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Action Bias among Elite Soccer Goalkeepers: The Case of Penalty Kicks*

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Abstract

In soccer penalty kicks, goalkeepers choose their action before they can clearly observe the kick direction. An analysis of 286 penalty kicks in top leagues and championships worldwide shows that given the probability distribution of kick direction, the optimal strategy for goalkeepers is to stay in the goal's center. Goalkeepers, however, almost always jump right or left. We propose the following explanation for this behavior: because the norm is to jump, norm theory (Kahneman and Miller, 1986) implies that a goal scored yields worse feelings for the goalkeeper following inaction (staying in the center) than following action (jumping), leading to a bias for action. The omission bias, a bias in favor of inaction, is reversed here because the norm here is reversed - to act rather than to choose inaction. The claim that jumping is the norm is supported by a second study, a survey conducted with 32 top professional goalkeepers. The seemingly biased decision making is particularly striking since the goalkeepers have huge incentives to make correct decisions, and it is a decision they encounter frequently. Finally, we discuss several implications of the action/omission bias for economics and management.

1. Introduction

According to the classical assumptions in economics, when people face decision problems involving uncertainty, they should choose what to do according to their utility from the possible outcomes and the probability distribution of outcomes that follows each possible action. How an outcome comes about should not matter. For example, suppose that the decision maker has two possible actions, A and B, and he prefers the probability distribution of outcomes that follows A over the one that follows B. If in a different problem the decision maker has possible actions X and Y that lead to the same distributions of outcomes as A and B, respectively, then the decision maker should choose X.

Many studies involving subjective judgment of decision outcomes, however, found that the evaluation of an outcome depends not only on the outcome itself, but also on the way in which this outcome came about. Kahneman and Tversky (1982), in a seminal article, found that people feel a more poignant emotional reaction to bad outcomes that result from action relative to otherwise identical outcomes that result from inaction.¹ The different emotional reaction to outcomes depending on whether they come from action or inaction was later replicated in many other studies (see for example Landman, 1987; Ritov and Baron, 1990, 1992, 1995; Kordes-de Vaal, 1996; Patt and Zeckhauser, 2000; Kruger, Wirtz and Miller, 2005), and was referred to in the literature in several terms, including *emotional amplification*, *the action bias*, *the action*

¹ It is helpful to illustrate Kahneman and Tversky's findings by citing their experiment. Subjects were asked the following question: "Paul owns shares in company A. During the past year he considered switching to stock in company B, but he decided against it. He now finds out that he would have been better off by \$1,200 if he had switched to the stock of company B. George owned shares in company B. During the past year he switched to stock in company A. He now finds out that he would have been better off by \$1,200 if he had kept his stock in Company B. Who feels more regret?" (p. 173). A large majority of the subjects thought that George, who acted, felt more regret than Paul, who did not act.

effect, the inaction effect, the actor effect, and the omission bias (for a detailed review of this literature, see Anderson, 2003).

Kahneman and Miller (1986) proposed the norm theory to explain the above phenomenon. According to this theory, negative outcomes are perceived as worse when people can easily imagine that a better outcome could have occurred. They further assume that in general it is easier to mentally “undo” an action that had occurred than to imagine having taken an action when none had occurred. Consequently, the reaction to outcomes of action is stronger than the reaction to outcomes of inaction (also referred to in the literature as "omissions"). Consistent with this proposal, Ritov and Baron showed, in a series of investigations, that people tend to judge acts that are harmful (relative to the alternative option) as worse than omissions that are equally harmful or even more harmful (for a review, see Baron, 1994).

Almost all the literature so far has studied cases in which people are biased in favor of inaction. The explanation of Kahneman and Miller (1986) for this bias is based on the idea that people can more easily imagine the alternative to action than to inaction, because inaction is often the norm. In cases in which action becomes more normal, however, we might expect, according to the rationale behind the norm theory, that the opposite bias would occur: people would be biased in favor of action when both action and inaction might lead to the same negative outcome. Confirming this prediction – and in line with some previous research (Ritov and Baron, 1990; Spranca, Minsk and Baron, 1991) – Ritov and Baron (1994) demonstrated that when action was more expected than inaction, adverse outcomes of failure to act were judged worse than (identical) outcomes of action (see also Miller and Taylor, 1995). Similarly, Zeelenberg et al (2002) argue that action might be more normal than inaction when we consider previous outcomes; in particular, they claim that when a soccer team loses by a large margin, it becomes more normal for the coach to act in the next game (replace players in the opening team) than not to act (keep the same players), a claim that is supported by their experimental findings.

Most studies on the action/omission bias² used hypothetical questions, where decisions do not bear real consequences for the subjects. A few exceptions are worth mentioning. Davis et al (1995) examine perceptions after loss of a child or a spouse. Zeelenberg and Pieters (2004) study the participation in lotteries in The Netherlands. Kruger, Wirtz and Miller (2005) look at the decision whether to change a previous answer on a multiple-choice test, and Pieters and Zeelenberg (2005) examine voting in the national elections in The Netherlands.

Because we believe that the action/omission bias has important implications for economics, and because many economists are skeptic regarding experiments that lack salient financial incentives (even though in psychology it is a common practice to conduct such experiments), we attempt to observe whether an action bias exists in a real-world situation, where incentives are huge: the behavior of elite goalkeepers during penalty kicks.³ Moreover, goalkeepers face penalty kicks regularly, so they are not only highly-motivated decision-makers, but also very experienced ones in the domain of the decision they have to make. The norm for goalkeepers in penalty kicks is to act (jump to the right or to the left), leading us to predict, based on the norm theory, a bias towards action. Indeed, we find that while on average, given the behavior of kickers, it is optimal

² In what follows, we use the term "action/omission bias" to refer generally to the phenomenon that outcomes are evaluated differently depending on whether they were preceded by action or inaction. We use "action bias" to refer specifically to cases in which people are biased in favor of acting, and use "omission bias" for cases where people are biased in favor of inaction.

³ Despite the fact that goalkeeping involves decision making (see for example the soccer goalkeeping coaching guidelines in Welsh, 1990), the area of goalkeepers' decision making is still under-researched. One aspect of goalkeepers' behavior that did receive some attention is their behavior during penalty kicks. For example, cognitive processes such as anticipation, cue utilization and response time have been studied (see for example Morris and Burwitz, 1989; Williams and Burwitz, 1993; McMorris and Colonso, 1996; Savelsbergh, Williams, Kamp, and Ward, 2002). However, to our knowledge, no study systematically investigated fallible judgments (i.e., heuristics and biases) of goalkeepers in general and in particular when facing a penalty kick, as we do in this article.

for the goalkeeper to choose to stay in the center of the goal (which can be considered inaction), goalkeepers almost always jump to the right or to the left, thus exhibiting a bias towards action.

Recently, two other papers that address the behavior of players during penalty kicks have been published. Chiappori, Levitt and Groseclose (2002) examine the question whether kickers and goalkeepers play the mixed-strategy Nash equilibrium (MSNE). They show that several predictions that should hold if the MSNE is played are indeed supported by their data. It seems at first that our result (using a different dataset) of a bias in goalkeepers' behavior contradicts their conclusion. In their data, however, only in about 2% of the penalty kicks the goalkeeper chose to stay in the center, so their result, that play is consistent with the MSNE concept, is based almost entirely on the choice between right and left, and not on the choice between the center and the sides. Consequently, our result is not a contradiction of theirs. Palacios-Huerta (2003) also studies penalty kicks. In his empirical analysis, however, he analyzes a 2X2 game, in which kickers and goalkeepers can choose either right or left. His results suggest that in the choice between right and left, goalkeepers and kickers play in accordance with the MSNE predictions. Because he analyzes a 2X2 game, however, he cannot detect whether there is a bias in the choice of center versus the sides, which is the focus of our research.

The rest of the article is organized as follows. The next section gives some background on penalty kicks and describes our predictions. Section 3 presents the first study, in which we examine the behavior of kickers and goalkeepers during penalty kicks. Section 4 presents the second study, a survey conducted with elite professional goalkeepers about their attitudes and perceptions regarding penalty kicks. Section 5 concludes and offers a few possible implications of the action/omission bias for economics and management.

2. Soccer, Penalty Kicks, and Potential Biases

In a penalty kick, the kicker shoots a stationary ball located 11 meters from the goal, against only a goalkeeper (no other players are allowed to stand in the way), who must remain on the

goal-line until the kick is taken. This suggests that it is hard to stop a penalty kick, and indeed in our data about 80% of the penalty kicks resulted in a goal being scored. Penalty kicks in soccer are used in two cases. First, they are used as a means to determine the winner in certain championships, when the regular game ends with a tie. In this case their importance is obvious, since the penalty kicks determine the winner. Second, penalty kicks are awarded against a team that conducts certain severe offenses during the game. The great importance of penalty kicks in this case comes from the fact that the number of goals in an average game is only about 2.5 (by both teams together), so a goal scored in a penalty kick has high chances of changing the outcome of the game. This suggests the extreme importance of optimal performance during penalty kicks, for both kickers and goalkeepers. Since salaries and bonuses in professional soccer can reach hundreds of thousands and even millions of dollars and are affected by the player's performance and reputation, it is clear that players have huge economic incentives to do their best during penalty kicks.

Because the time it takes the ball to reach the goal from the penalty mark is only about 0.2-0.3 seconds (see Chiappori, Levitt and Groseclose, 2002; Palacios-Huerta, 2003), the goalkeeper generally cannot afford to wait until he sees clearly to which direction the ball is kicked before choosing his action; rather, he has to decide whether to jump to one of the sides or to stay in the center at about the same time that the kicker chooses where to direct the kick. This is the reason that both Chiappori et al (2002) and Palacios-Huerta (2003) model penalty kicks as a simultaneous-move game. Of course, in practice the situation is more complex: goalkeepers might get cues about the intended direction of the kick by observing the behavior of the kicker when he approaches the ball, or by knowing the history of his previous penalty kicks (although the kicker, in turn, has an incentive to surprise the goalkeeper). The evidence, to be discussed later, suggests that as implied by the assumption made by Chiappori et al (2002) and Palacios-Huerta (2003), the assumption that the kicker and the goalkeeper choose their actions

simultaneously is a good approximation, certainly much better than assuming that either of them chooses only after observing what the other has chosen.

This creates a simple and interesting real-life example (with huge financial incentives to make good decisions) of decision making under uncertainty: the goalkeeper has to choose whether to jump to the right, the left, or to stay in the center, in order to minimize the risk of a goal being scored, under uncertainty regarding the direction of the ball. This makes it very intriguing to find whether expert goalkeepers exhibit any deviation from rational decision making. To examine this, we collected data from games in the top leagues and championships worldwide. Later, in order to reinforce our conclusion from the first study, we also conducted a second study in which top professional goalkeepers were asked about their perceptions and attitudes regarding penalty kicks.

We hypothesized that the goalkeeper's behavior during penalty kicks may be affected, at least partly, by preference for action (the "action bias"). The norm, as the data we collected in both studies reveal, is to jump to either side (rather than to stay in the center). Consequently, according to the norm theory, goalkeepers would experience a bad outcome (not stopping a penalty kick) more strongly when it results from not obeying the norm (staying in the center) rather than from obeying the norm (jumping). Therefore, we hypothesized that goalkeepers would choose to jump more than is optimal.⁴ The analysis in the following sections shows that this conjecture was supported by the data. Thus, our study corroborates the predictions of the norm theory where the norm is to act rather than to choose inaction, a phenomenon that we denote as "the action bias" (following some of the previous literature). Moreover, we do so in a natural setting where

⁴ Notice that the norm theory (see Kahneman and Miller, 1986) in this context, as well as more generally, can create an interesting mechanism that reinforces norms where risky action/inaction decisions have to be made. When action is the norm, negative outcome following inaction is experienced more strongly than negative outcome following action, leading decision makers to prefer action, thus reinforcing the norm. A similar argument shows that a norm to choose inaction can also support itself through the mechanism proposed by the norm theory.

incentives for making correct decision are huge, supporting the claim that biases in behavior often persist even when incentives for optimal decision making exist.

3. Study 1: Goalkeepers' and Kickers' Behavior During Penalty Kicks

3.1. The Data

To determine whether soccer goalkeepers exhibit the action bias and jump during penalty kicks more than is optimal, we needed data on actual behavior of kickers and goalkeepers during penalty kicks. To obtain such data, we searched in the archives of various television channels, found different soccer matches in the top leagues and championships worldwide, and watched the games to see whether they involved penalty kicks. For those penalty kicks that we found, we asked three independent judges to determine to which part of the goal the ball was kicked, to which direction the goalkeeper jumped (if at all), and whether he stopped the ball, using a diagram of the goal's area (see Appendix A). A total of 311 kicks were analyzed.

After the three judges evaluated the kicks, we excluded kicks that were missed because they were shot to the goalposts and the crossbar or outside the goal (18 such kicks existed in the data). The reason is that we later use the sample to estimate the probability of stopping a penalty kick by jumping to the side or by staying in the center. Balls that did not reach the goal itself (i.e. did not reach cells 1-9 in the diagram in Appendix A) are not scored goals, on one hand, but are not successes of the goalkeepers in stopping the ball, on the other hand. Therefore it seemed best to exclude them from the data.

Because balls sometimes get to the boundary area between two cells (e.g. between cells 3 and 6), it is not surprising that in these cases different judges could mark a different cell. It would be a mistake to eliminate such observations because of the disagreement between the judges, because this means that we systematically eliminate many balls that are kicked to any boundary between two cells, leaving a biased sample. Therefore, in those cases where two judges chose the same

cell and one judge chose an adjacent cell, we recorded the ball as being where the two judges agreed. In rare cases (7 out of 311 kicks) where one of the judges chose a cell that was not adjacent to one chosen by the other two, or where the three judges chose three different cells, we excluded this observation from the data. The elimination of these observations and of the balls kicked outside the goal resulted in the sample size shrinking to 286 observations.

There is a potential confusion about directions in this context. If the goalkeeper jumps to his left, and the kicker kicks towards his left, these are two opposite directions even though both are "left." To avoid this confusion, in what follows, every time we mention right or left, it is from the goalkeeper's perspective. Thus, cells 1, 2 and 3 in Appendix A are kicks to the right. Table 1 presents the data, divided according to the direction of jumps and kicks. The top panel presents the raw frequencies, and the bottom panel presents the distribution in percentages.⁵

⁵ An analysis of the sample that includes all 311 kicks (i.e., including also the 25 kicks that were excluded as explained before) reveals that goalkeepers stayed in the center, jumped right, and jumped left in 7.1%, 44%, and 48.9% of the kicks, respectively. Since these percentages are very close to the ones in the sub-sample of 286 kicks, we prefer to focus our discussion on these 286 kicks rather than to discuss goalkeeper behavior on the entire sample and scoring probabilities and kicker behavior on a different sub-sample.

Table 1: Joint Distribution of Jumps and Kicks

		Jump direction			Total
		Left	Center	Right	
Kick direction	Left	54	1	37	92
	Center	41	10	31	82
	Right	46	7	59	112
	Total	141	18	127	286

		Jump direction			Total
		Left	Center	Right	
Kick direction	Left	18.9%	0.3%	12.9%	32.2%
	Center	14.3%	3.5%	10.8%	28.7%
	Right	16.1%	2.4%	20.6%	39.2%
	Total	49.3%	6.3%	44.4%	100.0%

Table 1 suggests that the decisions taken by the kicker and the goalkeeper are made roughly simultaneously. If goalkeepers had observed to which direction the ball was headed and only then chose to which direction to jump, they would have always jumped to the direction of the kick. If, on the other hand, the kickers had observed to which direction the goalkeepers jumped and only then kicked the ball, they would have always kicked to a different direction from the goalkeeper's jump. The fact that the directions of the kick and the jump match in 43% of kicks rather than in 0% or 100% of the kicks suggests that neither the kicker nor the goalkeeper can clearly observe what the other chose when choosing their action. While the data do not suggest that goalkeepers' and kickers' decisions are completely independent, the interaction between the goalkeeper and the kicker is closer to being a simultaneous interaction than to the other two simple alternatives (the

goalkeeper observing the kick direction and only then choosing his action, or vice versa).⁶ The data could result, for example, from an aggregation of a small percentage of kicks in which the goalkeeper realized where the kick goes, and a large percentage of kicks where the kick and jump direction are completely independent (see Appendix B).

To be able to analyze the optimality of goalkeepers' decision making, it is also necessary to examine the probability of stopping the ball following each combination of kick and jump directions. Table 2 presents the average stopping chances, computed as the number of kicks stopped divided by the number of kicks (for each combination of kick and jump directions).

Table 2: Chances of Stopping a Penalty Kick

		Jump direction			Overall
		Left	Center	Right	
Kick direction	Left	29.6%	0.0%	0.0%	17.4%
	Center	9.8%	60.0%	3.2%	13.4%
	Right	0.0%	0.0%	25.4%	13.4%
	Overall	14.2%	33.3%	12.6%	14.7%

Not surprisingly, most of the kicks stopped occur when the goalkeeper chooses the same direction to which the ball was kicked. We can see, however, that in a few cases a goalkeeper who jumped to one of the sides was still able to stop a ball directed towards the center. It is clear why this is possible if we remember that a kick that is classified as "Center" need not be at the exact center, but rather at any point in cells 4, 5, or 6, so jumping to the left allows the goalkeeper

⁶ The data provide evidence that goalkeepers might have some noisy signals, or cues, about the direction of the kick, since they do better (43% match between their jumps and the ball's direction) than the 33.3% rate they could achieve by choosing randomly, or the 39.2% they could achieve by always jumping to the right (the most common kick direction).

to potentially stop a ball directed a bit to the left of the center. It is also possible to stop a ball to the center when jumping if the goalkeeper stops the ball with his legs.

In order to estimate the probability that a goalkeeper has to stop a kick, we take the total number of balls stopped when choosing a certain direction, and divide it by the total number of jumps to that direction. Goalkeepers in the sample, for example, jumped left 141 times and stopped 20 balls when jumping left, yielding a 14.2% stopping rate. Combining the choices of right and left to an action that we can denote “jump” and comparing the payoff from this action (36 stopped kicks vs. 232 scored goals) to the payoff of “stay in the center” (6 stopped kicks vs. 12 scored goals) allows us to reject the null hypothesis that the two actions give the same payoff (stopping probability), $\chi^2(1, N = 286) = 5.33, p = 0.02$.

3.2. Optimal Behavior versus Actual Behavior

Before we can examine whether goalkeepers deviate from utility-maximizing behavior, we should find out what is the utility-maximizing behavior in the decision problem they face. Assuming that the goalkeeper tries to maximize the chances of his team to win, his optimal decision rule is to choose the direction where his probability of stopping the ball is maximal. We can see in Table 2 that the optimal direction to choose is center; the difference between the stopping chances in the center and either left or right are large. While it is optimal for goalkeepers to choose to stay in the center, however, they almost always choose to jump to one of the sides! Only in 6.3% of the cases they stay in the center. This suggests that goalkeepers might exhibit biased decision making.

A first conjecture about which bias goalkeepers exhibit might be the probability matching bias. To give a brief explanation of this principle, assume that subjects have option A, which is optimal with chances of $p > 0.5$, and option B, which is optimal with chances of $(1-p)$. Also assume that the difference in utility between the two options is constant; for example, one option wins a dollar and another wins nothing, but the winning option can change in each round. When

people learn the pattern of the game (i.e., the value of p), their optimal behavior is to always choose option A. In many experiments, however, it has been observed that people often choose A with probability p and B with probability $(1-p)$, a behavior that was coined "probability matching" (for a review of this literature, see Vulkan, 2000).

If goalkeepers behave according to the probability matching principle, they should choose to stay in the center in about 28.7% of the kicks (the percentage of kicks towards the center). The probability with which they choose to stay in the center, however (6.3%), is much lower, suggesting that probability matching is not the bias we see here. Indeed, it has been shown in the past that with experience, probability matching is gradually eroded (see for example Bereby-Meyer and Erev, 1998), and obviously elite goalkeepers are very experienced subjects in facing penalty kicks. This supports the conclusion that probability matching does not seem to be the reason for the surprisingly low frequency of goalkeepers choosing to stay in the center.

We propose that the reason for goalkeepers not staying in the center is action bias. Because the norm (as can be easily seen in the data) is that goalkeepers choose action (jumping to one of the sides) rather than inaction (staying in the center), norm theory (see Kahneman and Miller, 1986) predicts that a negative outcome would be amplified following inaction. That is, an identical negative outcome (a goal being scored) is perceived to be worse when it follows inaction rather than action. The intuition why is that if the goalkeeper jumps and a goal is scored, he might feel "I did my best to stop the ball, by jumping, as almost everyone does; I was simply unlucky that the ball headed to another direction (or could not be stopped for another reason)." On the other hand, if the goalkeeper stays in the center and a goal is scored, it looks as if he did not do anything to stop the ball (remaining at his original location, the center) – while the norm is to do something – to jump. Because the negative feeling of the goalkeeper following a goal being scored (which happens in most penalty kicks) is amplified when staying in the center, the goalkeeper prefers to jump to one of the sides, even though this is not optimal, exhibiting an "action bias."

4. Study 2: Goalkeepers' Attitudes

Our explanation discussed above for the seemingly non-optimal decision making by goalkeepers is based on the argument that the norm is to jump to one of the sides rather than to stay in the center. While it is evident from the data that goalkeepers almost always jump to one of the sides and therefore this can be considered the norm, we wanted to test the assertion that jumping is the norm directly, by asking the top professional goalkeepers for their opinion. Since getting such top goalkeepers to participate in a survey provides a rare and not easily-obtained opportunity to look into the attitudes of top goalkeepers, we decided also to examine whether their attitudes about penalty kicks support our conjecture that goalkeepers feel worse when they do not stop a penalty kick following inaction (staying in the center) than following action (jumping to one of the sides). The questionnaire that was designed to examine these issues is presented in Appendix C.

To collect data from the top goalkeepers available to us, we used the following procedure: we compiled a list of the two goalkeepers in each of the teams in the Premier League (the highest league in Israel), and of the opening (and therefore better) goalkeeper in each of the teams in the National League (the second highest league). Since each league has 12 teams, this resulted in a list of 36 goalkeepers, which represent the top professional goalkeepers in Israel. One of the authors used his extensive network of connections in the soccer industry to obtain the contact details of these professional goalkeepers. Eventually we were able to obtain contact details and approval to participate in the study from 32 out of these 36 goalkeepers.

The results of questions 1 and 2 in the survey can be used to construct for each goalkeeper an order of perceived normality among the three options (the option that is neither chosen as the most normal nor as the least probable is the intermediate one). For example, we can denote by RLC a goalkeeper who considered Right to be the most normal action and Center to be the least probable. Four different patterns of choice appear in the data. 16 goalkeepers chose RLC, 9 chose

LRC, 5 chose CLR, and 2 chose CRL. Since we are not interested in differences between right and left but only in differences between center and jumping (denoted by J), we can combine RLC and LRC to a choice category of JJC, and combine CLR and CRL to a choice category of CJJ (notice that no goalkeeper exhibited a choice of the type JCJ). We therefore have 25 choices of JJC, representing goalkeepers who think jumping is more normal than staying in the center, and 7 choices of CJJ, representing the opposite. The results therefore support our hypothesis that jumping is perceived as the norm (as our data from study 1 also suggested), $\chi^2(1, N = 32) = 10.13, p = 0.001$.

The third question tries to measure the regret from the same outcome – a goal being scored – but following three different possible actions – jumping right, left, or staying in the center. Unfortunately, 15 out of the 32 goalkeepers gave the highest possible rating (10, “feel very bad”) to all three outcomes. The ceiling effect for these goalkeepers does not allow for meaningful comparison between the different situations. Two goalkeepers gave the same response (but less than 10) to all three scenarios. Of the remaining 15 goalkeepers, 11 indicated that they would feel worse about a goal being scored when staying in the center than when jumping to either side, and 4 indicated the opposite pattern ($\chi^2(1, N = 15) = 3.27, p = 0.07$). An exact calculation using a binomial distribution shows that the probability of getting up to 4 successes out of 15 trials (with success probability in each trial of 0.5) is 0.059. This implies that the one-tailed test of the hypothesis that goalkeepers feel worse about a goal being scored when staying in the center has a p-value of 0.059. While these results are not statistically significant at the 5% level, they are at least compatible with our hypothesis that goalkeepers feel worse about a goal being scored following inaction (staying in the center) than following action (jumping), which can lead them to jump to the sides more often than is optimal.

5. Conclusion

We hypothesized that soccer goalkeepers jump to the sides during penalty kicks more than they should. The analysis of 286 penalty kicks in various soccer games in top leagues and championships worldwide shows that while the utility-maximizing behavior for goalkeepers is to stay in the goal's center during the kick, in 93.7% of the kicks the goalkeepers chose to jump to their right or left. This non-optimal behavior suggests that a bias in goalkeepers' decision making might be present. According to our hypothesis, the reason for this non-optimal behavior is "action bias" – the opposite of the more famous "omission bias." The reason that the usual bias is reversed here is that usually the norm is to choose inaction, while in the goalkeepers case, the norm is to act (jump to the side rather than stay in the center).

According to the norm theory (Kahneman and Miller, 1986), people have stronger feelings associated with outcomes when they come from abnormal causes. Consequently, because the norm is that goalkeepers jump to one of the sides, the disutility associated with missing a ball might be greater following a non-common behavior (staying in the center) than following normal behavior (jumping to the side). Thus, we claim that elite goalkeepers' behavior in our data, despite their vast experience and the huge incentives involved, exhibits the action bias. The action bias explains the intriguing difference between goalkeepers' optimal behavior and actual behavior. This study demonstrates that the action/omission bias can exist even in a natural setting with huge financial incentives to decide correctly, and where the decision makers are highly experienced in the decision they have to make.

To reinforce the findings in the first study and our interpretation of them, we conducted a second study in which we elicited the attitudes and opinions of top professional goalkeepers. The results support our claim (which was based on the data collected in the first study) that the norm during penalty kicks is that the goalkeeper jumps to one of the sides and does not stay in the goal's center. The results are also compatible with our explanation for the tendency of goalkeepers to jump more than is optimal, which suggests that goalkeepers feel worse about a

goal being scored when it follows from inaction (staying in the center) than from action (jumping).

We want to stress that the argument that the goalkeepers are better off choosing to stay in the center is based on the current distribution of kicks. If goalkeepers will always choose to stay in the center, however, kickers will start aiming all balls to the sides, and it will no longer be optimal for the goalkeeper to stay in the center. The distribution of jumps and kicks that will constitute an equilibrium (in which both the kicker and the goalkeeper will be happy with their choices given what the other players does) is therefore one in which each player randomizes among his various possible actions – known as a mixed-strategy equilibrium. However, here we limit our attention to the question what is optimal for goalkeepers given the current behavior of kickers; analyzing the mixed-strategy equilibrium of the game is beyond the scope of this article and is left for future research.

The action/omission bias has received attention in psychology, but hardly any in economics (one exception is Patt and Zeckhauser, 2000). We think, however, that it has very important implications for economics and management. For example, the action/omission bias might affect the decision of investors whether to change their portfolio (action) or not (inaction). It can affect the choice of managers whether to leave their company's strategy or investments unchanged (inaction), or to change them (action). The bias may also have implications for the decision of workers whether to stay in their job (inaction) or look for a better job (action), and one's decision whether to re-locate to another city or not. In the macro-economic level, the action/omission bias may also affect decisions made by governments and central banks whether to change various policy variables (interest rates, tax rates, various types of expenditures, etc.), or leave them unchanged.

Of particular relevance in these cases are the results of Zeelenberg et al (2002) about the effect of previous outcomes on what is considered normal to do. They found that following a bad outcome (losing by a large margin in a previous soccer game), subjects consider action (changing

the opening team) more normal than inaction, but following a good outcome (winning a previous game), inaction is considered more normal.

Along the same lines, we may conjecture that if the economy has been doing poorly lately, the central bank or the government might be tempted to "do something" and change certain economic variables, even if the risks associated with the changes not necessarily outweigh the possible benefits. If things turn bad, at least they will be able to say that they tried to do something, whereas if they choose not to change anything and the situation continues to be poor (or becomes worse), it may be hard to avoid the criticism that despite the warning signs they "didn't do anything." On the other hand, if the economy has been doing well recently, policy-makers might have a temptation not to change anything, even if they believe that changes can improve the economy further. The reason is that if the economy becomes bad, this might seem a result of their changes if they do something, but if they do nothing, they are less likely to be blamed for the sudden adverse change. Similar arguments apply to managers who consider whether to change the direction and strategy of their firm, as well as to the other examples discussed above.

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Appendix A: Questionnaire Given to Judges for Evaluating Recorded Penalty Kicks*

Dear Sir,

You are about to participate as an evaluator in a research on soccer that deals with penalty kicks. You will watch a cassette that shows penalty kicks that were collected from various games that were conducted in Israel and worldwide during the last few years.

Look carefully at the next page: you will find a soccer goal divided to 9 cells. The outside areas around the goalposts and the crossbar are denoted in English letters (A.....K) and the corresponding areas on the goalposts and the crossbar are denoted in English letters with ' (A'.....K'). Please make sure this division is clear to you; this is very important! Thanks.

Now let's go to work: please look carefully in the kicks presented on the screen. On each kick, you are requested to answer a few simple questions. You are asked to write the answers on the answer sheet you have, you have as much time as you need, and if in doubt, you can return and watch any kick as many times as you want.

We also want to stress that this is not an exam; we only want you to write on the answer sheet what you think is the most correct and/or accurate, based on your personal opinion only.

We thank you in advance for your cooperation!

Regards,

The research team

* The original questionnaire was given in Hebrew.

Kick Number	Cell to which the ball was kicked (mark a number or a letter)	Was a goal scored?		Goalkeeper behavior, mark X in the correct cells						
				Jumps				Touching the ball		
		Yes	No	Jumped Right	Jumped Left	Didn't jump-stayed in center	Other	Stopped the ball	Touched the ball but didn't stop it	Didn't touch the ball and didn't stop it
1										
2										
.....										

Diagram of the goal's area

	D		E		F		G		H	
		D'		E'		F'		G'		H'
C	C'		1		4		7		I'	I
B	B'		2		5		8		J'	J
A	A'		3		6		9		K'	K

Appendix B: Data Aggregation Analysis

In this appendix we explore what conditions about the independence between the goalkeeper's and kicker's choices are consistent with the data. The hypothesis of complete independence can be rejected with p-value of 0.006. However, the association between the goalkeeper's and kicker's choices is very weak, leading to the conjecture that the data could result from an aggregation of a small percentage of kicks in which the goalkeeper realized where the kick goes, and a large percentage of kicks where the kick and jump direction were completely independent.

Suppose that in $C\%$ of the kicks, the way the kicker ran to the ball gave a strong cue about the direction of the kick, or the goalkeeper took a big risk and waited until he clearly saw the kick direction before choosing his action. Also assume that in all the other kicks, the kick and jump directions were completely independent. To see how consistent are the results from different values of C with the data, we can perform a Chi-square test not only based on the marginal distributions (of Table 1), but also taking into account C . For example, suppose that in 10% of the kicks the goalkeeper knew the kick direction before choosing his action (and therefore he chose the same direction as the kick direction). This means that in 9.2 kicks to the left, the goalkeeper chose left because he had information (10% of the 92 kicks to the left), in 8.2 kicks to the center he chose center, and in 11.2 kicks to the right he chose right. In the other 257.4 kicks, we compute the joint distribution of kicks and jumps based on the marginal distributions, i.e., assuming independence between kicks and jumps. This gives us a table of predicted values, which we can compare to the actual data using a Chi-square test. For $C = 10\%$, we obtain the following predicted values:

Table A1: Predicted Distribution for C = 10%

		Jump direction			Total
		Left	Center	Right	
Kick direction	Left	50.02	5.21	36.77	92
	Center	36.38	12.84	32.77	82
	Right	49.70	6.34	55.96	112
	Total	136.1	24.4	125.5	286

Comparing these predicted values to the actual values (see Table 1) suggests that the difference between the two is not statistically significant ($\chi^2(4, N = 286) = 5.54, p = 0.24$). In fact, repeating this exercise for different values of C is interesting, because the p-value is not monotonically increasing in C (because a higher value of C implies that the goalkeeper knows more often the direction of the kick, and therefore implies a higher predicted positive association between the kicks and jumps, but in the data this association is weak). The p-values that we obtain for different values of C are reported below:

Table A2: p-values for Different Values of C

C	0%	3%	5%	7%	8%	9%	10%	11%	15%	20%
p-value	0.006	0.069	0.148	0.214	0.233	0.241	0.236	0.222	0.113	0.019

A more refined analysis shows that the highest p-value is obtained for C = 9.1% and that for values of C between 2.4% and 17.6%, the p-value is above 0.05. This implies that the data could result from a small percentage of kicks in which the goalkeeper predicts accurately the kick direction when choosing his action, and a large percentage of kicks in which the kick and jump are completely independent.

Appendix C: Goalkeepers Attitudes Questionnaire*

Hello,

My name is Galit and I participate in a research conducted on penalty kicks in soccer, which is being held at Ben-Gurion University of the Negev in association with the Hebrew University. We are interested in feedback from the best goalkeepers, and you have been chosen to participate in the research as one of the best goalkeepers in Israel. We will be grateful if you can answer three short questions.

1. When goalkeepers try to stop a penalty kick, what is the most normal thing they will do?

Jump right / jump left / stay in the center of the goal

2. When goalkeepers try to stop a penalty kick, what is the least probable thing they will do?

Jump right / jump left / stay in the center of the goal

3. How bad will you feel, on a 1-10 scale (1 = won't feel bad at all, 10 = feel very bad), in each of the following situations, which present the outcome of a penalty kick in an important game?

You jumped right and a goal was scored _____

You jumped left and a goal was scored _____

You stayed in the center of the goal and a goal was scored _____

Thank you very much for your help!

* The original questionnaire was given in Hebrew. Half of the subjects received another version in which the order of the possible answers to each question was changed.