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Evidence from a Natural Experiment**

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ABSTRACT

Sabotage in Tournaments: Evidence from a Natural Experiment*

Many tournaments are plagued by sabotage among competitors. Typically, sabotage is welfare-reducing, but from an individual's perspective an attractive alternative to exerting positive effort. Yet, given its illegal and often immoral nature, sabotage is typically hidden, making it difficult to assess its extent and its victims. Therefore, we use data from Judo World Championships, where a rule change in 2009 basically constituted a natural experiment that introduced one costless opportunity for sabotage. In Judo, competitors can break an opponent's attack in an unsportsmanlike manner; these are seen as acts of sabotage. Based on a unique dataset of 1,422 fights, we find that the rule change in 2009 has led to a large increase in the use of sabotage. Moreover, sabotage is more likely to be employed by relatively less qualified individuals, and to be targeted at more qualified ones. From a survey among spectators, we show that sabotage is welfare-reducing.

JEL Classification: C93, D03, L83, M51, M52

Keywords: tournaments, sabotage, Judo, natural experiment

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1 Introduction

Tournaments such as races for job promotions, political office, or sports competitions are often plagued by sabotage among competitors. Instead of exerting positive effort to win the tournament, competitors may alternatively resort to sabotage, for instance through spreading malicious rumors about competitors, withholding important information, or by destroying a competitor's output. Sabotage is therefore typically welfare damaging, either in a direct way by reducing output or performance of competitors or indirectly if it reduces the agents' incentives to exert productive effort (Konrad, 2000; Carpenter et al., 2010; Harbring and Irlenbusch, 2011). While it seems obvious that sabotage is costly for organizations, it is due to its very nature hard to observe. Since sabotage is typically associated with illegal – or immoral – and punishable activities, those who engage in it will try to hide their activities. Therefore, it is hardly possible to collect clean, disaggregated data on sabotage at the individual level from organizations. Using the words of Charness and Levine (2004, p. 1), “because sabotage breaks rules it is difficult to study in the field”.

So far, two prominent approaches have been used in the literature to examine sabotage empirically. The first one is to resort to controlled laboratory evidence, where sabotage can be observed by the experimenters. Several experiments have found that sabotage increases with the prize spread in a tournament (Harbring and Irlenbusch, 2005, 2008, 2011; Falk et al., 2008) and that sabotage has disincentive effects on tournament participants (Carpenter et al., 2011). Interestingly, Charness et al. (2011) have shown that sabotage can even occur in the absence of material incentives as a result of status-seeking behavior. The second approach is to use data from sports tournaments, where behavior is observable and well recorded. For instance, Garicano and Palacios-Huerta (2005) and del Corral et al. (2010) have studied how an increase in the points awarded for victory in soccer tournaments has affected the incidence of fouls, yellow cards (booking) and red cards (immediate dismissal) and the number of defensive players in a team. Their main finding has been that stronger incentives have increased the defensive play of teams and the incidence of fouls and thus yellow and red cards.

In this paper we also use data from a sports tournament, in particular from Judo World Championships, in order to examine the response of sabotage to changes in its cost structure, as well as its relationship with a number of personal characteristics such as (relative) ability and gender. To our knowledge, this is the first paper presenting field evidence on the interplay between the cost and the extent of sabotage. While previous experimental and field studies

from soccer have examined how the prize for winning a contest affects sabotage activities, the cost side of sabotage has not received attention yet. From a legal perspective, however, it seems straightforward that jurisdictions are primarily concerned with how to determine penalties for sabotage and less so with intervening in the prize spread between winner and loser prizes in competitions. Likewise, organizations can easily adapt internal rules of conduct to change the expected cost of sabotage, for instance by monitoring more closely employees' activities or by threatening certain types of behavior with dismissal.

The use of data from Judo competitions has a number of advantages for the study of sabotage in tournaments. First, the rules are such that one can distinguish between “productive activities” aimed at winning the fight through a positive technical score, in the best case an *Ippon* (the equivalent of a knock-out in boxing), and “destructive activities” intended to hinder the opponent's attack, which are penalized (called *shido*) if they are judged to be against the rules of the game. We will treat such “destructive activities” as a form of sabotage. Second, a change in the rules, effective since 2009, has provided fighters with an opportunity for one costless act of sabotage. Comparing data before and after the rule change allows studying the impact of a different cost structure on the use of sabotage in what is in effect a natural experiment (List and Reiley, 2008). Third, Judo is an individual sport, which means that – contrary to soccer or other team sports – there is no public goods dimension to sabotage that may distort the incentives to execute sabotage. In the case of team sports, sabotage may be beneficial for the team as a whole, but detrimental to the team member executing it. Then, sabotage can be seen as contributing to a public good, with the usual free-rider problems linked to it. For this reason, Judo as an individual sport seems to be closer to the kind of tournaments that the literature on sabotage has typically occupied itself with, namely tournaments among individuals for jobs or promotions in the workplace.

On the basis of a unique dataset of 1,422 Judo fights from two consecutive World Championships – the last one before the rule change (2007) and the first one with the new rules (2009) – we have arrived at the following main results. First, we observe a considerable increase in the use of sabotage following the rule change in 2009. This indicates that Judokas responded to the change in the cost of sabotage in the expected way. Second, we find strong evidence that sabotage is more likely to be used by relatively less competent individuals, and to be targeted at more competent individuals. Competence is measured by means of the Judokas' world ranking.¹ Third, we have examined the welfare implications of sabotage,

¹ This second finding is consistent with laboratory evidence from Charness et al. (2011), where sabotage is strongly negatively correlated with a subject's competence. Hence, our findings from the field are complementary to experimental evidence and support the experiment's external validity.

complementing our dataset with a survey administered on 115 spectators of a Judo Grand Prix. The competition data and survey responses clearly support the welfare reducing effect of *shido*, implying that the rule change in 2009 had a negative impact on spectator welfare.

The findings of this paper can be extended beyond the domain of sports, given that there is a close link between on- and off-the-field behavior of athletes, and there is an increasing mutual transmission of values and patterns of behavior between sports and other areas of society (Eitzen, 1999). More generally speaking, our findings can help advance the understanding of various factors that determine how individuals resort to sabotage. The evidence that sabotage responds to changes in its cost for the saboteur is useful information for the way in which internal control mechanisms are set up in the workplace. Much in line with Becker's (1968) theory on crime and punishment, our data suggest that rule-breaking behavior can be discouraged through increases in the penalties – and hence in the expected cost of such behavior. On a different issue, our results relate sabotage to ability and suggest that the more competent individuals are also more likely to be its victims. Of course, this is bad news for aggregate productivity, if the output of the most productive members of an organization is targeted by counterproductive activities.

The rest of the paper is organized as follows. In section 2 we give some background information on Judo and its rules, including details on our measure of sabotage in this context and on the recent rule change. Section 3 presents our dataset and the main results of the paper. Section 4 concludes.

2 Judo: General information and rules

2.1 A noble sport with a long history

While the origin of Judo as the “gentle way” of self-defense is rooted in the ancient martial art of Jiu Jitsu, Judo was established as a genuine sport in Japan in 1882, and it has been an Olympic Sport since 1964. Today, the International Judo Federation (IJF) has 200 member nations, and participants in World Championships or Olympic Games are typically paid professionals. Demanding high standards of the athletes in terms of skill, technique and timing, Judo can be regarded as one of the most challenging sports regarding physical strength and agility. Beyond that, however, respectfulness, self-discipline and the aspiration towards improvement are the basic ideals, which constitute the so-called “Spirit of Judo” according to the statutes of the IJF (see www.ijf.org). These basic principles should not only govern the Judokas' behavior in sporting competitions, they should also translate into guidelines for

everyday life. As mentioned in the preamble of the IJF statutes, “*Judo is a [...] sport in which the mind controls the expression of the body and is a sport which contributes to educating individuals*”.²

2.2 Description of the basic rules

The rules of Judo are set by the IJF and enforced by three referees in every fight.³ There are four different types of scores awarded for positive effort: ranked from highest to lowest they are called *Ippon*, *Waza-ari*, *Yuko* and *Koka*. These scores are given for legitimately throwing or holding the opponent on his back on the mat with control (*Osaekomi-waza*). An *Ippon* is given for a perfectly executed technique, a 25-second *Osaekomi-waza*, or in case a contestant gives up, and it leads to immediate victory (equivalent to a knock-out in boxing). A *Waza-ari* is awarded when one of the elements of the throwing technique is missing, or when the *Osaekomi-waza* lasts for 20-24 seconds. Two *Waza-ari* sum up to an *Ippon* and thus lead to immediate victory. When two elements are missing from the technique, e.g., when one throws his opponent on his side, or holds him down for less than 20 seconds, a *Yuko* is awarded. Finally, the lowest score (*Koka*) is given when one contestant with control throws the other onto one shoulder, his thigh(s), or buttocks, or by *Osaekomi-waza* for 10 to 14 seconds.

The scores are lexicographic, so that – unless a fight has already been decided by an *Ippon* or two *Waza-ari* – the winner is the fighter with the score of higher rank at the end of the fight. In other words, no matter how many *Yuko*, respectively *Koka*, one collects, their score will be inferior to one *Waza-ari*, respectively one *Yuko*.

In addition to these positive scores, penalties are given to fighters who breach the rules of contest. There are two types of penalties, called *shido* and *Hansoku-make*. For a slight infringement, a contestant receives a penalty of *shido*, which is automatically converted into a positive score in favor of the opponent. The first *shido* leads to a *Koka* for one’s opponent, the second one replaces this *Koka* with a *Yuko*, and so on (see Table 1). It is then obvious that, when a fighter picks up four *shido*, he immediately loses the fight since the four penalties sum up to an *Ippon* for his opponent. Grave infringements are punished with the penalty of *Hansoku-make*, which results in direct defeat as well as disqualification from the entire tournament. Actions that are dangerous for the opponent or the athlete himself are classified as grave infringements.

² See http://www.ijf.org/editor_up/up/STATUTS_angol.pdf.

³ See http://www.ijf.org/IJF_Referee_Rules/English_Version_/English_Version.

Table 1 about here

The regular contest time (at the adult level) is five minutes if none of the fighters manages to score an *Ippon*. In the event of a tie, a “golden score” rule is applied, which means that the fight continues and the first athlete who picks up a positive score is declared the winner of the fight. In all Judo tournaments, contestants are divided into seven weight classes per gender, ranging from 60 kg or less (extra light weight) to 100 kg or more (heavy weight) for men, and from 48 kg or less to 78 kg or more for women. The competitions in each weight class are held on a single day. The tournament format in Judo is called elimination system with double repêchage. The Judokas are placed by random drawing in two tables and an elimination system is used to determine the two finalists in each weight class. The contestants previously defeated by the four semi-finalists take part in the repêchage (i.e., the “second chance”) of their respective table, and they fight for the bronze medal against the loser of the semi-final fight of the other table. The latter rule implies that two bronze medals are awarded.

The rules underwent a considerable change by the IJF at the beginning of 2009: *Koka*, the previously lowest score, was abolished, turning *Yuko* into the lowest score as of January 1st, 2009. As a consequence, the first collected *shido* became a free warning under the new rules (see Table 1). Since we will interpret *shido* as sabotage, the free warning is seen as equivalent to one opportunity for a costless act of sabotage, which we will exploit when we analyze individual behavior in section 3.2.

2.3 The *shido* as an act of sabotage

As already mentioned above, the *shido* is a penalty given for an infringement of the rules of Judo. We believe that the *shido* should be seen as an act of sabotage. Based on the definition of Lazear (1989), sabotage in a competition refers to “any (costly) actions that one worker takes that adversely affect the output of another” (p. 563). In the context of a Judo fight, the *shido* is the result of a – typically costly – action taken by one Judoka in order to adversely affect the opponent’s productive effort, which in this case is his positive technical score. For example, a *shido* is given when a fighter “kicks the hand or arm of the opponent to make him release his grip”, “bends back the opponent’s finger in order to bend his grip”, “adopts an excessively defensive posture”, takes various actions that “prevent action in the contest”, shows “non-combativity”, “holds the opponent’s sleeve end(s) for a defensive purpose”, goes

outside of the contest area, etc.⁴ These actions are clearly aimed at illegitimately hindering the opponent's attack, thereby reducing the opponent's chances at improving his output through a positive technical score, without contributing anything to one's own technical score. In section 3.2 we will examine how the change in the cost of the first *shido* since 2009 has affected the likelihood of *shido*. Our hypothesis is that a cost reduction will lead to more *shido*.

Another feature of sabotage is that, by reducing the opponent's productive output, it aims at increasing one's chances of winning a competition. A *shido* can be interpreted in this way, as it may prevent a direct defeat through *Ippon*. Notice that, as long as the fight is continuing, it is always possible for the fighter lagging behind in terms of technical scores to win the match, even in its last second, if he manages to score an *Ippon*. This is due to the lexicographic winning rule. In that sense, a *shido* allows a fighter to stay in the game by avoiding a knock-out move by his opponent, and therefore can be seen as an effort to increase one's chances of winning. In section 3.3 we will analyze how a fighter's and his opponent's ability are related to the use of *shido*, thus examining in particular at whom sabotage is targeted. Our hypothesis is that *shido* should be more often employed by less qualified and more often targeted at more qualified subjects.

One last important feature that must be taken into account when drawing the parallel between sabotage in Judo and sabotage in organizations is the effect of sabotage on welfare. In section 3.4 we will use the occurrence of positive scores resulting from legitimate attacking techniques as a proxy for spectator welfare, and we will show that *shido* are indeed welfare reducing.

3 Results

3.1 Structure of the dataset and summary statistics

Our dataset includes all fights from the World Championships of 2007 (held in Rio de Janeiro) and 2009 (held in Rotterdam). We chose the World Championships because they are the largest and most important international competitions for which data are available under the old as well as under the new rules. The Olympic Games are arguably the most prestigious competition, but they have not yet taken place under the new rules.

⁴ Source: <http://judoinfo.com/penalty.htm>.

With the help of IJF employees, we were able to collect data on all 1,422 fights that took place in both World Championships. This means we have 2,844 observations, since each fight provides data on the individual behavior of two Judokas. Each observation consists of the following variables: personal information (name, gender, age, nationality, position in world rankings, weight class), summary information about the fight (duration, final score, winner, winning technique, golden score), and detailed information on the timeline of the fight. The latter includes the scores and penalties given to a fighter and the precise time (in seconds) at which an event occurred. For reasons of comparability and consistency across fights, we restrict ourselves to the first five minutes in each fight, meaning that for the 99 fights (out of 1,422) that were decided after golden score we only consider events during regular time.⁵

Table 2 presents summary statistics, broken down by tournament⁶ and including in its third column also the total figures. The first six rows refer to the score that was pivotal for determining the winner, i.e., the score that made the difference between the two fighters. While we see that the majority of fights ended abruptly with an *Ippon* (about 60%), a sizeable share of about 33% of fights was decided based on the score after the five minutes of regular contest time. About 7% of fights were tied after five minutes and thus decided by golden score.

Table 2 about here

For each score, we have data on whether it was the result of a fighter's own (positive) effort or the result of one or more *shido* given to the opponent. This allows us to identify those fights in which *shido* was pivotal for the outcome, in the sense that the decisive difference in the final scoreline between the two opponents was the result of a *shido*. The sixth row of Table 2 shows that these fights account for approximately 13% of the total number of fights.

⁵ We also exclude fights in which one of the two contestants either did not turn up or forfeited due to injury.

⁶ Note that before 2009, all losers to the four semi-finalists were allowed into the repêchage, while since 2009 only the losers in the quarter-finals were admitted to the repêchage. As a consequence, there have been fewer fights in the repêchage since 2009. This is one of the reasons why we have fewer observations from 2009 than from 2007 in our dataset. We have examined the robustness of our results if we apply the repêchage-rules since 2009 to the 2007-data and have found qualitatively the exact same results. These robustness checks are available upon request.

3.2 Consequences of changing the cost of *shido* in 2009

Since 2009, every fighter has the opportunity for one costless *shido*. In other words, the marginal cost of the first *shido* is zero, but from the second *shido* onwards the marginal as well as total cost is the same as under the old rules. Hence, if fighters react to the rule change, we should observe fewer cases where a fighter commits *no shido* at all. As Figure 1 shows, the proportion of fighters who did not commit any *shido* dropped sharply after the rule change, from 66.3% to 42.3% ($p = 0.000$, χ^2 test). Accordingly, the mean number of *shido* increased under the new rules, from 0.46 to 0.99 per observation ($p = 0.000$, Mann-Whitney test). This finding is also supported by econometric evidence presented in section 3.3. Thus, exploiting the recent rule change allows us to formulate the first finding of our paper: individuals react to lower costs of sabotage by increasing its use.

Figure 1 about here

Looking at the rule change from a slightly different angle, the set of costless *shido* increased from $\{0\}$ in 2007 to $\{0,1\}$ in 2009. When we compare the number of observations with zero *shido* in 2007 against those with zero or one *shido* in 2009, we find that the proportions are not significantly different from each other (66.3% vs. 69.7%; $p = 0.259$, χ^2 test). This provides further support for our hypothesis that individuals take the cost of sabotage into account when deciding on their strategies and that they react as predicted to changes in the cost structure.

Despite being much lower than in 2007, the proportion of observations with zero *shido* in 2009 still seems surprisingly high at 42.3%. When given the opportunity for one costless *shido*, why would not all fighters take advantage of it? Part of the answer lies in the fact that many fights are decided by *Ippon* before the 5 minutes of regular contest time are over, so that fighters often do not pick up a *shido*, although they might have done so in the full course of a fight. In fact, 59.5% of all fights in our sample were decided by *Ippon*. If we exclude these fights and recalculate the proportions shown in Figure 1, the proportion of zero-*shido* observations in 2009 is only half as high as before, at 23.3%. The corresponding figure in 2007 is again significantly higher than in 2009, at 49.6% ($p = 0.000$, χ^2 test).

While we have correctly anticipated that the number of observations with zero *shido* would decline in 2009 and that, accordingly, the mean number of *shido* would increase, it is not clear how the rest of the distribution (i.e., observations with more than one *shido*) should look like under the new rules. If individuals had perfect foresight into the future and could

choose optimally the number of *shido* that maximizes their chances of winning a given fight, then the number of fights with two or more *shido* should not differ across the two rule regimes, because there is no difference in the cost of the second, third or fourth *shido*. In other words, we should only observe a shift from the first bar in Figure 1 (zero *shido*) towards the second bar (one *shido*). However, while the proportion of observations with one *shido* has indeed increased significantly, albeit only mildly (23.7% vs. 27.4%; $p = 0.027$, χ^2 test), there has been a large increase in the cases of two, three or four *shido* (10% in 2007 vs. 30.3% in 2009; $p = 0.000$, χ^2 test).

An explanation for this pattern could be the following. If the first *shido* is costless, a fighter might be more likely to resort to it the first time that he finds himself in a difficult situation, instead of risking a positive score (in the worst case an *Ippon*) for his opponent. If this conjecture holds true, a fighter may continue picking up additional *shido* depending on the situation and the needs of his strategy, so that, in the end, we end up with a pattern like the one shown in Figure 1.

In order to pursue this line of reasoning, we look at the mean time that it takes a Judoka to resort to a *shido* for the first time during a fight. Indeed, we find that the mean time to the first *shido* (conditional on there being at least one) falls from 138.9 seconds under the old rules in 2007 to 107.4 seconds in 2009 ($p = 0.000$, Mann-Whitney test). Another way of looking at this is by means of the cumulative distribution function of the time to the first *shido* over the 300 seconds of a fight. Figure 2 shows the results. The 2009 distribution stochastically dominates that of 2007, confirming that sabotage was used earlier after the introduction of the new rules in 2009.⁷

Figure 2 about here

In order to account for the possibility that the increase in sabotage between 2007 and 2009 is due to a general trend in Judo – and not due to the rule change in 2009 –, we collected data on the average number of *shido* per observation for the World Championships from 1995 to 2005. The evolution over time is shown in Figure 3. It turns out that the mean number of *shido* was actually showing a downward trend between 2003 and 2007, i.e., before the rule change. Then, after the rule change in 2009, this trend was reversed and we observe the strong surge documented in our data. Thus, we can confidently say that the observed increase in the

⁷ In the appendix we also show (in Figure A1) the cumulative distribution function of the occurrence of any *shido* (not just the first one). Again, the distribution for 2009 first-order stochastically dominates the distribution for 2007, confirming that *shido* were used, in general, earlier after the rule change in 2009.

number of *shido* per observation in 2009 has not been the result of a general upward time trend and that, if anything, this increase may be underestimating the true effect of the rule change.

Figure 3 about here

In addition to the number of *shido* per fighter, we also present in Figure 3 the evolution of the time to the first *shido*, to rule out the possibility that our findings are due to time trends. The pattern is qualitatively the same: the time to first *shido* was actually showing an upward trend between 2003 and 2007, before falling sharply in 2009 after the rule change. Hence, our data strongly support the finding that the natural experiment of making the first *shido* costless since 2009 has led to more *shido* and to an earlier use of them.

3.3 Sabotage and competitors' qualification

Next we are going to examine how the use of sabotage is related to the competitors' qualification and other characteristics. In order to create a measure of the Judokas' qualification or competence, we reconstructed every fighter's position in the world ranking list at the time when a tournament took place (i.e., in 2007 or 2009). The world ranking list is based on each fighter's four best results during the most recent two-year period, with points allocated on the basis of performance in a tournament, adjusted for the importance of the tournament. Using this ranking, we then created a normalized measure of an athlete's ability within the weight class that he or she is competing in a given competition. This variable, called *ability*, is 0 for the lowest-ranked athlete in a weight class and 1 for the highest-ranked athlete.⁸

Looking at the correlations between ability and the number of *shido*, we document that the latter is increasing in the opponent's ability (correlation between opponent's ability and own number of *shido*: $\rho = 0.15$, $p = 0.000$). This result suggests that sabotage is more likely to be targeted at the more competent individuals in a tournament. At the same time, we find a negative correlation between own ability and number of *shido*, which implies that sabotage is more likely to come from less competent individuals, all else equal ($\rho = -0.04$, $p = 0.039$).

The two ordered probit regressions in Table 3 explain the use of sabotage (number of *shido*) based on a fighter's own ability, on his (her) opponent's ability, the rule regime (old

⁸ The *ability* measure is defined exactly as $1 - (\text{rank}-1)/(n-1)$, where n is the number of participating fighters and *rank* a fighter's ordinal ranking within the set of participants.

versus new rules) and the athlete's gender. Both specifications use standard errors clustered by fight, to account for the fact that the two observations per fight are not independent of each other.

Table 3 about here

The first noteworthy result is that the regressions confirm the strong positive response of the use of *shido* to the lower cost under the new rule regime (coefficient on the variable *new rules*). Moreover, in model (1) we see a significantly negative (positive) effect of own (opponent) ability on the number of *shido* committed, with the effect of the opponent's ranking being substantially stronger than that of an athlete's own ranking. In model (2), the effects of own and opponent's ability on sabotage are given by the joint coefficients, *ability + ability * new rules*, respectively *opponent's ability + opponent's ability * new rules*. Both of these joint coefficients are statistically significant at the 1% level according to a Wald-test. The insignificant interaction terms reveal that the reaction of athletes to the rule change did not vary by ability level. Our results also show that there is no significant gender effect in the use of sabotage, nor is the reaction of women to the introduction of the new rules statistically distinguishable from that of men (captured by the insignificant interaction term *female*new rules* in the second column).

3.4 Welfare effects of the *shido*

So far, our results draw a clear pattern. With the introduction of the new rules in 2009, the use of *shido* became more frequent. But what are the welfare implications of this rule change? Such a question does not have an obvious answer in the context of a sports tournament. Since we are dealing with a zero-sum game between the two Judokas, we can abstract from their welfare – which arguably only depends on victory. Instead, we examine how spectators perceive the game and how changes in the number of *shido* affect their welfare.

To this end, we have conducted a survey among spectators of a major Judo tournament, the Judo Grand Prix⁹ held in November 2011 in Amsterdam. A research assistant collected survey responses from 115 spectators. The full questionnaire and mean answers are given in the appendix.

⁹ The hierarchy of Judo tournaments (with respect to the number of points that can be gained for the world ranking) is Olympic Games, World Championships, Grand Slam, Grand Prix, World Cups and Continental Championships.

Our conjecture is that spectators dislike *shido*, and that they prefer to watch actions and techniques by the two athletes leading to the award of positive scores; after all, these techniques are what Judo is about. On the contrary, scores awarded on the basis of *shido* do not provide any sort of spectacle and normally should not add to the satisfaction of the audience. The survey responses to three key questions confirm this intuition. On a scale of 1 to 5 – where 1 indicates strong disagreement and 5 strong agreement – the mean response to the item “*I would like to see as many shido in a fight as possible*” is 1.47. Conversely, the mean response to the item “*I prefer to see Waza-ari and Yuko that are the result of an attack, not the result of a shido*” is 4.16, and the item “*I am happy when a fight is decided by Ippon*” collects a mean response of 4.55.

Accordingly, in order to assess the impact of the increased use of *shido* since 2009 on spectator welfare, we compare the share of fights that were decided through positive scores (*Ippon*, *Waza-ari* or *Yuko*) in 2007 and in 2009 (see Table 1).¹⁰ It turns out that there was a significant drop in this share between 2007 and 2009, from 79.6% to 75.1% ($p = 0.049$, χ^2 test). Similarly, if we compare the total number of these positive scores awarded during the course of a fight in 2007 and 2009, we find that it decreased from an average of 1.31 scores per fight to an average of 1.21 scores per fight ($p = 0.044$, Mann-Whitney test). Combined with the survey responses, these findings suggest negative welfare effects of the *shido* when one defines welfare in terms of spectator satisfaction, and hence they lend further support to our view of *shido* as a means of costly, welfare-reducing sabotage in a tournament.

4 Conclusion

In this paper, we have examined how the individual use of sabotage responds to changes in its cost structure. While previous experimental and field studies from soccer have examined how the prize for winning a contest affects sabotage activities (Harbring and Irlenbusch, 2011; del Corral et al., 2010), the cost side and its influence on the incidence of sabotage has not received attention yet. Hence, we consider our paper as the first one presenting field evidence on the interplay between the cost and the extent of sabotage.

We have exploited a natural experiment in Judo that arose as the result of a rule change in the cost of sabotage activities from 2009 onwards. Prior to this date, illegitimate techniques were punished immediately, while since 2009 the first infringement of rules has

¹⁰ We do not include fights that were decided through *Koka*, as this was not possible in 2009.

been treated by a costless warning. We have interpreted the *shido* in Judo as an act of sabotage. According to Lazear (1989), sabotage in a competition refers to “any (costly) actions that one worker takes that adversely affect the output of another” (p. 563). In the context of a Judo fight, the *shido* is the result of a – typically costly – action taken by one Judoka in order to adversely affect the opponent’s productive effort that aims at receiving a positive technical score.

Based on 1,422 fights from two Judo World Championships in 2007 and 2009 we have found that the change of rules in 2009 has increased the number of *shido* significantly. As an important complementary result we have also found that the time to the first *shido* has been reduced by about 30 seconds, leading to more observations of two or more *shido*. As a consequence, the relative frequency of fights that are decided by negative scores through *shido* has increased from 10.6% in 2007 to 17.3% in 2009 ($p = 0.000$, χ^2 test). The reverse side of this finding is that fewer positive scores have been observed in 2009 than in 2007. From a survey among spectators we have reasons to believe that fewer positive and more negative scores are welfare reducing from the viewpoint of spectators. Hence, the rule change by the International Judo Federation has not only changed the characteristics of fights (more and quicker *shido*; fewer positive scores), but arguably also the perception and well-being of spectators. Therefore it seems well justified to summarize that the change in the cost of sabotage has had a profound impact on the tournament.

We have also found that sabotage activities are significantly more often targeted at more qualified agents, measured by means of a Judoka’s world ranking, and they are less often used by better Judokas. This is certainly an intuitive finding. However, it is exactly the type of finding that worries organizations around the globe, namely that destructive activities will negatively affect the best performers, something that can bear high costs for the profits of a company, or – in a different context – for the quality of candidates in electoral campaigns. Our field study has provided strong evidence that these worries may be well justified. Moreover, we have shown that the worries will be exacerbated if the costs of sabotage are reduced, since agents react systematically to incentives, such as a change in sabotage costs. For this reason, internal control mechanisms in companies that try to monitor and discourage sabotage are very important to prevent losses in productivity that may arise if the output of the most productive members of an organization is targeted by counterproductive activities.

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Tables and Figures

Table 1: Conversion of *shido* into positive scores

	2007	2009
<i>shido</i> #1 translates into:	<i>Koka</i>	free warning
<i>shido</i> #2 >>	<i>Yuko</i>	<i>Yuko</i>
<i>shido</i> #3 >>	<i>Waza-ari</i>	<i>Waza-ari</i>
<i>shido</i> #4 >>	<i>Ippon</i>	<i>Ippon</i>

Table 2: Summary statistics. Reported values are numbers of fights, percentages over total in brackets

pivotal score	2007	2009	Total
<i>Ippon</i>	511 (58.9)	335 (60.4)	846 (59.5)
<i>Waza-ari</i>	80 (9.2)	38 (6.8)	118 (8.3)
<i>Yuko</i>	99 (11.4)	44 (7.9)	143 (10.1)
<i>Koka</i>	27 (3.1)	n/a	27 (1.9)
<i>Hansoku-make</i>	1 (0.1)	0 (0.0)	1 (0.1)
<i>shido</i>	92 (10.6)	96 (17.3)	188 (13.2)
fight ended in draw	57 (6.6)	42 (7.6)	99 (7.0)
total number of fights	867	555	1,422
women's fights	356 (41.1)	223 (40.2)	579 (40.7)

Table 3: Sabotage and athletes' characteristics

Dependent variable: number of *shido*. Ordered probit regressions, dependent variable takes integer values between 0 and 4.

	(1)	(2)
<i>ability</i>	-0.181 *** (0.061)	-0.093 (0.080)
<i>opponent's ability</i>	0.487 *** (0.063)	0.422 *** (0.081)
<i>new rules</i>	0.672 *** (0.051)	0.718 *** (0.117)
<i>ability * new rules</i>		-0.199 (0.123)
<i>opponent's ability * new rules</i>		0.147 (0.127)
<i>female athlete</i>	-0.043 (0.051)	-0.015 (0.068)
<i>female * new rules</i>		-0.061 (0.103)
prob. > χ^2	0.000	0.000
p (<i>ability</i> + <i>ability * new rules</i> = 0)		0.002
p (<i>opponent's ability</i> + <i>opponent's ability * new rules</i> = 0)		0.000

$N = 2,844$. Standard errors in brackets, clustered by fight. *** denotes significance at the 1% level.

Figure 1: Distribution of the number of *shido* per observation, by rule regime



Figure 2. Cumulative distribution functions of first *shido* during the course of the fight, 2007-2009.

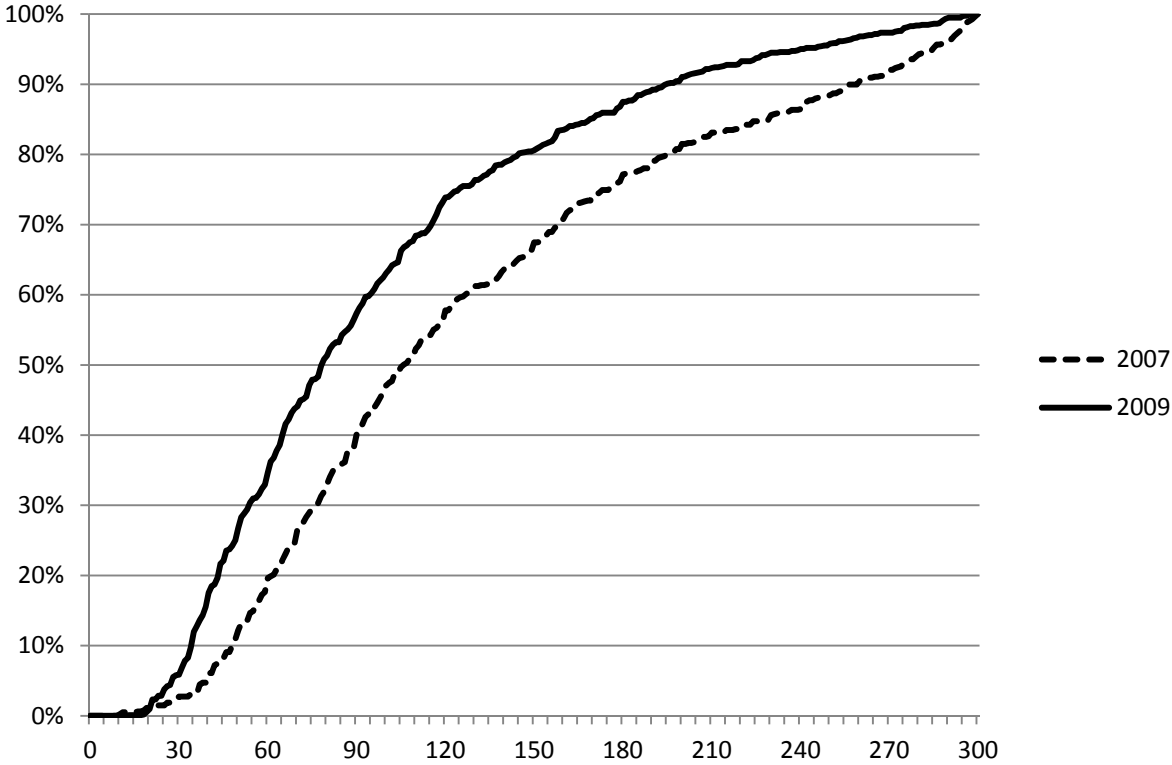
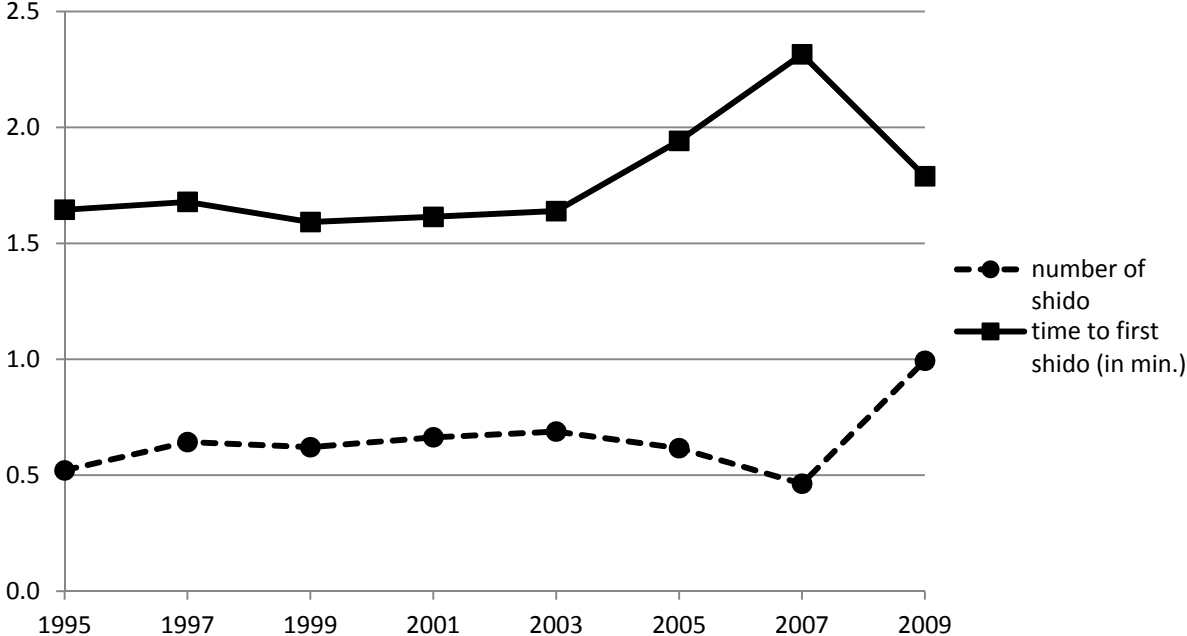


Figure 3: Evolution of number of *shido* and time to first *shido*, World Championships 1995-2009



Appendix

Spectator Survey [including mean response values and number of observations per response]

Good morning/afternoon. We are a research team from the University of Innsbruck, Austria. In agreement with the IJF, our team is conducting a survey on Judo.

We would be grateful if you could spare 2-3 minutes to answer a few questions about your views on Judo and some of its rules.

1. Please indicate the following: (N=115)

Age: _____ (mean age: 37.5 years)

Gender (male/female): _____ (62% male)

Nationality: _____

2. Are you familiar with the rules of Judo? (N=115)

No, not at all	5%
Only a little	21%
Quite familiar	24%
Very familiar	50%

3. [If the answer to (1) is other than NO, NOT AT ALL]:

As a neutral spectator, state the degree of your agreement/disagreement with each of the following statements on a scale of 1 to 5 (where 1=strongly disagree; 2=disagree; 3= neither agree, nor disagree; 4=agree; 5=strongly agree)

I am happy when a fight is decided by Ippon	4.55 (N=83)
I would like to see as many Waza-ari and Yuko in a fight as possible	3.60 (N=82)
I prefer to see Waza-ari and Yuko that are the result of an attack, not the result of a shido	4.16 (N=82)
I usually prefer the underdog to win and advance to the next round, and not the favorite	2.65 (N=81)
I do not mind it when the fighters are very defensive or try to avoid action	2.12 (N=81)
I would like to see as many shido in a fight as possible	1.47 (N=81)
When there is an attacking move, I usually want it to be successful	3.90 (N=81)
I prefer to watch fights between famous Judokas, and not between outsiders	2.59 (N=81)

4. How often have you attended Judo tournaments in the past? (N=115)

Never before	17%
1 time	9%
2 – 4 times	16%
> 4 times	59%

5. Have you ever practiced Judo yourself? (N=115)

No, never	34%
Yes, but only at an amateur level	50%
Yes, at a professional level (took part in national competitions)	17%

Figure A1: Cumulative distribution functions of all *shido* during the course of the fight, 2007-2009

