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The Effect of Timeouts on Team Performance: Evidence from E-sports

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Victoria
23 de Noviembre, 2022

Tesis de Maestría en Economía de

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“El Efecto de los Tiempos Muertos sobre el Rendimiento de un Equipo: Evidencia de los E-sports”

Resumen

Este trabajo apunta a determinar el efecto causal de los tiempos muertos sobre el rendimiento de un equipo. Para esto, construyo una base de datos de 103 partidos de *Counter-Strike: Global Offensive*. Utilizo variación exógena proveniente de dificultades técnicas, por ejemplo, problemas de latencia. Cuando defino un tiempo muerto como uno que dura al menos 30 segundos - la duración usual de un tiempo muerto táctico- haber tenido un tiempo muerto técnico incrementa la probabilidad de revertir el ganador de la ronda previa en 14.76 puntos porcentuales. Este trabajo tiene importantes implicancias para los deportes. En primer lugar, muestra que la creencia de que los tiempos muertos pueden romper el impulso del otro equipo y, por ende, son una herramienta valiosa para incrementar la probabilidad de ganar, tiene sustento empírico. En segundo lugar, dado lo primero, saber cuándo pedir un tiempo muerto puede ser crítico para el éxito de un equipo. Es decir, los entrenadores deberían ser seleccionados en base a esta capacidad también. En tercer lugar, incrementar la cantidad de tiempos muertos, o hacerlos disponibles en deportes que no los permiten hoy en día, podría hacer al deporte más competitivo facilitando frenar el impulso del otro equipo.

Palabras Clave: Deportes; rendimiento de un equipo; e-sports; tiempos muertos; impulso psicológico

“The Effect of Timeouts on Team Performance: Evidence from E-sports”

Abstract

This study aims to determine the causal effect of timeouts on team performance. To do so, I constructed a data set on 103 high-tier *Counter-Strike: Global Offensive* matches. I use exogenous variation stemming from technical difficulties, for example, latency issues. When defining a timeout as one having lasted at least 30 seconds - the usual tactical timeouts' duration- having had a technical timeout increases the probability of reversing the previous round's winner by 14.76 percentage points. This study has important implications for sports. First, it shows that the belief that timeouts can help break the other team's momentum, and are, therefore, a valuable tool to increase the probability of winning, has some empirical support. Second, given the first point, knowing

when to call a timeout could be critical to the team's success. That is, coaches should be selected on this capability as well. Third, increasing the number of timeouts, or even making timeouts available on sports that do not currently allow them, could make the sport more competitive by making it easier to stop a team's momentum.

Keywords: Sports; team performance; e-sports; timeouts; psychological momentum

Códigos JEL: L83; Z20; Z29

Acknowledgements

I would like to thank my mentor, Martín Rossi, for his guidance during the process of making this thesis. I would also like to thank Peter Xenopoulos for making the awpy library public, which allowed me to get the data I needed, and for his help when I run into some trouble using it. I am also grateful for comments made by Amelia Gibbons, Marco Duarte, and fellow students at Universidad de San Andrés.

1 Introduction

Many factors can affect a team's performance in sports. The physical factor is the most obvious, but there is also the psychological factor. Psychology has been gaining traction in sports over the last few years. One psychological factor which has received much attention is momentum. Iso-Ahola and Mobily (1980) define *psychological momentum* as "an added or gained psychological power which changes a person's view of himself or of others or others' view of him and of themselves." The authors argue that this changed perception then influences players' performance. Therefore, momentum can influence the outcomes of matches. How does one gain momentum? By being successful. For example, suppose you score 6 points in a row in basketball. In that case, you will likely gain psychological momentum, giving you an advantage over the other team[1]. Timeouts can potentially play an essential role by stopping a team's momentum and letting players reset their mindset. This study aims to determine the causal effect of timeouts on team performance.

Some studies have tried to determine the main factors influencing coaches' decisions to call a timeout. Arias *et al.* (2010) found that most timeouts in volleyball are called after the opposing team scores 1 to 3 consecutive points. Lloveras and Vollmer (2021) studied Division 1 NCAA college basketball teams and, in line with these results, found that "the probability of calling a timeout increased as the relative points scored by the opposing team increased." There are, of course, many reasons to call a timeout beyond breaking the other team's momentum. Nevertheless, this idea seems to be in the coaches' minds. For example, Murray (2022) cites Tom Thibodeau, the New York Nicks' head coach, referring to a 9-0 run by the Los Angeles Clippers: "A bad minute could be 12 points. So I think using your timeouts to kill those runs is important." Although there have been some attempts to answer whether timeouts affect performance, they fall short in estimating a causal relationship, i.e., the average treatment effect of stopping game play. In the cases where they find an effect on some performance or outcome measure, other stories can serve as an explanation. If we see that, for example, the score differential decreases after a timeout, one might be tempted to attribute it to the timeout itself. Nonetheless, since timeouts are more often called when on a bad slump, we might just be seeing a reversion to the mean. This would be another example of Ashenfelter's dip (Ashenfelter, 1978). Another source of endogeneity comes from the fact that some coaches can be better than others at motivating the players. If good coaches know how to motivate their players, they would be more likely to ask for a timeout -since they would find it more effective-. Then the results would contain the effect of stopping the other team's momentum

[1] Psychological momentum can also work the other way around. Losing many points in a row can be demoralizing and cause players to play even worse.

and the difference in the coach's capabilities. Consequently, we need exogenous variation on the timing of the timeout and some control over the coaches' influence to measure a causal effect. I use evidence from *Counter-Strike: Global Offensive*, a video game, to measure a causal effect by using timeout variation stemming from technical issues, for example, connection problems.

Counter-Strike: Global Offensive has two types of timeouts: tactical and technical. *Tactical timeouts* are timeouts a team calls to discuss strategy, the same as in basketball. Each team has a certain amount of available tactical timeouts - depending on the tournament's rules- and can choose to use them anytime they want, even in a row. *Technical timeouts* are called due to technical issues, like player latency. It is important to note that players and coaches are not allowed to speak during technical timeouts, unlike tactical timeouts[2]. Thus by utilizing technical timeouts, I am looking at the average treatment effect of stopping game play; this is what I will be referring to throughout this study. The no communication rule during technical timeouts makes them different than regular timeouts. Nevertheless, this means that I will estimate the effect of the timeout itself. That is, the results found in this study should be taken into account but are not indicative of anything if the coaches can motivate players enough to overcome the adverse effect of calling a timeout. Although the final effect of tactical timeouts during the game also includes the motivation factor, the momentum-stopping effect is found to be relevant and large.

Unlike in sports like basketball or volleyball, there are rounds in *Counter-Strike: Global Offensive*. The number of rounds won determines the score instead of some particular outcome that can change rapidly. Ideally, I would define *momentum* as having won many rounds in a row, which would be the equivalent of scoring many points in a row on a basketball match, for example. Unfortunately, I am forced to define momentum as having won the previous round due to insufficient data. For example, when defining it as having won the previous two rounds, I am left with only one technical timeout in the sample. Nevertheless, since rounds last up to almost 2 minutes, a team could potentially build momentum within the round and have achieved a psychological momentum advantage by the end of it. I do, however, also control for the number of rounds won in a row. I run multiple econometric specifications. There are two ways to think about a timeout's effect on performance. It's possible to think that the effect comes from having a timeout or not, the *extensive* effect, or from the duration of the timeout, the *intensive* effect. To measure the extensive and intensive effect of the timeout, I define two different treatment variables. One is a dummy taking the

[2] Since the matches used in this study were played online, all players had cameras on them, which would make monitoring easy. Also, the communications app players use records the voice communications of the players and coaches.

value one if there was a timeout at the beginning of the round. The other is a variable that measures the duration, in seconds, of the timeout. I also run an alternative model where I define a technical timeout as one having lasted over 30 seconds - the usual duration of a tactical timeout-. I run these specifications using two different samples. I keep one round after technical and tactical timeouts in the first sample. This will allow me to compare the exogenous and endogenous timeout estimates. In the second sample, as a robustness check, I drop the rounds after a tactical timeout; thus, I can concentrate only on the exogenous timeout's effect.

When defining a timeout as one having lasted at least 30 seconds, I find a large effect of timeouts on reversing the previous round's winner, even when controlling for several characteristics and having a small number of timeouts. In this setting, a timeout increases the probability of reversing the previous round's winner by 14.76 percentage points. I also find a statistically significant, albeit small, effect of the timeout duration. A timeout lasting 30 seconds -the usual tactical timeout duration- increases the probability of reversing the previous round's winner by 0.67 percentage points. These results have important implications for sports. It shows that the belief that timeouts can help break the other team's momentum, and are, therefore, a valuable tool to increase the probability of winning, has some empirical support. From this, follows two conclusions. First, knowing when to call a timeout could be critical to the team's success. That is, coaches should be selected on this capability as well. Second, increasing the number of timeouts, or even making timeouts available on sports that do not currently allow them, could make the sport more competitive by making it easier to stop a team's momentum.

When deleting the necessary observations, I am left with a small number of exogenous timeouts, which makes it harder to trust the results. For example, if I only had one technical timeout, the obtained coefficient would depend heavily on that round's characteristic. In other words, the coefficient would have a high variance. In this case, I have nine technical timeouts in the first sample and six in the restricted one. This is still a low number, and my results could be due to those rounds' particular characteristics rather than the actual effect of timeouts. Furthermore, any tests I do based on whether there was a timeout on that round will suffer from low statistical power. If the null hypothesis is in my favor, this would also bias the results in my interest. To minimize this problem as much as possible, I perform leave-one-out placebos to ensure that no particular round drives my results. Also, when running a test based on technical timeouts, I utilize the full sample when possible, which includes more timeouts.

This study relates to the psychological momentum in sports literature, introduced by Iso-Ahola and Mobily (1980), which can be considered a formalization of the "hot-hand phenomenon" (Gilovich, Vallone, and Tversky, 1985). After they gave the phenomenon a definition, researchers moved to understand how it works, find instances of momentum and determine its effects on performance measures (Briki *et al.*, 2013; Iso-Ahola and Dotson, 2014; Jones and Harwood, 2008; Shaw, Dzewaltowski, and McElroy, 1992; Vergin, 2000). It also relates to the timeouts literature, which studies what factors influence the decision to call a timeout (Duke and Corlett, 1992; Hastie, 1999; Kozar *et al.*, 2016; Lloveras and Vollmer, 2021; Mace *et al.*, 1992; Wang *et al.*, 2010; Zetou *et al.*, 2017). It also attempts to measure how effective they are (Arias *et al.*, 2010; García-Tomo, Valladares, and Morante, 2003; Gómez *et al.*, 2011; Kozar *et al.*, 2016; Mace *et al.*, 1992; Ortega *et al.*, 2010; Prieto *et al.*, 2016; Roane *et al.*, 2004; Sampaio, Lago-Peñas, and Gómez, 2013). Out of the many studies that attempt it, to my knowledge, there are only two that explicitly state trying to address the potential endogeneity. Gibbs, Elmore, and Fosdick (2020) argue that the endogeneity comes from not controlling for match characteristics prior to the timeout. To solve this, they employ a propensity score matching strategy. Nevertheless, this strategy is still subject to the Ashenfelter Dip phenomenon. The other study which mentions dealing with endogeneity is Permutt (2011). To avoid comparing the score before a timeout to the score after one, which would be subject to the Ashenfelter Dip phenomenon, he compares short-term periods after a negative 6-0 run when a timeout was called and when no timeout was called. He argues that the decision to call a timeout in these scenarios is plausibly exogenous. Nevertheless, there is a reason that a timeout was called in one scenario and not the other. The methodology is also subject to bias from the coaches' ability to motivate their players. Having said this, this is, to my knowledge, the first study that deals with the potential endogeneity of the timeout's timing and the coach's influence.

2 Data

The data used in this thesis was extracted from HLTV and contains information on 2820 rounds from 103 matches[3] played between 2020 and 2021. All matches were played online because of the COVID-19 pandemic. I chose this period because players were playing from their homes and were more subject to technical issues. Of the 103 matches and 2820 rounds, I use information from 103 matches and 732 rounds[4]. The data was gathered using the *awpy* library developed by Peter Xenopoulos.

2.1 *Counter Strike: Global Offensive* overview

To understand the data, I will first lay out the basics of *Counter-Strike: Global Offensive*. It is a First-Person Shooter (FPS) multiplayer video game. In each match, two teams of five play against each other until either they win 16 rounds or, in case there is a tie at 15-15, until they win 4 out of the six rounds in overtime. There are two sides: Counter-Terrorist and Terrorist - Team A and Team B hereafter-. Either side can win the round by eliminating every opposing team player. Team B can also win a round by planting and defending the bomb from Team A. If they manage to plant the bomb and it explodes, which happens 40 seconds after being planted, they win the round. On the other hand, Team A can win the round by defusing the bomb if Team B planted it. Rounds last by default one minute and fifty-five seconds; if Team B cannot plant the bomb and at least one player of each team is alive, then Team A wins the round. The sides are switched after 15 rounds.

Players can buy weapons, equipment, and grenades each round. Weapons vary from pistols, which are less expensive but also do less damage, to primary weapons, which are more expensive but do more damage. Equipment refers to protective gear, which reduces damage taken, and defusers - only available to Team A-, which diminish the time it takes to defuse a bomb by half. Each player can purchase different grenades, some of which deal damage while others can be useful to give themselves an advantage.

In order to purchase weapons, equipment, and grenades, players receive a certain amount of money each round - they can be given no money in some cases-. The amount they receive depends on the number of rounds won or lost in a row, how many enemies they eliminated, and what weapon/ grenade they did so with. Players keep any money that was not spent on previous rounds. They can also keep some equipment from previous rounds if they were not eliminated. If the player

[3] A 4 and 5-star filter was used, which means all matches are from high-tier tournaments and teams.

[4] I will explain the criteria for dropping the rounds below.

survived the previous round, they would keep any weapons and protective gear (in the condition it was at the end of the round[5]), and unused grenades they had. This will be important because I will control for the previous round, i.e., pre-treatment characteristics. If the player was eliminated in the previous round, they start the next with essential equipment: a default pistol and a knife.

2.2 Data gathering and management

Counter-Strike: Global Offensive has a practical data storing system. Every match produces a *demo file*, which is a document containing the information needed to reproduce the game. Peter Xenopoulos has recently developed a library that can analyze *demo files* and turn them into readable components[6]. I have utilized his library to obtain most of the data I am using in this thesis. In particular, I used the library to read the demos. Then, I developed Python code to obtain information on round characteristics, for example, round number and match score; and on team characteristics, for example, equipment value and money available. Most importantly, Xenopoulos's library allowed me to get information on when technical or tactical timeouts were called[7]. There was no way to determine the type of timeout (tactical or technical) or who called it. Therefore, I made the program create a text file pointing me towards which game and round number a timeout was called, and I manually inserted the type of timeout and which team asked for it whenever possible. The code and the explanation of how I determined the type of timeout and the team that requested it are available in Appendix A. Timeouts can only happen between rounds, even if the technical issue happened in the middle of the round. The only time a round is stopped and reset is when the technical issue happens before any player takes any damage. The duration of tactical timeouts depends on the tournament's rules but is usually 30 seconds long. On the other hand, technical timeouts last as long as the problem persists, be that 20 seconds or 30 minutes[8].

Since timeouts can only happen between rounds, all control variables must be from before the round starts. Otherwise, they could be affected by the timeout itself; that is, they would be bad

[5]Protective gear is deteriorated by taking damage. Both Kevlar and Helmet start at 100 when first bought. If the player survived the round with only 50 Kevlar left, he would begin the next round with 50 Kevlar. He may repurchase Kevlar to reach 100, although at full cost.

[6]A visual example of the data structure provided by the library is available in my Github repository. I reduced the example to the minimum information required to understand the structure. Every frame contains more information on every player of each team.

[7]Technically, it helped determine when there was a longer than usual break. Those that were not timeouts are common breaks in play. For example, players are given a break after playing 15 rounds in most tournaments.

[8]Therefore, teams are not forced to continue playing, and I will not be measuring the effect of, for example, continued connection issues.

controls. Therefore, I collected data on team characteristics from the last recorded second of the previous round. I will use the money available and equipment value, which sums up the value of weapons, protective gear, and utilities. Remember, players who avoid elimination keep both equipment and money. Therefore, even though using the current round characteristics would probably lead to a better prediction of the round winner, the previous round's features will still be helpful.

For the outcome variable, since I want to determine whether a timeout has an effect on the momentum of the game, I will define the dependent variable as a dummy variable taking the value one if the team that lost the previous round wins the current one. Ideally, I would like to define momentum as having won many rounds in a row. However, this would further reduce the number of observations and leave me without enough variation in the technical timeout. For example, I am left with only one technical timeout after a team won two rounds in a row and one after a team won three rounds in a row. I will, however, control for the number of wins in a row that the previous round's winner has accumulated up to that round. That is, I will add a control variable that, for example, takes the value four if the previous round's winner has won not just the previous round but also the three rounds before that. Then, my estimates will give the average effect of a technical timeout on the probability of reversing the previous round's winner, *ceteris paribus* the number of rounds won in a row, among other things. Taking that limitation into account, I am forced to define momentum as having won the previous round. This definition comes with difficulty in creating the controls since they should depend on the previous round's winner and should not be affected by the technical timeouts.

For example, I want to control for the team's equipment value since having more weapons, defensive gear, defusers, and grenades can lead to a higher probability of winning the round. First, If I included the equipment value at the beginning of the current round, my estimates could be biased since these are outcomes. That is, having a timeout could affect the decision to buy equipment. Therefore, I need the equipment value to be measured before the timeout. Since timeouts can only happen between rounds, I measured the equipment value at the last recorded second of the previous round. I will call Team A's [Team B's] equipment value at the last recorded second of the previous round *Equipment Value A [B]*. Since my interest variable is the probability of reversing the previous round's winner in the current round, I need the controls to depend on the previous round's winner. To do this, I define the control variable *Win Equipment Value* as follows:

$$Win\ Equipment\ Value = (Equipment\ Value\ A * Lag\ A\ win) + (Equipment\ Value\ B * Lag\ B\ win)$$

Since *Lag A win* and *Lag B win* are mutually exclusive, *Win Equipment value* will measure the equipment value at the last recorded second of the previous round for the previous round's winner. This procedure is repeated with all other control variables when possible. A detailed description of all variables used in the analysis is available at the end of Appendix B.

I define the variable *Technical Timeout* as taking the value one if there was a technical timeout called at the beginning of that round, regardless of who called it. This is because I cannot determine which team called a technical timeout every time; the broadcast did not specify it, and the casters did not mention it. At first, it might seem unnecessary to determine the team that called the technical timeout since these are unexpected issues related to the player's computer or his connection to the server. Nevertheless, one might think that having an issue with either of these might be frustrating for the player if they lost the previous round due to the issue[9]. One might also suspect players are faking or "creating" technical issues to take a break if they are losing. To address both concerns, if technical timeouts are exogenous, one would expect them not to be correlated with any characteristics, particularly with which side won the previous round.

Tables 1 and 2 show the means of the control variables and of the previous round's winner variables based on which team called the technical timeout[10]. If there were cheating or frustration, one would expect technical timeouts to be more common when the opposite team won the previous round. In Table 1, when I could identify eight Team A tactical timeouts, the difference in the previous round's winner variable's means is not large; it also evidences the opposite of what we would expect if players were faking the technical issues. A mean-comparison test is also presented in the last column of Table 1. In table 2, the difference on the previous round's winner variable seems small even when I could only identify five Team B technical timeouts. A mean-comparison test reveals no statistical difference between the two (see column four).

[9]Remember that rounds are not restarted unless no player has taken damage.

[10]In these tables, I utilize the full sample. That is, I do not drop observations after technical or tactical timeouts since it is not necessary to do so for these tests. Doing this increases the statistical power of the tests, which makes the results more reliable.

Table 1: Mean comparison test by team A technical timeout

Variable name	Mean team A timeout = 0	Mean team A timeout = 1	P-value mean-comparison test
Team B won previous round	0.47	0.38	0.60
	(0.50)	(0.52)	
Wins in a row	2.49	1.75	0.25
	(1.80)	(1.16)	
Winner timeout	0.02	0.00	0.66
	(0.16)	(0.00)	
Loser timeout	0.12	0.13	0.98
	(0.33)	(0.35)	
Score differential (winner - loser)	0.98	1.50	0.71
	(4.02)	(3.51)	
Winner's equipment value	11,538.74	15,225.00	0.26
	(9,284.39)	(7,410.37)	
Loser's equipment value	5,878.33	3,900.00	0.45
	(7,461.29)	(9,763.89)	
Winner's cash	28,916.32	27,943.75	0.83
	(12,794.17)	(12,126.99)	
Loser's cash	21,484.53	22,743.75	0.69
	(8,839.13)	(8,929.74)	

Notes: Number of team A technical timeouts recorded: 8. Standard deviation in parenthesis.

Table 2: Mean comparison test by team B technical timeout

Variable name	Mean team B timeout = 0	Mean team B timeout = 1	P-value mean-comparison test
Team A won previous round	0.53	0.60	0.76
	(0.50)	(0.55)	
Wins in a row	2.49	2.80	0.70
	(1.80)	(1.10)	
Winner timeout	0.02	0.00	0.73
	(0.16)	(0.00)	
Loser timeout	0.12	0.20	0.59
	(0.33)	(0.45)	
Score differential (winner - loser)	0.98	0.80	0.92
	(4.02)	(2.59)	
Winner's equipment value	11,543.69	14,790.00	0.43
	(9,270.84)	(14,603.53)	
Loser's equipment value	5,873.15	5,480.00	0.91
	(7,470.36)	(6,499.67)	
Winner's cash	28,907.71	31,960.00	0.59
	(12,788.70)	(14,778.29)	
Loser's cash	21,484.81	23,350.00	0.64
	(8,844.95)	(3,321.14)	

Notes: Number of team B technical timeouts recorded: 5. Standard deviation in parenthesis.

Out of the 2820 rounds, due to an error with the demo parser, I have to drop 40 observations. I also drop the first round of every match since I cannot define the relevant variables (the previous round's winner and loser), which leaves me with 103 rounds less. Since rounds after a timeout could also be affected, I only kept one round after a technical timeout was called. This avoids outcome rounds being used as controls. Since rounds after a tactical timeout can also be affected, I will run a regression with a full sample - keeping only one round after a tactical timeout- and one with a restricted sample - dropping all rounds after tactical timeouts-. In both cases, I also drop the rounds after a *non-defined timeout*[11]. That is, rounds with a larger than usual pause between the round before and the current one, but I could not determine whether a tactical or technical timeout was called. Out of the ten rounds in which this happened[12], three were rounds where it is usual to have some rest time. For example, teams are given a break in many tournaments after playing 15 rounds. Another example is when the match goes to overtime (after having tied 15-15), teams must accept to start each overtime half, which means there is a minimal delay between rounds. The remaining seven are rounds in which a timeout was called, but I could not determine the type. The reason is that the broadcast did not show the timeout animation in that specific case or that the casters did not mention it, which I argue is random. Considering that, my estimates are not affected by eliminating these rounds. When including rounds after a tactical timeout, the full sample, I am left with 732 rounds, 91 tactical timeouts, and 9 technical timeouts.

The summary statistics for the full sample, i.e., those including one round after a tactical timeout, are available in Table 3. The only thing worth commenting on is that the maximum timeout duration is approximately 850 seconds, which amounts to a little over 14 minutes. This is an outlier, and I will run leave-one-out placebo tests to verify my results are not driven by that observation[13].

[11]I do not keep the round directly after a non-defined timeout.

[12]After having eliminated rounds after a tactical timeout.

[13]Nevertheless, the outcome variable in that round took a value of zero, meaning that the previous round's winner also won that round. Therefore, if anything, my estimates would be lowered by including that observation.

Table 3: Summary statistics

Variable name	Mean	SD	Minimum	Maximum
Technical timeout	0.012	0.110	0.000	1.000
Duration (s) of technical timeout	2.272	34.419	0.000	850.555
Wins in a row	2.314	1.491	1.000	11.000
Winner timeout	0.025	0.155	0.000	1.000
Loser timeout	0.100	0.300	0.000	1.000
Score differential (winner - loser)	1.439	2.237	-5.000	10.000
Winner's equipment value	12,876.503	8,985.599	0.000	34,000.000
Loser's equipment value	4,819.126	6,819.111	0.000	28,600.000
Winner's cash	28,719.331	11,710.240	6,450.000	73,400.000
Loser's cash	21,063.934	6,009.702	7,600.000	51,950.000

3 Estimation methodology and results

I develop two econometric specifications to measure timeouts' extensive and intensive effects. The extensive specification is as follows:

$$Y_{ir} = \alpha + \beta \, Technical\ Timeout_{ir} + \delta_i + \delta_r + \gamma X_{ir} + \epsilon_{ir} \tag{1}$$

where Y_{ir} takes the value 1 if the previous round's loser wins round r in match i; $Technical\ Timeout_{ir}$ takes the value 1 if a technical timeout was called on round t of the match i; δ_i and δ_r are match and round fixed effects, respectively; and X_{ir} are a series of controls for round win probability. Since timeouts happen in-between rounds, all controls have to be measured in the round before. This avoids using bad controls, i.e., controlling for variables that are themselves outcome variables. In particular, I control for the equipment value and money available, both measured in the previous round. I also include whether the previous round's winner or loser called a tactical timeout, the accumulated round wins from the previous round's winner, and the difference in score between the previous round's winner and loser. The match and round fixed effects control for unobserved time-invariant match characteristics and round shocks common to all matches. For example, it is common to avoid buying in the second round if you lost the first round to buy better equipment and weapons in the third round. Then, the probability of reversing the previous round's winner might differ in the second and third rounds. To account for correlation between the outcomes of the rounds in one match, I cluster the standard errors in every regression at the match level.

The intensive specification is as follows:

$$Y_{ir} = \alpha + \beta \, Technical\ Timeout\ Time_{ir} + \delta_i + \delta_r + \gamma X_{ir} + \epsilon_{ir} \tag{2}$$

where $Technical\ Timeout\ Time_{ir}$ is the time, in seconds, of the technical timeout. This measure is subject to error since, in specific cases, the actual recording of data is stopped, which means that I will see a smaller amount of time between rounds than it was. Since I had to manually check every timeout, I can measure the time between rounds when watching the games' broadcasts. I then created another variable with the "correct" values. In Appendix B, I estimate the main regression using the time recorded by the demo file, and the results are robust.

The results from estimating equations 1 and 2 are shown in Table 4. The first two columns include one round after tactical timeouts, and the last two columns restrict the sample to only rounds before a tactical timeout. Given the discussion on momentum, one would expect the effect of a timeout, no matter which type or who called it, to be positive since it would stop the previous round's winner momentum; this is not exactly what I find. The coefficients for the tactical timeout called by the previous round's winner are negative, implying that calling a timeout after winning a round increases your probability of winning the next one. In contrast, the coefficients for the the previous round's loser are positive, meaning that calling a timeout after losing increases your chances of winning the next round, which is what we would expect. Thus, from these estimates, calling a timeout is good for either team, whether they lost or won the previous round. This is inconsistent with the theory that timeouts stop the momentum, so one could be tempted to say that they do not actually break it. However, these coefficients are subject to the endogeneity discussed previously.

In the case of technical timeouts I find a positive, although not statistically significant effect, of a technical timeout on the probability of reversing the previous round's winner. A timeout increases the probability of reversing the previous round's winner by 8.49 percentage points. Given this, it would mean that calling a timeout after winning a round is not a good idea, even though the coefficient for tactical timeouts called by the winner implied they had significantly more chances of winning the next round. When estimating equation 2, I find a statistically significant, albeit small, effect of the duration of a technical timeout. A timeout lasting 30 seconds - the regular tactical timeout duration- increases the probability of reversing the previous round's winner by 0.67 percentage points.

As an additional result, I also ran similar regressions in the few cases in which I could identify the team that asked for the timeout. The results are shown in Table 5. Take into account that there is only one technical timeout called by the previous round's winner and three by the previous round's loser. These results indicate that using the tactical timeouts leads to biased estimations of the timeouts' effect since both the winner and loser technical timeouts increase the probability of reversing the previous round's winner; in contrast, the coefficient for tactical timeouts by the winner is negative. It is also worth noting that the coefficients for the previous round's winner are significantly larger than the loser's. However, this could be due to a lack of sufficient observations.

Table 4: Main specification

Dependent variable: Reversing of the previous round's winner				
	(1)	(2)	(3)	(4)
VARIABLES	Extensive	Intensive	Extensive	Intensive
Technical timeout	0.0849		0.1011	
	(0.0599)		(0.0626)	
	[0.1595]		[0.1097]	
Duration (s) of technical timeout		0.0002*		0.0002*
		(0.0001)		(0.0001)
		[0.0691]		[0.0933]
Winner timeout	-0.1136*	-0.1142*		
	(0.0606)	(0.0606)		
	[0.0637]	[0.0622]		
Loser timeout	0.0486	0.0478		
	(0.0311)	(0.0313)		
	[0.1207]	[0.1293]		
Controls	Yes	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes
Round after tactical timeout included	Yes	Yes	No	No
Observations	732	732	643	643
Number of matches	103	103	102	102

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 5: Differentiating by previous round winner and loser when possible

Dependent variable: Reversing of the previous round's winner				
	(1)	(2)	(3)	(4)
VARIABLES	Extensive	Intensive	Extensive	Intensive
Winner technical timeout	0.2298***		0.2366***	
	(0.0387)		(0.0402)	
	[0.0000]		[0.0000]	
Loser technical timeout	0.1283***		0.1217**	
	(0.0472)		(0.0565)	
	[0.0077]		[0.0338]	
Duration (s) of winner technical timeout		0.0017***		0.0017***
		(0.0003)		(0.0003)
		[0.0000]		[0.0000]
Duration (s) of loser technical timeout		0.0001**		0.0001*
		(0.0001)		(0.0001)
		[0.0263]		[0.0806]
Winner timeout	-0.1147*	-0.1149*		
	(0.0605)	(0.0605)		
	[0.0609]	[0.0604]		
Loser timeout	0.0478	0.0476		
	(0.0309)	(0.0309)		
	[0.1251]	[0.1268]		
Controls	Yes	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes
Round after tactical timeout included	Yes	Yes	No	No
Observations	727	727	638	638
Number of matches	102	102	101	101

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Although the effect of a timeout is not statistically significant in Table 4, the coefficient may be biased towards zero. This is because some technical timeouts might be very short. Consequently, even though the round still appears to have received a technical timeout in the database, the effect might be diminished because the break was not long enough to stop the momentum. If this were the case, one would expect the effect to become larger and significant when redefining the variable to take the value one when the timeout was of a particular length. In Table 6, I show the previous estimates (see Table 4) alongside the estimates when defining a technical timeout as taking the value one if the break was longer than 30 seconds - the usual duration of a tactical timeout-. Now, the effect of a technical timeout becomes larger and significant at the 1% level. A round receiving a technical timeout lasting at least 30 seconds increases the probability of reversing the previous round's results by 14.76 percentage points. In Appendix B, I use the recorded timeout duration to define a tactical timeout, and the results are robust (see Table 16). There is a striking difference between the effect of a timeout lasting at least 30 seconds (Table 6) and the effect of 30 seconds of timeout duration (Table 4). This might be due to non-linearities in the relationship between the timeout's duration and the dependent variable.

Table 6: Redefining timeout based on duration

Dependent variable: Reversing of the previous round's winner				
	(1)	(2)	(3)	(4)
VARIABLES	Timeout = 1 if time > 0	time > 30	time > 0	time > 30
Technical timeout	0.0849	0.1476***	0.1011	0.1672***
	(0.0599)	(0.0461)	(0.0626)	(0.0487)
	[0.1595]	[0.0018]	[0.1097]	[0.0009]
Winner timeout	-0.1136*	-0.1144*		
	(0.0606)	(0.0605)		
	[0.0637]	[0.0615]		
Loser timeout	0.0486	0.0487		
	(0.0311)	(0.0310)		
	[0.1207]	[0.1195]		
Controls	Yes	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes
Round after tactical timeout included	Yes	Yes	No	No
Observations	732	729	643	640
Number of matches	103	102	102	101

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

As an additional result, I interact the technical timeout and wins in a row variables when the timeout lasts at least 30 seconds. The results are shown in Table 7. As I previously explained, there are not enough observations to interpret these results freely. For example, there is only one technical timeout in which the previous round's winner had won three rounds in a row. One would expect that the larger the accumulated wins, the larger the effect of the timeout on the probability of reversing the previous round's winner. This is different from what I find, though, once again, it may be due to a lack of sufficient observations.

Table 7: Interaction with accumulated wins

Dependent variable: Reversing of the previous round's winner		
	(1)	(2)
VARIABLES	time > 30	time > 30
Technical timeout * 1 Win in a row	0.1261	0.2014**
	(0.0945)	(0.0860)
	[0.1847]	[0.0211]
Technical timeout * 3 Wins in a row	0.2046***	0.1907***
	(0.0377)	(0.0388)
	[0.0000]	[0.0000]
Technical timeout * 4 Wins in a row	0.1262***	0.1217**
	(0.0473)	(0.0566)
	[0.0089]	[0.0340]
Controls	Yes	Yes
Match fixed effects	Yes	Yes
Round fixed effects	Yes	Yes
Round after tactical timeout included	Yes	No
Observations	729	640
Number of matches	102	101

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

3.1 Non-linearities

To explore non-linearities between the timeout's duration and the dependent variable, I estimate two additional models in the sample that includes a round after a tactical timeout and only using timeouts that last at least 30 seconds. My expectation is that timeouts increase the probability of reversing the last round winner and do so increasingly on the timeout duration. But, at a certain point, the timeout is so long that it's effect starts diminishing, until it reaches zero. I could model this by interacting the timeout duration with a dummy variable that takes the value one if the timeout is of a certain duration. Nevertheless, to avoid further reducing the amount of timeouts on each coefficient, I ran two different degree polynomials. The first one includes a second-degree polynomial for the timeout's duration, and the second one includes a third-degree polynomial.

The results are available in Table 8. The coefficients for both the duration and the squared duration are statistically significant in the squared model. The squared and the cubed duration coefficients are not statistically significant in the second model, implying the model is not a good fit. When using the second-degree polynomial, a timeout that lasts 30 seconds (when there was no timeout before) would increase the probability of reversing the previous round's winner by 3.88 percentage points if the slope remained the same. However, for every extra second, the slope is reduced by 0.0009 percentage points approximately. Now, even when taking into account the reduced slope for every extra second, this amounts to a quarter of the effect of a timeout lasting at least 30 seconds (see Table 6 column 4). Since there is one observation in which the tactical timeout lasted over 14 minutes, more than three times the duration of any other timeout, the results might be biased. Therefore, I also ran the same two models but omitted that round; the results are available in columns three and four. Now, the coefficients for the cubed model are not significant, but both the coefficients for the squared model are. A timeout lasting 30 seconds increases the probability of reversing the previous round's winner by approximately 5.8 percentage points, which is about four-tenths of the effect found for the timeout itself. Notice that the coefficient for the squared duration is minimal, implying that the timeout's duration is counterproductive only after a long time has passed. Therefore, the remaining difference can be explained by the fact that the dummy variable includes the effect of timeouts longer than 30 seconds.

Table 8: Non-linear models

Dependent variable: Reversing of the previous round's winner				
	(1)	(2)	(3)	(4)
VARIABLES				
Duration (s) of technical timeout	0.0013***	0.0021**	0.0019***	0.0001
	(0.0003)	(0.0008)	(0.0007)	(0.0048)
	[0.0000]	[0.0165]	[0.0053]	[0.9833]
Duration (s) of technical timeout ^{2}	-0.0000***	-0.0000	-0.0000*	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0001)
	[0.0000]	[0.1702]	[0.0920]	[0.7376]
Duration (s) of technical timeout ^{3}		0.0000		-0.0000
		(0.0000)		(0.0000)
		[0.2812]		[0.6728]
Controls	Yes	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes
Round after tactical timeout included	Yes	Yes	Yes	Yes
Includes duration outlier	Yes	Yes	No	No
Observations	729	729	728	728
Number of matches	102	102	102	102

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

3.2 Robustness check

I perform a series of placebos to verify my results further. In Table 9, I lead the technical timeout duration variable by one (columns 1 and 2), two (columns 3 and 4), and three rounds[14] (columns 5 and 6). That is, I estimate equations 1 and 2 having modified the treatment variable to be one to three rounds prior to its actual value. I dropped some observations because some technical

[14] I stop at three rounds lead because, when I establish a four round lead, I am left with just two technical timeouts.

timeouts happened in the first four rounds. By dropping the second, third and fourth rounds as I increase the lag -since I already dropped the first rounds before- I prevent the placebo rounds from being put into another game. Two of the three coefficients are statistically significant in the full sample, although one has a negative sign. This means there should be caution interpreting the effect found for the duration of the technical timeout since redefining the time in which the timeout took place leads to similar results. I also performed the placebo tests on the restricted sample, the preferred specification. The results are shown in Table 10, and they are basically identical to the previous case.

Following a similar procedure, to check the robustness of the effect of a technical timeout when the duration was longer than 30 seconds (see Table 6), I performed placebos on both samples; the results are available in Tables 11 and 12. The estimated coefficients are much smaller, except for the one-round lead, and none are statistically significant. The one-round lead coefficients are of similar magnitude and close to being statistically significant. Although this is somewhat worrisome, the previous coefficient was statistically significant at the 1% level. Given these results for the placebos, it is unlikely that the effect found was due to chance.

Table 9: Placebos

Dependent variable: Reversing of the previous round's winner			
	(1)	(2)	(3)
VARIABLES	Intensive	Intensive	Intensive
1 round lead technical timeout time	0.0002**		
	(0.0001)		
	[0.0283]		
2 round lead technical timeout time		-0.0002**	
		(0.0001)	
		[0.0469]	
3 round lead technical timeout time			-0.0002
			(0.0001)
			[0.1371]
Winner timeout	-0.1147*	-0.1146*	-0.1143*
	(0.0606)	(0.0606)	(0.0607)
	[0.0614]	[0.0615]	[0.0627]
Loser timeout	0.0469	0.0470	0.0467
	(0.0316)	(0.0316)	(0.0316)
	[0.1400]	[0.1399]	[0.1429]
Controls	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes
Round after tactical timeout included	Yes	Yes	Yes
Observations	729	727	725
Number of matches	101	101	101

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 10: Placebos with restricted sample

Dependent variable: Reversing of the previous round's winner			
	(1)	(2)	(3)
VARIABLES	Intensive	Intensive	Intensive
1 round lead technical timeout time	0.0002**		
	(0.0001)		
	[0.0367]		
2 round lead technical timeout time		-0.0002*	
		(0.0001)	
		[0.0522]	
3 round lead technical timeout time			-0.0002
			(0.0001)
			[0.1387]
Controls	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes
Round after tactical timeout included	No	No	No
Observations	640	638	636
Number of matches	100	100	100

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 11: Placebos when technical timeout = 1 if duration > 30

	Dependent variable: Reversing of the previous round's winner		
	(1)	(2)	(3)
VARIABLES	Extensive (time > 30)	Extensive (time > 30)	Extensive (time > 30)
1 round lead technical timeout	0.1728		
	(0.1113)		
	[0.1238]		
2 round lead technical timeout		-0.0947	
		(0.0930)	
		[0.3110]	
3 round lead technical timeout			0.0583
			(0.1125)
			[0.6054]
Winner timeout	-0.1162*	-0.1161*	-0.1154*
	(0.0606)	(0.0606)	(0.0606)
	[0.0579]	[0.0583]	[0.0596]
Loser timeout	0.0472	0.0462	0.0460
	(0.0312)	(0.0316)	(0.0316)
	[0.1329]	[0.1474]	[0.1487]
Controls	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes
Round after tactical timeout included	Yes	Yes	Yes
Observations	727	726	724
Number of matches	101	101	101

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 12: Placebos when technical timeout = 1 if duration > 30 with restricted sample

	Dependent variable: Reversing of the previous round's winner		
	(1)	(2)	(3)
VARIABLES	Extensive (time > 30)	Extensive (time > 30)	Extensive (time > 30)
1 round lead technical timeout	0.1588		
	(0.1048)		
	[0.1328]		
2 round lead technical timeout		-0.1008	
		(0.0868)	
		[0.2485]	
3 round lead technical timeout			0.0499
			(0.1072)
			[0.6425]
Controls	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes
Round after tactical timeout included	No	No	No
Observations	638	637	635
Number of matches	100	100	100

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

I also perform leave-one-out placebo tests. That is, out of the six timeouts recorded when using the restricted sample and defining a technical timeout as one having lasted at least 30 seconds, I drop one of them and estimate equations 1 and 2. Doing this ensures that the results I found previously are not driven by one observation. The results are available in Tables 13 and 14. In both tables, the relevant coefficients are still statistically significant and close to the magnitudes found previously. Note that in column three of Table 13, the coefficient of the timeout duration increases almost fivefold. This is due to one of the timeouts lasting over fourteen minutes (more than three times any other duration) and the outcome of the previous round not changing. In Appendix B, I also perform leave-one-out placebos for the nine timeouts available in the restricted sample before eliminating those lasting less than 30 seconds (see Table 17); the results hold. Note also that in column 4 of both tables, I am left with one match less, meaning that one of the timeouts happened at the first recorded round after cleaning the database. That is, there were no control rounds in that match. This could potentially lead to some issues, but in doing these leave-one-out placebos, we can see that the estimates were not affected by using that observation.

Table 13: Leave-one-out for technical timeout duration

	Dependent variable: Reversing of the previous round's winner					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES						
Duration (s) of technical timeout	0.0002*	0.0002*	0.0009***	0.0002*	0.0002*	0.0002*
	(0.0001)	(0.0001)	(0.0003)	(0.0001)	(0.0001)	(0.0001)
	[0.0912]	[0.0843]	[0.0011]	[0.0951]	[0.0890]	[0.0895]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Round after tactical timeout included	No	No	No	No	No	No
Observations	639	639	639	639	639	639
Number of matches	101	101	101	100	101	101

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 14: Leave-one-out when technical timeout = 1 if duration > 30

	Dependent variable: Reversing of the previous round's winner					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES						
Technical timeout	0.1664***	0.1728***	0.1837***	0.1672***	0.1609***	0.1511**
	(0.0411)	(0.0534)	(0.0492)	(0.0487)	(0.0594)	(0.0586)
	[0.0001]	[0.0016]	[0.0003]	[0.0009]	[0.0080]	[0.0113]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Round after tactical timeout included	No	No	No	No	No	No
Observations	636	636	636	637	637	637
Number of matches	101	101	101	100	101	101

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

4 Conclusion

In this study, I estimate the first causal effect of timeouts on team performance. To do so, I constructed a data set containing information on 103 high-tier *Counter-Strike: Global Offensive* matches and used exogenous variation stemming from technical issues. I find that a timeout lasting at least 30 seconds increases the probability of reversing the previous round's winner by 14.76 percentage points. This result is robust to time placebos - changing the round in which the timeout happened- and leave-one-out placebo tests.

Although I interpret the results as timeouts breaking a team's momentum, it is worth noting that due to data limitations, I can only measure the effect of reversing the previous round's winner. However, psychological momentum could be built very quickly. As stated by Tom Thibodeau, the New York Nicks' head coach, "A bad minute could be 12 points"; since rounds in *Counter-Strike: Global Offensive* can last up to two and a half minutes, a team may be building momentum within the round. Ideally, I would also determine which team had the technical issues to ensure my estimates are not biased due to frustration or cheating. Nevertheless, a mean comparison test provides evidence that this is not the case.

This study contributes to the literature by validating the very much present idea that timeouts impact team performance. At the same time, it illustrates that coaches should use timeouts as a tool to stop the other team's momentum when on a bad run. Finally, allowing teams to call for more timeouts could make a sport more competitive by making it less costly to stop the other team's momentum. However, it is unclear if there would be any adverse effects of allowing more timeouts. For example, the audience or fans might share the psychological momentum, and breaking that momentum could make the game less entertaining. This area requires further research.

Appendix A

I will describe the procedure for making the interest variables in this appendix. The replications files are available in my Github repository.

As stated above, Xenopoulos's library only allowed me to determine whether a timeout was called on any given round, not which type of timeout or which team called it. I manually searched for youtube videos or VODs (Video On Demand) of the relevant matches and went to the round in which a timeout was called. In most cases, I could determine whether a tactical timeout was called and who called it based on animations made by the broadcasters. An example is shown below in Figure 1.

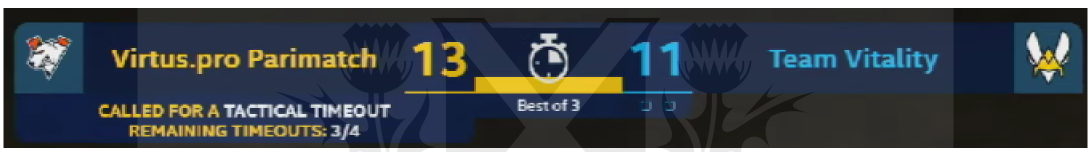

Figure 1: Typical broadcaster's animation on tactical timeouts

Sometimes, however, this was impossible because the broadcasters used the timeout to show, for example, previous round replays or player cameras instead of displaying the animations. Even without the animations, casters sometimes mentioned that the "X" team called for a tactical timeout. Moreover, other times, I used the information given by other timeouts to determine the type of timeout and the team who asked for it. For example, as shown in Figure 1, we can determine that the team "Virtus.pro Parimatch" has three remaining timeouts. If I could not get information on the next timeout, but on the one after that, I see "Virtus.pro Parimatch" only has one timeout left, then I can determine that the previous one was, in fact, a tactical timeout and that "Virtus.pro" called for it.

Although the process was similar in the case of technical timeouts, as mentioned in the study, information on who called the timeout was harder to obtain. As with tactical timeouts, there were animations referring to them in particular (see Figure 2). However, they did not specify the team that called for the timeout. The times I could determine which team called the timeout, it was because broadcasters mentioned it, specific players were disconnected, or were the only ones who stopped moving when the timeout was called[15]. I determined the team that called a technical timeout on just thirteen out of twenty-six rounds where there was a technical timeout.

[15] Timeouts are called by writing in chat, which cannot be done while moving.

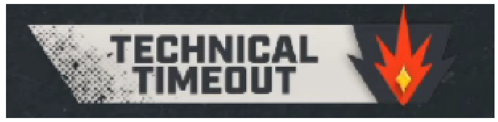

Figure 2: Example broadcaster's animation on technical timeouts

Having done that, I created a new variable called *nonDefinedTimeout* which takes the value one if the time between the end of one round and the start of the next one was higher than the usual value, but I could not identify if there was a tactical or technical timeout recorded. Most of these happened on rounds where there are usually breaks in play, like at the 15-round mark. The remaining ones are, most likely, tactical timeouts. This is because when there is a technical timeout, the casters usually mention what is happening to assure viewers that the game will continue shortly. Here, casters did not mention a problem and continued talking about the game or a replay of a particular round.

Appendix B

Table 15: Replicate of Table 4 using technical timeout's duration recorded in demo file

Dependent variable: Reversing of the previous round's winner		
	(1)	(2)
VARIABLES	Intensive	Intensive
Duration (s) of technical timeout	0.0002*	0.0002*
	(0.0001)	(0.0001)
	[0.0634]	[0.0906]
Winner timeout	-0.1143*	
	(0.0606)	
	[0.0621]	
Loser timeout	0.0478	
	(0.0313)	
	[0.1298]	
Controls	Yes	Yes
Match fixed effects	Yes	Yes
Round fixed effects	Yes	Yes
Round after tactical timeout included	Yes	No
Observations	732	643
Number of matches	103	102

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 16: Replicate of Table 6 using technical timeout's duration recorded in demofile

Dependent variable: Reversing of the previous round's winner				
	(1)	(2)	(3)	(4)
VARIABLES	Timeout = 1 if time > 0	time > 30	time > 0	time > 30
Technical timeout	0.0849	0.1293**	0.1011	0.1510**
	(0.0599)	(0.0540)	(0.0626)	(0.0587)
	[0.1595]	[0.0184]	[0.1097]	[0.0115]
Winner timeout	-0.1136*	-0.1138*		
	(0.0606)	(0.0606)		
	[0.0637]	[0.0630]		
Loser timeout	0.0486	0.0490		
	(0.0311)	(0.0310)		
	[0.1207]	[0.1169]		
Controls	Yes	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes
Round after tactical timeout included	Yes	Yes	No	No
Observations	732	732	643	643
Number of matches	103	103	102	102

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 17: Replicate of Table 13 using all timeouts in restricted sample

	Dependent variable: Reversing of the previous round's winner								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES									
Duration (s) of technical timeout	0.0002*	0.0002*	0.0002*	0.0002*	0.0002*	0.0002*	0.0002*	0.0009***	0.0002*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0001)
	[0.0895]	[0.0933]	[0.0933]	[0.0881]	[0.0929]	[0.0824]	[0.0886]	[0.0010]	[0.0954]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Match fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Round after tactical timeout included	No	No	No	No	No	No	No	No	No
Observations	642	642	642	642	642	642	642	642	642
Number of matches	102	101	101	102	102	102	102	102	102

Standard errors clustered at the match level are shown in parentheses. P-values are shown in brackets. Controls include Wins in a row, Score differential, and the winner and loser's Equipment value and Cash. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Data Description for Selected Variables

Variable	Description
Technical timeout	Dummy taking a value one if there was a technical timeout at the beginning of the round
Duration of technical timeout (seconds)	Duration of the technical timeout in seconds
Wins in a row	Amount of wins a row accumulated by the previous round's winner
Winner timeout	Dummy taking the value one if the previous round's winner called a tactical timeout at the beginning of the round
Loser timeout	Dummy taking the value one if the previous round's loser called a tactical timeout at the beginning of the round
Score differential (winner - loser)	Score differential between the previous round's winner and the previous round's loser
Winner's equipment value	Sum of weapons, grenades, defusers, kevlar and helmet value (in-game cost) for every player in the previous round's winner team
Loser's equipment value	Sum of weapons, grenades, defusers, kevlar and helmet value (in-game cost) for every player in the previous round's loser team
Winner's cash	Sum of cash for every player in the previous round's winner team
Loser's cash	Sum of cash for every player in the previous round's loser team

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