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J.D. Tena
Jorge Tovar

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Emotions and Performance: A Quasi Natural Experiment from the FIFA World Cup

J.D. Tena[1]

University of Liverpool, United Kingdom and University of Sassari, Italy

Jorge Tovar[2]

University of Los Andes, Bogota-Colombia

Abstract

Emotions are intrinsic components of human behavior that have the capacity to affect how individuals perform in their daily activities. Much of the literature has explored the topic using experimental data or, when using sporting events, focusing on pre-competition triggers. This paper uses, granular, event-level data from the 2018 FIFA football World Cup to study for the first time how observed and naturally induced emotions impact performance as measured by each player's passing ability. The quasi-natural experimental setup is rich enough to study the influence of positive and negative emotions and their duration. The paper finds that negative emotions harm performance between 3 to 9 minutes after the trigger. At the same time, there is weak evidence that positive emotions also constrain performance, but only between 6 to 8 minutes after the trigger event.

Keywords: sports economics, workers performance, emotions.

Jel classification: D91, Z29, C21.

[1] Corresponding author: J.D. Tena, University of Liverpool Management School (UK), Chatham Street, L69 7ZH, email: jtena@liverpool.ac.uk.

[2] Jorge Tovar, Universidad de los Andes, Facultad de Economía (Bogotá – Colombia), Calle 19a, No. 1-37 Este, Oficina W825, email: jtovar@uniandes.edu.co. Website: https://economia.uniandes.edu.co/tovar

1. Introduction

Emotions are part of the human psyche since the dawn of time. There is no unique definition of emotions, which, in general, are understood as "a reaction to a stimulus event" (McCarthy, 2011), whereby it can be distinguished by its defining characteristics, antecedents, and, importantly, its consequences (Hanin, 2007). Given an event, the beliefs about it can trigger emotions, generating behavior, and impacting the choices made under different states of emotions (Elster, 1998).

Emotions are an important part of sport psychology, either by intervening to influence them (Singer and Anshel, 2006) or studying how and why they impact performance (Hanin, 2007). In contrast, for a long time, economists, mostly with the development of neoclassical economics, neglected the importance of emotions despite having been part of the construct of utility theory since its inception (Loewenstein, 2000). That changed at least since the 1980s (Loewenstein, 2000).

Although laboratory experiments have been the norm to understand the relationship between psychology and economics, there is plenty of applied research on the topic, which shows that mood swings can substantially impact emotions (DellaVigna, 2009). The focus of much of that research is on discrete choice decisions given a one-time mood changer. DellaVigna's (2009) reviews several studies where the weather can influence behavior, such as increasing tips at restaurants or merely expressing higher happiness levels. Sports are a natural field to study how emotions impact apparently exogenous activities. Edmans et al. (2007), for instance, work on the relationship between international football

matches and stock returns. We add to this literature by using real-world data to study how repeated and variable stimuli impact individuals' performance during a standard period of time.

In particular, this paper uses a major sporting competition, the FIFA Football World Cup, to empirically quantify how emotions impact individuals' performance as measured by their passing ability. As a low scoring game, football is an ideal laboratory because emotions produced by goals typically linger for several minutes before they fade out or get replaced by new emotions. The insight is to measure how goals scored or conceded, i.e., positive or negative emotions, impact the probability of successfully passing the ball while controlling for relevant individual and game characteristics.

The use of football data is ideal to understand how negative or positive emotions impact performance because it is based on a standard setup accepted by all participants. This is important because emotions can be culturally-specific and may be interpreted differently across time and region (Elster, 1998), implying that individuals might react differently to the same stimulus in different settings. In football, particularly in the World Cup, it is apparent for all participants (including fans and media) that goals in favor relate to joy or happiness, while a goal against relates to sadness or worrisome.[3]

Regarding the direction of the stimulus, experimental settings have evaluated the impact of different emotional states on behavior. For instance, Conte et al. (2018) use four affective states (joviality, sadness, fear, and anger) induced by short clips to study risk preferences. Only one of the four emotional states are

[3] In motivating the paper, we do not focus in the degree of the shock (the valence), although in the empirical setting we do control for all relevant factors that might affect performance given the state of the game (score, minute of the game among others).

induced per participant in the experiment. In our paper, we use a real-world setting to explore how *continuous* negative and positive stimulus impacts an individual's performance while doing a relatively simple task, i.e., passing the ball, the most standard ability a professional football player has.

The simplicity of the task is relevant. As individuals, footballers, for instance, become more skilled in a task, their energy demand diminishes (Kahneman, 2011), and the action is no longer an effort but a natural, effortless action.[4] However, even in such simple tasks, pressure can build up and emotionally impact a player's performance, potentially hurting its expected outcome (Beilock and Gray, 2007, Ötting et al., 2020). In professional football, the most natural task is to pass the ball. It requires no additional or specific effort, making them the ideal indicator to understand how emotions can impact performance.

Goals scored and conceded, universally accepted as a good and a bad event, respectively, independent of any cultural differences that might bias interpretation, trigger emotions. We exploit the simplicity of a pass with the collectively accepted reactions to goals to study how potentially numerous and varying emotions affect an individual's performance.

Negative emotions (a type of visceral factor following Loewenstein, 2000) can lead people to behave in ways contrary to their self-interest. They might imply no "higher-level cognitive mediation," and they can affect behavior (Loewenstein, 2000 pp. 428). On the contrary, positive emotions tend to be linked to better task

[4] It is similar to Apesteguia and Palacios-Huerta (2010) who use a simple task in football, penalty kicks in shootouts, to explore how psychological effects can affect performance. We use passes, an even simpler, a much more common task.

performance and more favorable job attitudes, but relevant to our findings, there is also evidence of unfavorable outcomes (Hu and Kaplan, 2015).

As Hu and Kaplan (2017) note, there are few, if any, studies examining multiple states. We add to the literature by analyzing how positive and negative emotions impact performance in a unique and almost ideal scenario. Moreover, following McCarthy (2011), who states that emotions are a dynamic process, that evolves over time, our setup allows us to determine the duration of such emotions, whether positive or negative. In this sense, we go beyond experiments and use real-life data to quantify the effect that emotions can have on individuals over a period of time.

We use event-level data from Russia's 2018 FIFA Football World Cup, where 32 national teams composed of the world's best players competed towards the World Championship. We exploit the fact that goals trigger emotions in both the team that scores and concedes. And although there are potentially many types of emotions (Elster, 1998), our analysis is centered on positive and negative ones and how they can affect the player's outcome, i.e., the probability of completing a pass.

Our main finding is that emotions impacted the probability of successfully passing the ball during the 2018 World Cup. After a goal is conceded, triggering negative emotions, the successful passing rate falls in a statistically significant manner in the following 3 to 7 minutes. There are some weaker effects detected that suggest the impact can last up to 9 minutes. The result is stronger in the short run. We find that the odds of passing successfully four minutes after conceding a goal are just 47% relative to a situation with no positive or negative emotions. The results are asymmetric in the sense that positive emotions seem to trigger a

somewhat negative but weaker impact on the probability of passing the ball successfully. In a broad sense, positive emotions impact performance negatively, starting 4 minutes after scoring a goal until 9 minutes later. However, statistically robust results are only obtained between minutes 6 and 8. The odds of completing a pass are 60% relative to a situation with no negative or positive emotions involved.

2. Related literature

The role of emotions in decision making has been largely recognized in disciplines as diverse as economics, psychology, and neuroscience. Gilovich and Griffin (2010) and Lerner et al. (2015) display the evolution across time of Google Scholar searches for the exact terms "[emotion(s)/affect/mood] and decision making." They find an explosion of this interest from 2001 onwards in terms of actual number and proportion of scholarly publications.

This is especially relevant in economic research as emotions can affect economic decisions and behavior by making individual preferences time-inconsistent; see Thaler (1981), Elster (1998), and Loewenstein (2000) for some relevant references. In particular, Loewenstein (2000) explains three significant impacts of emotions on economic behavior. Firstly, people impacted by strong emotions can be affected in their rationality and even act contrary to their interests, trying to cause pain to the bargaining partner. Secondly, visceral factors make people more impatient, reducing the weight given to future utility. The third economic effect of emotion refers to the bias it creates on the cognitive evaluation

of risks. Overall, all these effects seem to indicate that visceral factors can have long-lasting economic consequences.

There is a growing empirical literature in economics devoted to exploring the impact of current feelings on individual economic decisions based on laboratory experiments; see Capra (2004), Drouvelis and Grosskopf (2016), and Oswald et al. (2015), among others. One can distinguish between the impact of mood, low-intensity, and relatively lasting feelings, in contrast to emotions, which are more intensive and short-lived; Capra (2004). Many experiments in psychology provide evidence that positive as well as negative moods and emotions can affect how people think and how successful individuals are at solving cognitive tasks; see Schwarz and Skurnik (2001) for a discussion on this issue. Other experiments find evidence that cognition ability is reduced by emotions produced by terrorist attacks (Blanchette et al., 2007) and spider phobia and exam anxiety (Jung et al., 2014).

The economic literature has shown a particular interest in the impact of feelings on teamwork interactions. Capra's (2004) and Oswald et al. (2015) experiments, for instance, show that happiness makes individuals more cooperative and productive, respectively, while Drouvelis and Grosskopf (2016) find that anger is detrimental to economic behavior. In an extensive discussion of the literature Lane (2017) highlights that, in general, there is a positive correlation between happiness and cooperative behavior and that experiments are a powerful device to investigate the topic. Moreover, others, such as (Schwarz, 2013), present evidence suggesting that positive mood shocks can make subjects more assertive and self-oriented, thus deterring cooperation.

The impact of feelings and emotions on decisions on social and economic behavior has also been tested by analyzing price reactions to news (Rouwenhorst, 1998, Cutler, D., Poterba, et al., 1991, and Jegadeesh and Titman, 1993), stock market reactions to sports results (Edmans et al. 2009) and the effect of unexpected losses of the local National Football League (NFL) team on domestic violence (Card and Dahl, 2011). Indeed, sports contests are an excellent natural laboratory to test the impact of moods and emotions on player decisions as their choices are readily observable. Unlike lab experiments where only small stakes are typically involved (Falk and Fehr, 2003 and Levitt and List, 2007), professional sports contests are part of a significant industry, which is the main activity for the players involved. Some relevant examples of this type of research are Uphill et al. (2012), Cohen-Zada et al. (2017), Krumer and Lechner (2017), and Hopfensitz and Mantilla (2019). Uphill et al. (2012) study the impact of six basketball players' post-game reported emotions on their minute-by-minute performance, finding an association between emotions and behavior. Cohen-Zada et al. (2017) study an interesting natural experiment in judo where the two contestants compete for the bronze medal after winning and losing their last fight. Their results show that the outcome is affected by psychological momentum. Krumer and Lechner (2017) examine the role of scheduling in explaining progression in different sports tournaments. Hopfensitz and Mantilla (2019) find that happy and angry expressions, respectively, correlate positively with team performance in the football World Cup. Anger associates with fewer goals conceded, while happiness to more goals scored.

We contribute to this literature by focusing on in-game emotions that are generated by the contest itself and their effects on subsequent players' actions.

Compared to other sports, football is a low score game which allows us to see the impact of emotions, represented by score changes, on players decisions for a number of minutes. Thus, like Uphill et al. (2012), we consider a granular database to explore short and in-game reactions to emotions and, like Hopfensitz and Mantilla (2019) and Krumer and Lechner (2017), we focus on team performance in a high-stake environment such as the 2018 Football World Cup. However, our most important contribution is the estimation of observed in-field and naturally induced emotions on performance. Compared to mood, emotions are intense and short-lived, making their effect more difficult to identify in empirical research.

3. Data

To explore the question at hand, we use event-level data from the 2018 FIFA World Cup held in Russia; arguably the most universal sporting event held every four years. The Russian Cup brought together the best 32 teams in the world, which were initially divided into eight groups of four teams, playing against each other. The best two of each group advanced to the round of sixteen, at which point the Cup moved to a knockout system until four teams reached the semi-final. The winners of these two games played the final, while the losers a consolation game to determine the tournament's third place. This adds to a total of 64 games.

The event-level data, provided by the football website www.golyfutbol.com, is collected by OPTA. The information available includes coordinates with every event's precise location, shot, and pass in which the ball is involved, including participating players. More specifically, during the World Cup's 64 games, there were 60,643 passes, around 1,010 per game, of which

81.2% were successful, in the sense that two players from the same team were able to connect.

To achieve the paper's objectives, we exclude certain passes because of their specific nature. In particular, we drop out kick-offs at the beginning of each period (which can be either the regular two 45 minutes halves or the two extra times which are possible in the knockout stage), corners kicks, as well as free kicks. We also drop fair play passes (balls sent intentionally off the pitch to attend an injured player) and hand passes by the goalkeeper. Once done, there are left with 58,296 passes, of which 81.5% are successful.

It is well established that the difficulty of achieving a successful pass in football depends strongly on the position of the pitch where the pass attempt occurs: "Surely, passes in the final third of the field and under defensive pressure were more difficult than passes between two central defenders with no opponent in sight" (Anderson and Sally, 2013. pp. 147). In this analysis, we consider the pitch zones where the difficulty in passing the ball is not trivial. More specifically, defining the pitch's length to be 100 units, 0 being the own team's goal and the rival's goal, we only consider passes that take place in the area equal to or beyond 65, circa the top third of the field. We focus on this section of the field where given the distance to the opposition goal, it is an area where successful passing is not trivial because the opposition team is vigorously guarding its goalkeeper. Indeed, during the World Cup, 99.1% of shots took place in this area, and all goals were scored within the zone considered. Under this scenario, our sample has 15,301 passes, of which 74.5% were successful. Note that the success rate is lower than the success rate when considering all passes in our area of interest.

To determine emotions, we use recent goals, the game's objective, and a rare event in football, which implies other shocks do not immediately offset goal emotions. Russia 2018 saw 169 goals, a relatively small number compared to other events, such as passes. The World Cup is a short tournament (lasts just over a month) where there is little room to recover from early upsets. If emotions can determine performance, goals are the mechanisms through which it travels.

Consequently, goals scored or conceded by a given player's team determine whether he is under a positive or negative emotions spell. The duration of such emotion is an empirically determined number of minutes. However, if another goal is scored or conceded or the period ends before the given number of minutes has elapsed, the current state of emotion also ends. This approach follows from the 15-minute intermission of a football game, long enough to cancel out any emotions from goals scored or conceded at the end of, for instance, the first half. Given that the World Cup has an extra time (two 15-minute periods) when a game ends in a draw during the knockout stage, we also consider the intermission time between the end of the 90-minute game and the first half of the extra time, and between the first and second halves of the extra time.

Letting the *status quo* (cold state as used in Loewenstein, 2000) be the time during which players have no positive or negative emotions stemming from goals scored or conceded, Table 1 presents the percentage of successful passes and the number of observations for each emotion spell. As the number of minutes for *emotions* gets longer, the number of observations increases, and it is only natural for the *status quo* to have fewer observations.

Table 1
Successful passes and number of observations per emotion type and minutes since a goal

		Minutes elapsed since last goal							
		3	4	5	6	7	8	9	10
Status Quo	Successful passes (%)	74.55%	74.60%	74.60%	74.60%	74.65%	74.65%	74.65%	74.67%
	Std. Err.	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%	0.37%
	Observations	15,051	14,907	14,801	14,656	14,531	14,413	14,287	14,173
Positive Emotion	Successful passes (%)	72.86%	74.55%	72.18%	70.16%	71.21%	71.26%	73.02%	72.43%
	Std. Err.	5.35%	4.17%	3.90%	3.32%	2.83%	2.45%	2.21%	2.09%
	Observations	70	110	133	191	257	341	404	457
Negative Emotion	Successful passes (%)	69.10%	68.44%	70.57%	72.28%	71.48%	72.21%	71.64%	72.05%
	Std. Err.	3.47%	2.77%	2.38%	2.11%	2.00%	1.92%	1.83%	1.74%
	Observations	178	282	367	451	512	547	610	669

Source: www.golyfutbol - OPTA. Own calculations

Table 1 suggests that the number of successful passes tends to be higher during a *status quo* emotion spell, while they tend to be lower during a negative emotion spell. The passing success is particularly low during a negative emotion spell during the first minutes of the event that triggered the emotion changes. Whether this is statistically relevant is an empirical matter which we deal with in the following section.

4. The estimation strategy

The objective is to capture the impact that the player's emotions have on his performance and determine how long the effect lasts. We estimate the probability of a successful pass using a logit model as follows:

$$Pr(P_{imtg} = 1) = F\left(E^{+/-}_{im^*g}, PP_{img}, U_{tm}, xP_{img}, CUM_{mg}, X_m, Y_m, Min_m, FE\right) \quad (1)$$

where the probability that the pass (P) attempted by player i at (the precise) moment (minute and second) m from team t in game g is successful is a function of the emotions -positive or negative- ($E^{+/-}$) that denote whether a goal was scored

or conceded in the previous m^* moments of match g.[5] The player is under positive (negative) emotions when his team has recently scored (conceded) a goal. Alternatively, he may be in a *status quo* spell. The former two are included in the econometric exercise as indicator variables relative to the *status quo*. These dummies are the variables of interest.

Other variables control for the players' confidence and previous expositions to the shock. We consider controls that stem from the analytical literature, including the pass's difficulty, the match score, the ball's position in the pitch, the timing and unobserved player and match characteristics.

At every moment in a game, the player's confidence in passing may be affected by his previous performance during the game g.[6] We capture this with variable PP_{img}, the player's i percentage of successful passes during the game g, prior to the pass attempt at m. Thus, it is a rolling figure over the game where the first observation for each player in the game is lost, which is of no significance given the richness of the data available.

A player, as part of the team, maybe used to the emotion spell he is under. It is not uncommon, for instance, that teams receive goals at a specific moment in different games, making the players to *be used* to those particular emotions. In contrast, it may be the case of a team that does not concede a goal for several games, and when they do, they would *not be used* to that negative emotion. U_{tm} refers to the number of times that in previous games in the Cup, the team has been under each emotion spell at any given minute. When a player attempts a pass at

[5] Note that the *t* subscript in *E's* case is redundant.
[6] As Hanin (2007) notes a person's performance may be determined by its experience defined as his past and present characteristics.

moment m, U_{tm} counts the number of times his team t has been under that emotion spell in any previous instant of the World Cup.

The inclusion of PP_{img} and U_{tm} guarantees that $E_{img}^{+/-}$ captures precisely emotions beyond how the player feels during the game given his performance and given the team's emotions throughout the World Cup.

A significant factor in determining a pass's success, regardless of its position, is the inherent difficulty of reaching the intended destination. To assess the difficulty of a pass, we follow the concept of expected goals, which can be defined as the estimated probability that a shot ends in a goal (Rathke, 2017). The expected pass xP_{img} is ultimately an objective measure of the difficulty embedded in each pass, independently of a player's ability. The estimation uses all passing attempts during the Russia World Cup, which implies that its potential difficulty is based on the entire set of passes for any given pass made during the World Cup (whether the first or last pass of the tournament).

Given that the choice of variables to estimate the expected pass indicator is *ad hoc*, we perform a forward selection method as done, for instance, in Tovar (2014). The estimation considers all types of passes considered by OPTA (head, chip, long ball, others), the pitch coordinates, distance, and angle. Table A.1 in the appendix presents the logit estimates. We take to equation (1) above the predicted probabilities.

A major factor that can impact the emotions of a player is the ongoing score of the game. CUM_{mg} captures this effect by subtracting the cumulative goals conceded during g game at the time of each pass m to the cumulative goals scored during that same game g at moment m.

Avoiding unnecessary subscripts, X_m and Y_m represent the precise coordinates where each pass took place. Y_m is normalized relative to the center of the pitch because what matters is how open the horizontal pass is relative to the middle of the field. The assurance of a player's passing abilities may vary during a match. Min_m is the precise time, minute/second, in which each pass took place.

To capture players' and teams' inherent abilities and the different World Cup stages, FE includes players, teams (own and opponent), and matchday fixed effects. Player and even team effects capture the concept that talented individuals tend to require less effort to solve problems than less capable counterparts (Kahneman, 2011). It can be argued that the player's abilities would require a specific control (beyond PP_{img}), but note that the fixed effect controls for such abilities under the assumption that for one month of 2018, the player's intrinsic skills remain constant.

A priori, we expect goals conceded, which triggers negative emotions (E^-)To impact negatively on performance. Goals scored activates positive emotions (E^+), and can impact likewise (McCarthy, 2011, Hu and Kaplan, 2015), but they may also impact negatively (Hu and Kaplan, 2015).

The expected sign of the controls is, in some cases, an empirical matter. PP_{img}, for instance, the percentage success for previous passes might positively impact the probability of successfully passing the ball if one believes that the player's current confidence depends on his past moves. On the contrary, a negative sign might imply a reversion to the mean, in the sense that the higher the passing success, the higher the probability that the next pass will fail.

Regarding the number of times that the player has been under the specific emotion when passing in previous games, U_{tm}, the effect can be positive if "experience" plays a role or negative if such state represents a concern.

The passing difficulty, *xP*, must relate positively to the probability of successfully passing the ball. If the pass is easy, the chances are that the ball will reach a teammate.

When the team is winning, CUM, the player might face stronger challenges from the opponent, thus reducing its probability of successfully passing the ball. However, it might be that the players are more confident; hence the likelihood of success increases. As with other control variables, it is an empirical matter.

Table 2 reports the summary statistics for successful passes and the control variables. The number of observations for successful previous passes is somewhat smaller because there is no observation for the first pass of each player in each game.

Age for each player during the World Cup is captured in the model by individual player effects. However, in practice, given that the tournament lasts just one month, the impact of age variations within this month is largely captured by the player's individual effects. Not surprisingly, the variable is not statistically significant. Table 2 shows that the average age for players was just over 27 years and a half. Despite its statistical insignificance, we will use *age* in our robustness checks.

Table 2
Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Successful passes (%)	15,301	74.485	43.596	0	100
Successful previous passes (PP) - %	14,956	78.766	16.268	0	100
Number of previous emotion spells (U)	15,301	4.239	2.597	1	13
Cumulative goal difference at time t (CUM)	15,301	-0.129	1.027	-6	6
Expected Pass (xP)	15,301	0.758	0.261	0.01	0.98
X	15,301	75.692	8.688	65	99.6
Y	15,301	31.239	13.484	0	50
Minute	15,301	49.898	27.841	0.1	123.2667
Age	15,301	27.61	3.39	19.45	39.38

Note: See text for variable definitions.
Source: www.golyfutbol.com - OPTA. Own calculations

5. Results

Table 3 reports the results from estimating equation (1) considering eight different regressions that differ between them in the time allowed for emotions to last, which, in the end, is an empirical matter. For instance, the *3 Min.* column assumes that any positive or negative emotion shock lasts up to three minutes. As Table 1 reports, it will have a relatively smaller number of observations for positive and negative emotion spells. By increasing the duration of such emotions (in minutes), we can determine how long the emotion spells last and how behavior differs with positive and negative shocks. Before discussing the variables of interests, positive and negative emotions, we analyze the control variables' findings.

Table 3

Dependent var: Probability of a Successful Pass	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10 Min.
Positive Emotion	-0.557 [0.334]*	-0.611 [0.290]**	-0.551 [0.282]*	-0.549 [0.221]**	-0.389 [0.200]*	-0.418 [0.178]**	-0.279 [0.171]	-0.286 [0.162]*
Negative Emotion	-0.743 [0.272]***	-0.824 [0.223]***	-0.689 [0.208]***	-0.428 [0.191]**	-0.454 [0.179]**	-0.353 [0.177]**	-0.363 [0.167]**	-0.271 [0.166]
Successful previos passes (**PP**)	-0.006 [0.002]***	-0.006 [0.002]***	-0.006 [0.002]***	-0.006 [0.002]***	-0.006 [0.002]***	-0.006 [0.002]***	-0.006 [0.002]***	-0.006 [0.002]***
Number of previous emotion spells (**U**)	-0.09 [0.046]*	-0.109 [0.039]***	-0.109 [0.037]***	-0.066 [0.033]**	-0.06 [0.030]**	-0.05 [0.029]*	-0.039 [0.028]	-0.037 [0.028]
Cumulative goal difference at time t (**CUM**)	-0.068 [0.031]**	-0.07 [0.031]**	-0.066 [0.031]**	-0.063 [0.031]**	-0.064 [0.031]**	-0.058 [0.031]*	-0.063 [0.031]**	-0.06 [0.031]*
Expected Pass (**xP**)	4.559 [0.106]***	4.567 [0.106]***	4.566 [0.106]***	4.565 [0.106]***	4.562 [0.106]***	4.561 [0.106]***	4.56 [0.106]***	4.557 [0.106]***
X	-0.032 [0.003]***	-0.032 [0.003]***	-0.032 [0.003]***	-0.032 [0.003]***	-0.032 [0.003]***	-0.031 [0.003]***	-0.031 [0.003]***	-0.031 [0.003]***
Y	0.002 [0.002]	0.002 [0.002]	0.001 [0.002]	0.002 [0.002]	0.002 [0.002]	0.002 [0.002]	0.002 [0.002]	0.002 [0.002]
Minute	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]
Constant	0.025 [0.518]	0.049 [0.517]	0.059 [0.519]	0.016 [0.520]	0.015 [0.519]	0.005 [0.520]	-0.01 [0.518]	-0.016 [0.519]
FE	Player, Own, Opponent, Matchday							
Observations	14713	14713	14715	14712	14714	14715	14715	14713
Robust standard errors in brackets * Significant * 10%, ** 5%, *** 1%								

Source: www.golyfutbol.com - OPTA. Own Calculations

The probability of successfully passing the ball decreases the higher the success of prior passes during the game, *PP*. With no clear theoretical expected sign, the results imply that a player is more likely to fail the next pass if he has been more accurate over the previous passes, i.e., in the extreme case that he has not failed his first *n* passes, he will likely miss the next pass.[7] This result can be capturing a reversion to the mean phenomenon.

There is evidence that the number of previous emotion spells, *U*, negatively impacts the probability of successfully passing the ball when we consider that emotion spells last in the range of four to seven minutes. There is weak evidence for spells lasting three and eight minutes—nothing detectable beyond the latter. The sign of the coefficient implies that given the player's

[7] We explored the quadratic option for this variable but they turned out to not be statistically significant.

emotion during a pass, the more times a player has been under that specific emotion in the past, the less likely its pass will be successful.

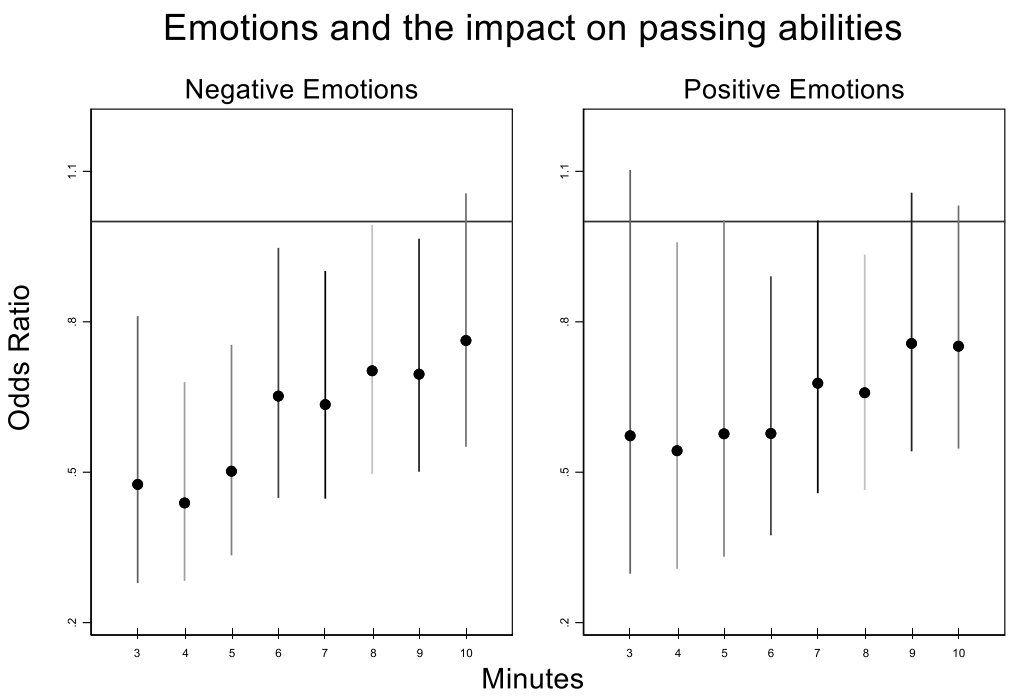
Given all else constant, we find that if a player's team is winning the game (*CUM*), the probability of successfully passing the ball decreases, implying that when a team is losing, net of emotions, his passes gain accuracy.

Regarding the coordinates where the pass took place, only X is statistically significant, implying that the closer to the opponent's rival, the less likely to succeed in the pass. There is no evidence of horizontal segmentation nor that the time in which the attempted pass took place matters.

Lastly, note that, for the most part, the coefficients are relatively robust across specifications.

Regarding the variables of interest, recall that Table 3 presents the logit estimation coefficients following equation (1). Overall, the negative emotions are statistically stronger than the positive ones across specifications, and the coefficient almost monotonically falls as time since the goal conceded passes by. Negative emotions reach their peak four minutes after the team concedes a goal. The left panel of Figure 1, which depicts the odds ratios derived from Table 3, shows that four minutes after the shock, under a negative emotion, the odds of successfully passing the ball is 44% of those under *status quo*. The goal conceded's impact lasts statistically robust until minute 9 (95% level of significance) when the negative spell's odds ratio is 70%. The effect dilutes over time, with no statistical effect detected beyond 9 minutes of the goal conceded. Indeed, the left panel in Figure 1 depicts the weakening trend of emotions over time.

Figure 1
Emotions and the probability of successfully passing



Note: 95% confidence intervals. Interpret relative to *status quo*. See text for definition.
Source: www.golyfutbol.com - OPTA. Own calculations.

When a team scores a goal, it triggers positive emotions, which according to the results reported in Table 3, also decreases the probability of successfully passing the ball. However, the results are more stable, particularly from the economic point of view. Statistically, nevertheless, the results vary, almost systematically, between 90 to 95% confidence levels. Regarding the former, between minutes 3 and 6 the odds of successfully passing the ball oscillate around 50% of those under *status quo*. The effect lasts until eight minutes after the goal scored when the odds of achieving a good pass are 66% of those under *status quo*. Overall, the trend does not fade as fast as when analyzing negative emotions, and the statistical effect is somewhat weaker. Nonetheless, the evidence does suggest that positive shocks decrease the probability of successfully passing the ball.

Our results support earlier findings in the sport psychology literature, which has found that negative emotions tend to play a leading role relative to positive ones (McCarthy, 2011).

6. Extensions

This section reviews alternative specifications to the main one discussed in the previous one. A natural robustness check is to explore the role of the current score on performance. Other exercises are extensions, rather than robustness tests, in that we divide the sample to examine how the data behave. These have a little saying on the strength of our main specification. All robustness checks are based on the main specification as presented in equation (1).

Equation (1) controls for the current game score (*cum*), but rather than assuming the impact of this variable to be monotonic; it may be that different scores could exert a disproportionate effect on the response variable. Following this intuition, we define five dummies: one when the player makes the pass while winning the game by more than one goal, another when winning by one goal, when tying, when losing by one goal, and when losing by more than one goal. We do not report the results because the variables of interest remain unaltered. Nevertheless, it is worth noting that the dummies are not statistically significant, except some weak evidence (90% confidence level) that the probability of successfully passing the ball is slightly higher when the player is losing by more than one goal relative to when it is a draw. Note that when reporting results in this section, we do so only for the variables of interest because the control variables remain stable across specifications.

It may be that what matters is whether the player's team is winning or losing, i.e., a discrete behavior. Table 4 reports the results for winning and losing.

When considering positive emotions, there are no effects but some weak evidence when the team loses 9 to 10 minutes after the event. On negative emotions, the results follow closer previous findings. Whether the team is winning or losing (although stronger results on the latter), statistical evidence shows that passing accuracy falls.

Table 4

Dependent var: Probability of a Successful Pass	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10 Min.
				When the team is winning				
Positive Emotion	-0.439	-0.909	-0.414	-0.38	-0.237	-0.323	-0.139	0.098
	[0.650]	[0.598]	[0.603]	[0.498]	[0.453]	[0.433]	[0.412]	[0.411]
Negative Emotion	-1.74	-2.594	-2.155	-1.821	-1.881	-1.94	-1.826	-1.432
	[1.366]	[1.192]**	[1.163]*	[1.159]	[1.155]	[1.158]*	[1.148]	[1.051]
Observations	2377	2377	2377	2377	2377	2377	2377	2377
				When the team is losing				
Positive Emotion	-2.789	-2.595	-2.538	-2.445	-1.674	-1.744	-1.565	-1.631
	[2.098]	[2.100]	[2.096]	[2.097]	[1.467]	[1.380]	[0.947]*	[0.931]*
Negative Emotion	-1.274	-0.962	-0.737	-0.411	-0.359	-0.268	-0.338	-0.221
	[0.551]**	[0.418]**	[0.368]**	[0.347]	[0.297]	[0.287]	[0.283]	[0.287]
Observations	3816	3816	3818	3815	3817	3818	3818	3816

obust standard errors in brackets
Significant * 10%, ** 5%, *** 1%

Source: www.golyfutbol.com - OPTA. Own Calculations

The following extension explores the impact of emotions on performance accounting for the stage of the World Cup. We divide the sample between those games played during the group phase and those played in the knockout stage. In doing so, we want to explore if emotions impact the probability of successfully passing the ball in the knockout stage when, a priori, players can be more sensitive because their future depends on just one game. Of course, the latter ignores that the third game of the group phase can have the same characteristics as the knockout stage.

Table 5

Dependent var: Probability of a Successful Pass	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10 Min.
				Group stage				
Positive Emotion	-0.511	-0.575	-0.37	-0.374	-0.31	-0.312	-0.219	-0.11
	[0.364]	[0.325]*	[0.333]	[0.260]	[0.238]	[0.220]	[0.214]	[0.203]
Negative Emotion	-0.783	-0.868	-0.675	-0.446	-0.436	-0.365	-0.387	-0.263
	[0.319]**	[0.258]***	[0.237]***	[0.223]**	[0.212]**	[0.203]*	[0.196]**	[0.191]
Observations	10506	10505	10507	10504	10506	10507	10507	10507
				Knockout stage				
Positive Emotion	-1.248	-0.805	-0.64	-0.925	-0.287	-0.137	-0.109	-0.513
	[1.154]	[0.991]	[0.824]	[0.718]	[0.536]	[0.499]	[0.474]	[0.457]
Negative Emotion	-1.458	-0.982	-0.399	-0.452	-0.384	-0.053	-0.286	-0.435
	[0.841]*	[0.741]	[0.710]	[0.610]	[0.538]	[0.558]	[0.531]	[0.524]
Observations	4099	4100	4100	4100	4100	4100	4100	4098

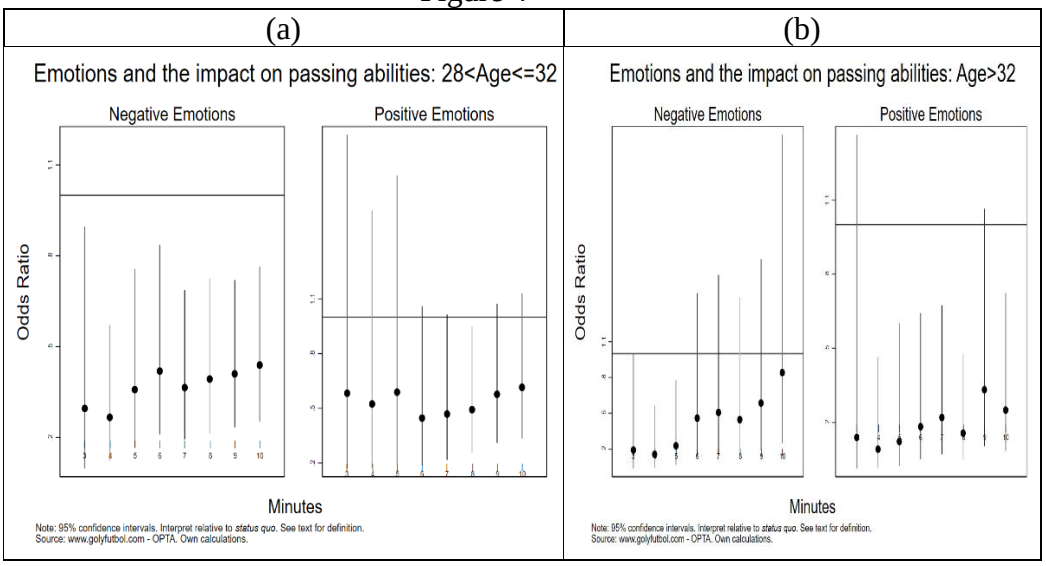
obust standard errors in brackets
Significant * 10%, ** 5%, *** 1%

Source: www.golyfutbol.com - OPTA. Own Calculations

The results (Table 5) suggest that negative emotions have a strong a sustained impact during the group stage. However, no effect is observed for positive emotions or negative or positive emotions during the knockout stage. One could argue for the latter that players are more psychologically prepared for a negative shock as they have probably experienced that before in the tournament. Furthermore, at the knockout stage, many teams may have already completed their target in the tournament.

Lastly, we split the sample by age groups considering players separately under 23, between 23 and 25, between 26 and 28, between 29 and 32, and older than 32. With fewer observations, given the exercise's setup, we report in Figure 4 the odds ratio for players older than 28, the only case where emotions have a statistically significant impact. The results imply that these players are more *emotional* than younger players, probably because they feel that the current World Cup might be the last chance for them to ever participate in the grand event. Negative emotions tend to hit hard, and for the eldest players, when their team scores, they might feel the nearby success, and the likelihood to miss a pass increases, thus the result for positive emotions (panel b).

Figure 4



7. Concluding remarks

While previous literature has already studied the impact of low intensity and relatively lasting feelings on performance, little is known about visceral-factors' short-lived impact. This paper studies this issue using granular event data from the 2018 FIFA Football World Cup, where naturally-inducted emotions are generated by scored and conceded goals. We exploit the fact that goals trigger emotions in a commonly accepted way by all participants in the game, where scoring leads to positive emotions and conceding to negative ones.

Our results confirm that emotions are short-lived and asymmetric as negative ones exert a more significant impact. Moreover, visceral factors are more relevant at the early stage of the competition and for the oldest players, while the current score does not play an important role. Although future research is warranted to understand the importance of visceral factors on workers' performance, our results are suggestive as they indicate that emotions affect

productivity in a complex way that depends on the type of emotion, the individual worker, and the task's importance.

Our paper is partially limited in that we do not describe in detail the type of emotions that we are referring to. As Hu and Kaplan (2015) note, there is a number of different states in, for instance, positive emotions. They can be joy, interest, pride, or gratitude. However, although their might have different effects, in our case, it is not a significant issue because the event that triggers the emotions is commonly accepted to all participants in the game, and there is consensus that a goal scored relates to positive emotions, while one conceded relates to negative ones.

8. Appendix

Expected Goals logit results.

x refers to the pitch's length normalized to 100. *y*, also normalized to 100, is the pitch's width. Z1 and Z2 refers to passes inside the goal area and outside but perpendicular to the goal.

Table A.1: Expected passes

	Expected Pass
Head	-1.86
	[0.039]***
SwitchOfPlay	1.313
	[0.108]***
Flick On	-1.26
	[0.088]***
Layoff	-0.415
	[0.113]***
Chip	-1.279
	[0.044]***
Through Ball	-1.357
	[0.175]***
Long Ball	-2.096
	[0.050]***
Offensive	-0.413
	[0.058]***
Defensive Or Backward	1.109
	[0.065]***
PullBack	-1.943
	[0.260]***
Cross	-2.496
	[0.098]***
Distancia	0.028
	[0.002]***
Z1	-1.982
	[0.087]***
Z2	-0.616
	[0.054]***
X	-0.003
	[0.001]***
Y	0.001
	[0.000]**
Constant	2.007
	[0.077]***
Observations	58296
Robust standard errors in brackets	
* Significant * 10%, ** 5%, *** 1%	

Source: www.golyfutbol.com - OPTA. Own Calculations

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