff map is typically a table or matrix where each strategy for one player is a row and each strategy for the other player is a column. Conventionally, the payoff for the row player is listed first and the column player second. In an ordinal game, these payoffs are expressed as a payoff function, where both players prefer outcomes with a higher number; this allows us to define the ordinal preferences of each player, but not the degree to which they prefer one outcome over another (6). Fortunately, a ranking of each player's preferences is enough to understand how they would behave in the context of this game.

Pre-Debate Game

The game represents the situation prior to the presidential debate. One "player" represents the Democratic Party, and the other player is Biden himself. While there are obviously many people within the Democratic Party who

will not always be taking the same course of action, the “actions” of the party refer to the prevailing consensus among influential Democrats. The Democrats, abbreviated as D, have two options: cooperation with Biden, C—by supporting him—or noncooperation, ~C—by calling on him to step down. Biden, B, also has two options: cooperation with his concerned party, C—by stepping down—or noncooperation, ~C—by insisting on staying in the race. A table (Fig. 1) outlining these decisions and their outcomes for each player is shown below. Outcomes are listed in the order (D , B), with 3 as the most desirable outcome and 0 as the least desirable:

only to find out that his party would have cooperated with him.

The third assumption for each player is much more subjective, and harder to prove than the first two. However, these final assumptions only determine how each player ranks their middle two outcomes (expressed as “1” and “2” on the payoff map.) As the game analysis will demonstrate, the relative rankings of these two outcomes will not change the result of the game as long as they are less than 3 and greater than 0. Therefore, even if one disagrees with these two assumptions, the results of the analysis are still valid.

| (D , B) | | B | |
|---------|----|---------|---------|
| | | C | ~C |
| D | C | (3 , 1) | (1 , 3) |
| | ~C | (2 , 2) | (0 , 0) |

Figure 1. Payoff Map for Pre-Debate Game.

The preferences of D are based on three assumptions:

1. The Democrats prefer to avoid conflict, which creates controversy and hurts their image. As Democrat Ro Khanna told the Associated Press, “It’s in our interest to have the president succeed as much as possible” (7).
2. The Democrats would prefer if Biden stepped down and a more popular candidate took his place. This is supported by the AP-Norc Poll (4).
3. The Democrats prefer getting Biden to step down by creating conflict within the party over not creating any conflict and allowing Biden to stay in the race.

The preferences of B are also based on three assumptions:

1. Biden prefers to stay in the race because he believes he can win a second term. He has stood by his claim that he “would have beaten Trump, could have beaten Trump” (8).
2. If his party is unwilling to cooperate with him, Biden would prefer to step down because he would have low chances of success and would hurt his party as well. In his own words, he “didn’t want to be one who caused a party that wasn’t unified to lose an election” (8).
3. Biden would prefer a scenario where he drops out due to non-cooperation over a scenario where he drops out

Using these assumptions, the outcome of each strategy combination is explained in more detail. Note that strategies are also listed in the order (D , B).

(C , C): *Mutual cooperation.*

Both players cooperate. Democrats support Joe Biden, or at least do not actively criticize him, but Biden yields to their wishes for him to step down anyway. This is the best outcome for the Democrats, who get what they want without having to create conflict. However, it is Biden’s second-worst outcome, as he would have been able to stay in the race with his party’s support if he had chosen ~C.

(C , ~C): *Democrats cooperate with Biden, but Biden does not reciprocate.*

Democrats cooperate by not challenging Biden, Biden does not cooperate with his detractors by continuing to run for President. This is the most desirable outcome for Biden, who would continue to run unopposed, but the second-worst outcome for Democrats who are still concerned he will not be able to win reelection.

(~C , C): *Democrats challenge Biden, who cooperates with them.*

Biden withdraws from the race due to facing opposition. This is the second-best outcome for Democrats, who get what they want after some conflict. It is also the second-best outcome for Biden, who would rather not end his campaign, but still wants to comply with his party.

(~C, ~C): *Mutual non-cooperation.*

Democrats challenge Biden, who continues to run for President despite this. This is the worst outcome for both players. The Democrats do not get what they want, and Biden's reputation has been significantly damaged, making the prospects of a Democratic victory slim.

This paper will consider the outcome of this game and its implications for the Democratic Party.

For D, the strategy ~C is strictly dominated by the strategy C, meaning that regardless of B's strategy, the strategy C yields a strictly better result every time (5). This is because regardless of which action Biden will choose, Democrats secure the better outcome for themselves by cooperating with him. If B chooses C, D will also choose C because it yields a payoff of 3, whereas (~C, C) only yields a payoff of 2. If B chooses ~C, D will choose C because the payoff is 1 rather than 0.

This makes sense considering the real political context: if Biden decides to drop out of the race (C), it is better for Democrats to cooperate by not criticizing him as this would cause needless conflict. If Biden is not willing to drop out of the race (~C), there is nothing to be gained by not cooperating and pushing him to step down anyway. As a result, D will always choose C as its strategy.

Knowing that D will always choose C, then for B, C is conditionally strictly dominated by ~C, meaning ~C is the better choice under the condition that D will choose C. Because there is no incentive for D to deviate from strategy C, it is always in the best interest of B to choose ~C, since B prefers (C, ~C) to (C, C). By this logic the solution of the game is for D to play C and B to play ~C, for a payoff of (1, 3). Figure 2 illustrates this:

| (D, B) | | B | |
|--------|----|--------|--------|
| | | C | ~C |
| D | C | (3, 1) | (1, 3) |
| | ~C | (2, 2) | (0, 0) |

| (D, B) | | B | |
|--------|----|--------|--------|
| | | C | ~C |
| D | C | (3, 1) | (1, 3) |
| | ~C | (2, 2) | (0, 0) |

Figure 2. Solutions for Pre-Debate Game. Top: Because ~C is strictly dominated by C for D, D will never choose it and the strategy is eliminated from consideration. Bottom: B prefers a payoff of 3 to a payoff of 1, and so whenever D chooses C, B will choose ~C.

This solution is a Nash equilibrium — a combination of strategies “from which no player wishes to deviate, given the other players’ strategies” (6). When a game reaches a Nash equilibrium, neither player has any reason to change their strategy, even if they learn what the other player is going to do. We can see that (C, ~C) satisfies

this property. If B plays C or ~C, D's best choice is C. If D plays C, B's best choice is ~C; if D plays ~C, B's best choice is C. Nash equilibria can be found by looking at the strategy of each player, and labeling the best outcome for the other player with the player's name. Any outcome which is labeled with both players is a Nash equilibrium. This is demonstrated in Figure 3:

| (D, B) | | B | |
|--------|----|-----------------|--------------------------|
| | | C | ~C |
| D | C | D (3, 1) | D (1, 3) B |
| | ~C | (2, 2) B | (0, 0) |

Figure 3. Nash Equilibrium for Pre-Debate Game. The solution can also be found by analyzing each player's conditional preferences. The D in each column is the preference of D given that strategy of B. The B in each row is the preference of B given that strategy of D. The outcome where they overlap, (C, ~C), is the same equilibrium found in Figure 2.

This Nash Equilibrium describes the state of the election up to the June 27 debate. While a few voices called for Biden not to run again, the stance of the Democrats as a whole was to fall in line behind him. However, that debate is widely regarded by both Democrats and Republicans as the turning point at which Democrats stopped cooperating with Biden, leading to the end of his campaign. A modified post-debate version of this game will demonstrate this turning point.

Post-Debate Game

In this version of the game, the first assumption about D's preferences changes so that non-cooperation (~C) is just as desirable as cooperation (C) if it results in Biden cooperating by dropping out of the race. In other words, this scenario considers what would happen if the debate convinced Democrats that any outcome where Biden drops out is equally desirable, even if it involves conflict within the party. Biden's preferences remain the same. This gives (~C, C) a payoff of (3, 2) instead of (2, 2). If Biden is unwilling to cooperate, it is still better for Democrats to cooperate with him rather than tank his chances of reelection, so the other outcomes remain unchanged. This modified scenario is shown below (Fig. 4):

| | | | |
|--------|----|--------|--------|
| (D, B) | | B | |
| | | C | ~C |
| D | C | (3, 1) | (1, 3) |
| | ~C | (3, 2) | (0, 0) |

Figure 4. Payoff Map for Post-Debate Game.

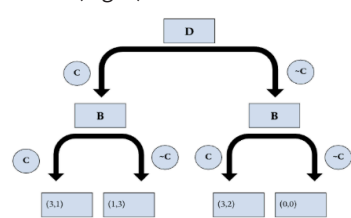
This game changes D's payoffs, making (~C, C) and (C, C) equally preferable for D. This means that there are no strictly dominated strategies for this game, so it must be solved by searching for Nash equilibria. Applying the second method from the previous game shows that this game has two Nash equilibria, shown below (Fig. 5):

| | | | |
|--------|----|-------------------|-------------------|
| (D, B) | | B | |
| | | C | ~C |
| D | C | (3, 1) | D (1, 3) B |
| | ~C | D (3, 2) B | (0, 0) |

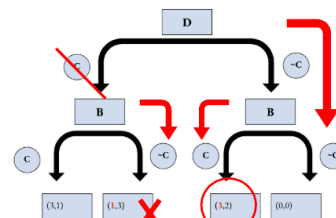
Figure 5. Nash Equilibria for Post-Debate Game.

Unlike in the previous game, there is now the possibility that D will continue to choose ~C, leading to an equilibrium where D continues to force B to choose C, reinforcing D's decision to choose ~C. In this equilibrium, the outcome is (~C, C), with a payoff of (3, 2). That alternate equilibrium is shown in Fig. 5 alongside the equilibrium from the first game, (1, 3). For Democrats, this means that if they continue to call for Biden to step down, they can put Biden in a position where he is forced to cooperate. If Biden knew they were going to call for him to step down, he would choose to comply, preferring a payoff of 2 to 0. However, Democrats could still choose to cooperate, which leads to the same result as the pre-debate game, (C, ~C).

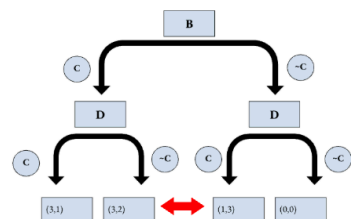
This would normally mean that it is impossible to predict for certain the outcome of the game. One way to interpret this uncertainty is to treat the situation as an extensive game. Rather than have players make their choice at the same time, extensive games have a sequential structure where players take turns choosing their strategy (6). For a game like this, with two Nash equilibria, the equilibrium that is reached will depend on which player goes first. The two possible outcomes are shown below (Fig. 6):



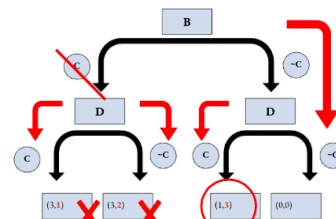
1. When the game is played sequentially, it is modeled as a flowchart, known as a game tree. For now, assume D chooses their strategy first.



2. Here, D will choose ~C, forcing B to choose C. This is because if D chooses C, B will choose ~C, which leaves D worse off. Possible payoffs for D are bolded.



3. However, if B chooses first, the game tree changes. Note that the positions of the payoffs for (C, ~C) and (~C, C) have been swapped.



4. Here, B will choose ~C, forcing D to cooperate, just like D did before. By choosing ~C, B secures a payoff of 3, which is better than either option branching from C. Possible payoffs for B are bolded.

Figure 6. Post-Debate Game in Extensive Form

Determining which Nash Equilibrium is more likely, then, requires figuring out which player goes “first.” The order of a game like this depends on its real-world context. This game was not played only once but constantly played between the Democrats and Biden throughout his campaign. The game only ends if Biden wins the Democratic Party Nomination at the DNC National Convention, or if Biden drops out and does not seek nomination. This also has important implications for our understanding of the outcomes. If Biden chooses not to cooperate and stay in the race, he can change his mind up until the nomination convention. However, if Biden decides to cooperate by dropping out of the race, he cannot change his mind and re-enter it the next day — the decision is permanent. With this in mind, we can consider a flowchart of the game’s outcomes and whether it repeats (Fig. 7):

that their decision is fixed and unable to be changed by the actions of the second player. Because the Democratic party is composed of hundreds of influential politicians and members of the media, it is much more difficult for the group as a whole to change their strategy compared to Biden and his staff. Their course of action is less sensitive to Biden’s actions than Biden is to theirs. The Democrats behave like the first player in the sequential game, and Biden behaves like the last player.

This all means that even if Biden convinces some Democrats to cooperate, or convinces Democrats to cooperate for a brief period, the burden is on him to maintain this status quo; if at any point he chooses to cooperate, the game ends. Once the equilibrium of (C, ~C) is broken and enough Democrats begin to challenge Biden, it becomes extremely difficult—if not impossible—for him

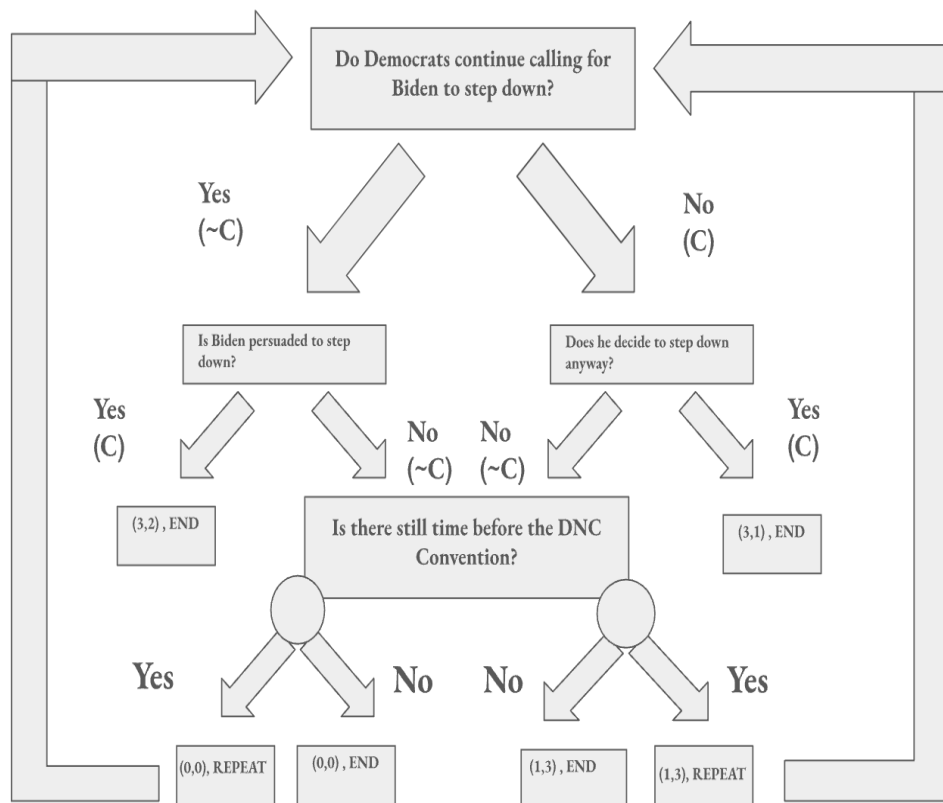


Figure 1. Payoff Map for Pre-Debate Game.

This chart shows how the game repeats whenever Biden does not cooperate but ends when he does. A similar chart could be drawn for the pre-debate game, but it would be unnecessary because neither player deviates from their original strategy. In the post-debate game, circumstances are different. Biden is the only player with the ability to end the game by choosing C, which makes it likely that he will be the last player to choose a strategy. Additionally, a key characteristic of the first player in this sequential game is

to get every single Democrat to permanently back down and support him.

Conclusion

I believe that as current events become history, Joe Biden’s presidential campaign will be heavily studied by political scientists, sociologists, and game theorists. This is because the case study provides us with an opportunity

to study a conflict among allies rather than between rival groups. There is also potential for further research beyond the model in this paper, including variations where Democrats are represented as a cooperative team of multiple players rather than a single actor. In this specific instance, the Democrats' Dilemma highlights an interesting paradox: the Democrats prefer every outcome where Biden leaves the race to every outcome where he does not, but they ensure that he stays in the race by always choosing to cooperate with him. The possibility of getting what they want without conflict, (C, C), incentivizes the Democrats to avoid the risk of non-cooperation. It is only once there is no longer a preference to avoid conflict, as seen post-debate, that the Nash Equilibrium changes from (C, ~C) and Democrats achieve what they want.

Given its massive implications for the 2024 Presidential election, this case study holds important lessons for social scientists studying cooperation and conflict within political groups.

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Dr. Bruce Pollack-Johnson earned a B.A. in Sociology from Brandeis University, an M.A. in Applied Mathematics from Temple University, and an M.S. and Ph.D. in Operations Research from the University of Pennsylvania. He taught at Oberlin College, then at Villanova University starting in 1990, and retired in 2025 as an Emeritus professor of Mathematics and Statistics at Villanova University. He has published dozens of papers in project management, forecasting, educational modeling, and on teaching applied mathematics, as well as 3 editions of a two-volume text on business calculus and finite mathematics focusing on student-generated projects from students' own lives using technology. His most recent research has been on mathematical models incorporating quality considerations in project scheduling.