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# Do Financial Bonuses Reduce Employee Absenteeism? Evidence from a Lottery

## **Abstract**

This paper investigates the effectiveness of a lottery-based bonus reward system in reducing employee absenteeism. Starting in June 2002, a Dutch manufacturing firm held a monthly lottery for workers who had taken no sick leave in the previous three months and had not previously won the lottery. In a given lottery, each of seven contestants whose names were randomly drawn received 75 Euros. The authors find statistically significant differences in absence patterns across groups of workers with different eligibility statuses depending on their attendance records and whether they had previously won. One finding is that absenteeism rose among workers who, having won already, were ineligible for further participation. Nevertheless, and although the reduction in firm-wide absence associated with the lottery drifted from 2.4 percentage points to 1.1 percentage points after seven months, the authors conclude that the lottery was of net benefit to the firm.

# DO FINANCIAL BONUSES REDUCE EMPLOYEE ABSENTEEISM? EVIDENCE FROM A LOTTERY

WOLTER H.J. HASSINK and PIERRE KONING\*

This paper investigates the effectiveness of a lottery-based bonus reward system in reducing employee absenteeism. Starting in June 2002, a Dutch manufacturing firm held a monthly lottery for workers who had taken no sick leave in the previous three months and had not previously won the lottery. In a given lottery, each of seven contestants whose names were randomly drawn received 75 Euros. The authors find statistically significant differences in absence patterns across groups of workers with different eligibility statuses depending on their attendance records and whether they had previously won. One finding is that absenteeism rose among workers who, having won already, were ineligible for further participation. Nevertheless, and although the reduction in firm-wide absence associated with the lottery drifted from 2.4 percentage points to 1.1 percentage points after seven months, the authors conclude that the lottery was of net benefit to the firm.

A perennial question is how firms can most effectively use financial incentives to motivate workers and thereby boost productivity. In this paper we investigate this issue with respect to workplace absenteeism, which is a measure of lost productivity.<sup>1</sup> We

analyze the effectiveness of a monthly lottery incentive system established by a large Dutch manufacturer with the aim of improving work floor attendance. Such a system, if it is effective, holds the promise of both reducing disruption in production and lowering the costs associated with recruitment and compensation of substitutes.

The lottery was based on the following scheme. At the beginning of each month, the firm identified workers who had taken no sick leave in the previous three months. From this group, seven winners were selected at random. Each lottery winner received a coupon gift with a value of 75 Euros. Furthermore, the names of the winners were announced company-wide. Winners were excluded from future lotteries, regardless of

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The data used in this study are confidential, but special requests for limited analyses pertaining to this study can be made to the corresponding author, Wolter Hassink, Utrecht School of Economics, Utrecht University, Janskerkhof 12, 3512 BL Utrecht, The Netherlands; w.hassink@econ.uu.nl.

<sup>1</sup>Absence means that the worker is not present at the job, not counting vacation, bereavement, or a paid holiday. The proposition of our analysis is that a worker is able to choose his absenteeism to some extent. In

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the Netherlands, workers are generally not obliged to present a doctor's certificate when they report ill. In most cases, their employer will monitor them only after a few days of absence, which gives workers some room for shirking. From conversations with colleagues from abroad, we have learned that even a system requiring a doctor's certificate is not foolproof, because an employee can often influence the doctor's decision.

their subsequent sick leave records. Hence, lottery winners lost an incentive to reduce their sick leave. The setup of the lottery enables us to obtain and analyze information on absence during each of three stages: the period prior to the lottery; the period during the lottery, when a worker had not been selected as a winner; and the period after a worker had won the lottery.

The incentive scheme was characterized by three features that are largely unexplored in the literature on sickness absenteeism. First, this attendance bonus system was related directly to individual absence behavior. Only Jacobson (1989) has investigated a direct relationship between monetary incentives and work floor attendance. Using paired sample t-tests, he showed that absence among teachers in a particular school district in the State of New York declined significantly after introduction of the incentive plan. A few other empirical studies have investigated the impact on absenteeism of more general performance-related measures, such as bonuses and profit sharing (Wilson and Peel 1991; Brown et al. 1999; Engellandt and Riphahn 2004). All of these studies have found that incentive pay reduces absenteeism, but low-powered group incentives are not directly linked to absenteeism behavior. In the European context, where income and job protection provisions in some countries make it difficult to implement negative incentives for absenteeism, it is especially important to analyze the effects of rewards on absence.<sup>2</sup> It is thus surprising that so little research has addressed the issue. Empirical evidence consistently confirming the responsiveness of absenteeism to negative financial incentives

cannot be generalized to the effectiveness of bonus schemes.<sup>3</sup> Carrots and sticks of the same size will not necessarily elicit the same response from workers (see, for example, Fehr and Falk 2002).

The second distinctive feature of the lottery incentive system is its probabilistic, game-of-chance nature. Quite apart from the lure of the potential winnings, which are modest, workers may take pleasure from participation in the lottery (Kahneman and Tversky 1979; Conlisk 1993). Lotteries may be cheaper than group rewards, as only a few members of the group actually need to be rewarded by the firm. Both of the two published academic studies of lotteries and attendance behavior find that absenteeism falls during the lottery intervention (Pedalino and Gamboa 1974; Stephens and Burroughs 1978). In our analysis, the lottery does not provide a range of financial rewards that we can use to gauge its incentive effect. Instead, we will argue that the pattern of workers' absences as a function of their eligibility for future lotteries can be used to evaluate the effectiveness of the incentive mechanism. In particular, we use records of sick leave taken in the past two months to identify three monthly states of absence, and demonstrate that workers in the group with no absences in the previous two months have the highest incentive to abstain from absence in the current month. In other words, reporting sick reduces the option value of participating in future lotteries. We calculate the change in absence that results from a transition across the three monthly states of absence.

The third feature of the lottery is that it may help illuminate whether a bonus incentive can have a persistent influence on absence

<sup>2</sup>For instance, although Dutch employers are obliged to continue to pay only 70% of gross earnings during sickness, most of the collective bargaining agreements between employers and employees stipulate that employers must supplement the benefits so that net earning levels are maintained (De Jong and Lindeboom 2004). Income protection for absenteeism is not a peculiarly Dutch phenomenon: in neighboring countries such as Germany and Denmark, most employees do not suffer an immediate wage drop when they go on sick leave. Sickness benefits are usually topped up by extra-legal arrangements laid down in collective labor contracts (Einerhand et al. 1995; Barmby et al. 2002).

<sup>3</sup>Absenteeism is inversely related to the unemployment rate. Since absence-prone employees are more likely than other workers to be laid off, the threat of being laid off has a disciplining effect, and employees are less likely to shirk when unemployment is high (for example, Leigh 1985; Kaivanto 1997). Absenteeism has also been shown to fall when employees experience a wage decrease at the conclusion of a spell of absence (for example, Barmby et al. 1991; Johansson and Palme 1996; Henrekson and Persson 2004; Arai and Skogman Thoursie 2005; Ichino and Riphahn 2005).

behavior. Can an incentive system such as the one we examine change individual absence even when the worker is no longer influenced by the incentive? Jacobson (1989) raised this question but left it unanswered.<sup>4</sup>

### The Firm

We focus on two plants of a firm we will call "Acme," a large Dutch manufacturer with capital-intensive technologies. Machines operate 24 hours a day, except for weekends and public holidays. Workers are employed in shifts, in order to keep the machines running. Consequently, absences are costly to the firm, since they can sometimes necessitate recruitment of additional workers at considerable cost. A majority of the work force can be characterized as blue-collar workers who are employed in low-level jobs. About 75% of the work force has a maximum monthly gross salary below 2,467 Euros (March 2002).

Acme acquired both of these plants on July 1, 2001. In the first months, Acme reorganized the departments and changed some of the job titles. The work force, which consisted of 419 workers in July 2001, declined by about 10% over the following seven months. Employment remained stable at 377 workers—with mild fluctuation around this average—from February 2002 onward. Shortly after the acquisition, the rate of sick leave ranged between 10% and 15%, which substantially exceeded the average in the Dutch manufacturing sector. This high absenteeism is evidently what induced the firm, in April 2002, to announce that a monthly lottery would begin in June 2002. The lottery reward for a winner was modest, representing an increment of 4–6% in monthly net pay. The lottery's introduction did not coincide with major employment reallocations by Acme of the kind that may influence absence

decisions (Røed and Fevang 2007; Dionne and Dostie 2007).

Our data were obtained from the individual personnel records of all workers for the period July 1, 2001–July 31, 2003. The dataset comprises an unbalanced panel of 481 workers. Furthermore, we observed the absence records of Acme workers on a daily basis over the same period. As the lotteries were organized on a monthly basis, we transformed the daily information into (a) a monthly rate of sick leave, defined as the fraction of working days a worker reported sick in a particular month, and (b) the monthly incidence of sick leave, a 0-1 variable defined by whether the worker reported sick at any time in the month, irrespective of the number of sick leave days taken. We use the latter as the dependent variable in the regression analysis. The transformation resulted in a data set of 9,637 monthly observations.

Figure 1 shows the development of both the monthly rate and the monthly incidence of sick leave over the period July 2001–July 2003. We observe a downward trend beginning in September 2001. It is unclear, however, if, and to what extent, this trend can be attributed to the lottery.<sup>5</sup> The figure also shows the quarterly rate of sick leave in the Dutch manufacturing sector over this period. In the first months, absenteeism was substantially higher in the firm than in the sector. It peaked at Acme in October and November 2001. The conclusions of our analysis are not driven by this peak, though.

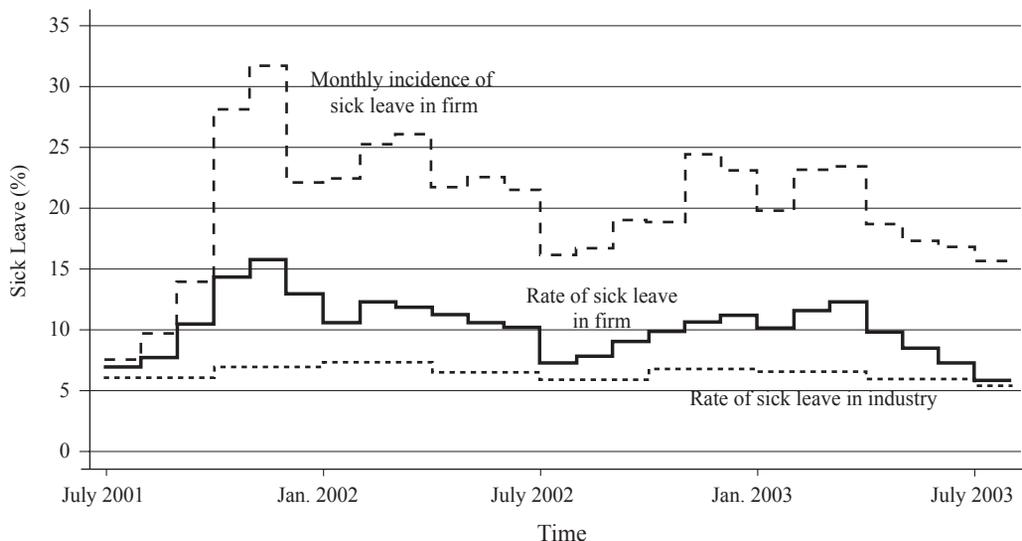
There are no statistically significant differences in the averages of observables of workers who were hired before and after the announcement of the lottery. Although the introduction of an incentive system may lead to inflow of less risk-averse workers (Lazear 2000), such a pattern seems unlikely to have occurred in this firm, as the lottery bonus was non-recurrent.

Next, we focus on the workers' eligibility for the lottery, for the period June 2002–July

<sup>4</sup>A complete evaluation of the incentive system should take account of externalities. If an incentive system does motivate workers not to report sick, one possible unintended consequence is that employees, failing to internalize the external effects of their sick leave decision, will come to the workplace when they are sick, infecting their co-workers and causing a net increase in absenteeism. We do not address this issue.

<sup>5</sup>A probit model of the monthly incidence of sick leave (corrected for all observable worker characteristics) indicates that sick leave was 1.7 percentage points higher in the period before the lottery was held.

Figure 1. Sick Leave in the Firm and the Industry, July 2001–July 2003.



2003. Figure 2 distinguishes three groups of workers: those who had won a previous lottery; those who had been on sick leave on any working day of the past three months; and the remaining workers, who were eligible for the lottery.<sup>6</sup> In July 2003, about 25% of the work force (93 workers) had won one of the lotteries. Over the fourteen-month period, the probability of being on sick leave in the past three months varied between 20% and 30%. Conditional on participating in the lottery, the probability of winning increased from 3.0% (August 2002) to 3.8% (July 2003). The number of eligible workers declined over time, so that the attractiveness of participation may have grown somewhat for workers who had not yet won the lottery.

### The Effect of the Incentive

We demonstrate that the opportunity to participate in future lotteries can influence

the decision to report sick in the current month. We introduce four monthly states.<sup>7</sup> In states  $k$  ( $k = 1, 2, 3$ ), the worker has not won the lottery so far, and the first lottery for which he may be eligible is  $k$  months ahead. State 4 refers to the absorbing state for workers who have won the lottery. The following vector results:

$$(1) \quad x_{m-1} = [(1-S_{m-1})(1-S_{m-2})E_m, (1-S_{m-1})S_{m-2}E_m, S_{m-1}E_m, 1-E_m],$$

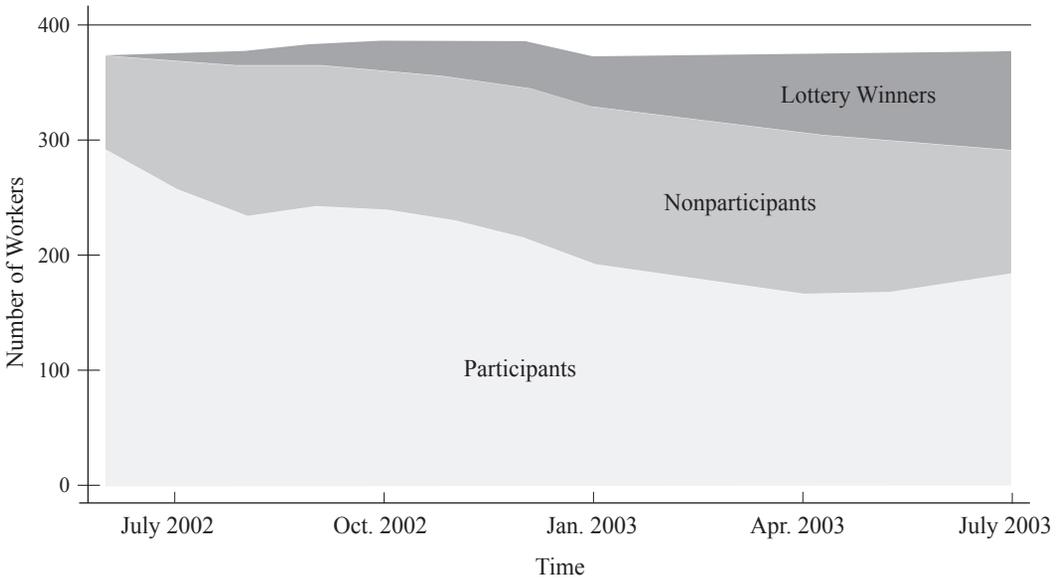
where subscript  $m$  refers to the  $m^{\text{th}}$  calendar month.  $S_m$  measures the monthly incidence of absenteeism; it is 1 if the worker has been on sick leave during the  $m^{\text{th}}$  month, 0 if not.  $E_m$  is 1 if the worker has not won any lottery up to (and including) the  $m^{\text{th}}$  month, and 0 in all other cases. In state 1, the worker has not been on sick leave in the past two months ( $S_{m-1} = 0, S_{m-2} = 0$ );<sup>8</sup> in state 2, the worker was

<sup>6</sup>The number of workers participating in the lottery was somewhat higher in June and July 2002. Shortly after the announcement, the scheme pertained to workers who had not been on sick leave in the past two months. Exclusion of June and July 2002 from the sample does not alter our conclusions.

<sup>7</sup>If workers are risk-neutral, it can be shown that the incentive effect will remain constant within a particular month (see the appendix in Hassink and Koning 2005).

<sup>8</sup>We have not modeled an additional state for  $k = 0$ , since workers who had not been on sick leave in the past three months could only participate in the first upcoming lottery (next month) when they abstained

Figure 2. Number of Participants, Nonparticipants, and Winners in the Lottery, June 2002–July 2003.



on sick leave two months ago ( $S_{m-1} = 0, S_{m-2} = 1$ ); in state 3, the worker was on sick leave in the previous month ( $S_{m-1} = 1$ ). Thus, given these states we define the following functions:

$$\begin{aligned}
 Z1_m &= (1 - S_{m-1})(1 - S_{m-2})E_m \\
 Z2_m &= (1 - S_{m-1})S_{m-2}E_m \\
 Z3_m &= S_{m-1}E_m
 \end{aligned}$$

As these functions are conditional on the incentive of one upcoming lottery, they add up to 1 for a worker who has not won the lottery:

$$(2) \quad Z1_m + Z2_m + Z3_m = 1 \text{ when } E_m = 1.$$

The matrix of transition across the four states:

$$(3) \quad M = \begin{bmatrix} (1-P_w)(1-P_1) & 0 & P_1 & P_w(1-P_1) \\ (1-P_2) & 0 & P_2 & 0 \\ 0 & (1-P_3) & P_3 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

from sick leave in the current month. In this respect, they did not differ from the other workers in state 1.

where cell  $(i, j)$  gives the probability of transition from state  $i$  to state  $j$ .  $P_k, k = 1, 2, 3$ , is the probability of reporting absent in state  $k$ , and  $P_w$  represents the probability of winning the lottery for eligible workers. The first row of  $M$  shows that workers remain in state 1 with probability  $(1 - P_w)(1 - P_1)$  when they do not report absent and do not win the lottery; absence leads to transition to state 3 with probability  $P_1$ ; winners move to state 4 with probability  $P_w(1 - P_1)$ . In state 2, workers move either to state 1 with probability  $1 - P_2$  (no absence) or to state 3 with probability  $P_2$  (absence). Workers remain in state 3 with probability  $P_3$  (absence) or move to state 2 with probability  $1 - P_3$  (no absence).

The incentive effect of the lottery is the pleasure of participation plus the expected value of winning (relative to the cost of not reporting sick). The expected monetary payoff of not reporting sick in the current month becomes  $P_w(1 - P_1)75$  Euros for a worker in state 1. Although it is small, due to the low probability of winning the lottery  $P_w$  (see Figure 2), the financial incentive may affect behavior at the margin. Workers may also

value the possibility of participating in (forthcoming) lotteries. Consequently, the motivation for not reporting absent in the coming month is highest in state 1, when there are the most opportunities to participate in forthcoming lotteries, and lowest in state 3, when the opportunities are fewest. In state 1 ( $Z1 = 1$ ), the worker may participate in the upcoming lottery held in the first working days of month  $m + 1$ , whereas in state 2 ( $Z2 = 1$ ) and state 3 ( $Z3 = 1$ ), the first possibilities are in month  $m + 2$  and month  $m + 3$ , respectively.

We generalize the incentive effect by including a monthly discount factor  $\rho$  that denotes the value the worker attaches to the two consecutive lotteries following the upcoming lottery. If  $\rho = 0$ , the worker values the upcoming lottery only, perhaps owing to what labor economists term myopia. If  $\rho = 1$ , the worker values the three upcoming lotteries equally.<sup>9</sup> The incentive is based on the discounted maximum number of possibilities of participation in the three upcoming lotteries, given that  $S_m = S_{m+1} = S_{m+2} = 0$ . The incidence of absence becomes a function of the state variables,<sup>10</sup>

$$(4) \quad S_m = [1 + \rho(1 - P_w) + \rho^2(1 - P_w)^2]Z1_m + [\rho + \rho^2(1 - P_w)]Z2_m + \rho^2Z3_m,$$

so that the incentive not to report absent is highest in state 1 and lowest in state 3.

The three state variables together measure the impact of the incentive system.

<sup>9</sup>Experimental studies often stress the importance of discounting and awareness of the incentive (Frederick et al. 2002). Within the context of the lottery, workers may not be fully aware of the consequences of their absenteeism on their participation in consecutive lotteries, or they may be interested in the upcoming lottery only. Discounting may occur as a result of time preferences, as well as with respect to the probability of reporting sick in the next (relevant) months. From this perspective, we may expect  $\rho$  to be higher for healthy workers.

<sup>10</sup>We calculated the discounted sum of three transitions from period  $m$  to period  $m + 2$ , for which there was no absence in each of these months. The three probabilities of absence in matrix  $M$  are captured by  $S_m$ . The incentive effect is the first element of the state vector in period  $m + 2$ .

### Empirical Implementation

The empirical analysis provides estimates of the effect of the three state variables  $Z1$ ,  $Z2$ , and  $Z3$  on  $S$ , with the state of the lottery winners as the reference group. As  $P_w$  is observed, there are three sources of information that (over-)identify  $\rho$  and the effect of the incentive system. The state variables are not strictly exogenous. We avoid the so-called initial conditions problem<sup>11</sup> by specifying the individual effect as the sum of a worker-specific error term,  $\alpha_i$ , and  $\bar{S}_i$ , which is the average worker-specific incidence of absenteeism over the  $M1 - 2$  months prior to the start of the lottery.<sup>12</sup>

We start with a reduced-form random effects probit model,<sup>13</sup>

$$(5) \quad S_{i,m} = \kappa_1 Z1_{i,m} + \kappa_2 Z2_{i,m} + \kappa_3 Z3_{i,m} + \beta_1' X_i + \beta_2' T_m + \gamma \bar{S}_i + \alpha_i + \varepsilon_{i,m},$$

$i = 1, 2, \dots, N; m = 0, 1, \dots, M,$

with

$$\bar{S}_i = \frac{1}{(M1 - 2)} \sum_{m=-M1}^{-3} S_{i,m},$$

where subscript  $i$  refers to the  $i^{th}$  worker. The first lottery was held in  $m = 0$ .  $X_i$  is a vector of time-invariant observable worker characteristics.  $T_m$  is a vector of calendar month dummies (13 dummies).  $\beta_1$ ,  $\beta_2$ , and  $\gamma$  are (vectors) of parameters. State 4, in which the lottery has ceased to motivate workers, is the reference group of the three included state variables (see equation (2)). The variables ( $Z1_{i,m}$ ,  $Z2_{i,m}$ ,  $Z3_{i,m}$ ,  $X_i$ ,  $T_m$ ) are assumed to be contemporaneously exogenous with respect to the idiosyncratic (i.i.d.) error term  $\varepsilon_{i,m}$ .

<sup>11</sup>We have not specified a logit model with fixed worker effects, as the time-varying state variables are not strictly exogenous. This is a necessary assumption for consistency of the estimates.

<sup>12</sup>The advantage of choosing this time interval is that  $\bar{S}_i$  (for July 2001–March 2002) and the state variables (for April 2002–July 2003) refer to non-overlapping periods.

<sup>13</sup>We did not apply a linear probability model with fixed worker effects, since preliminary estimates indicated that this specification yields an unacceptably high number of negative predictions of the dependent variable (about 36%).

The worker-specific random error term,  $\alpha_p$ , is independent of all explanatory variables and  $\varepsilon_{i,m}$ . We assume that  $\alpha_i \sim \text{Normal}(0, \sigma_\alpha^2)$  and  $\varepsilon_{i,m} \sim \text{Normal}(0,1)$ . Equation (5) is estimated over the  $M+1$  months of the lottery (that is, fourteen months, June 2002–July 2003) by maximum likelihood, which yields a consistent estimate of the regression parameters.<sup>14</sup>

The effects of the state variables are identified in equation (5), but they give no information about the size of  $\rho$ . We identify  $\rho$  by re-estimating the model,

$$(6) \quad S_{i,m} = \lambda Z_{i,m}^\rho + \beta_1' X_i + \beta_2' T_m + \gamma \bar{S}_i + \alpha_i + \varepsilon_{i,m},$$

$$i = 1, 2, \dots, N; m = 0, 1, \dots, M,$$

and imposing the following structural restrictions implied by equation (4):<sup>15</sup>

$$(7a) \quad \kappa_1 = 1 + \rho(1 - P_w) + \rho^2(1 - P_w)^2$$

$$(7b) \quad \kappa_2 = \rho + \rho^2(1 - P_w)$$

$$(7c) \quad \kappa_3 = \rho^2$$

Since equation (6) is strongly non-linear in its parameters, we apply a grid-search procedure, in which we choose the value of  $\rho$  that maximizes the log likelihood function.

To identify changes in absence after winning the lottery, we estimated equations (5)

and (6) for the subsample of winners. We introduce an additional explanatory variable,  $dur_{i,m}$ , which is defined as the number of months after winning the lottery and therefore has a value of zero as long as it has not been won. Endogeneity prevents inclusion of  $dur$  in an equation estimated for a sample of all workers, so that we can determine the effect of  $dur$  for winners only. As the month of winning is random conditional on winning one of the fourteen lotteries, we may assume that  $dur_{i,m}$  is strictly exogenous. Thus, we can include  $\bar{dur}_i$  (average over the period of estimation) to obtain Chamberlain's random effects specification of the probit model.

**Data**

In this section we describe the data selection and discuss the descriptive statistics of the variables used in the empirical analyses. The starting point is the broad data set of 9,637 observations from 481 workers that we described above. In order to obtain a sample for which it is possible to estimate equations (5) and (6), we selected observations as follows. First, we selected the observations from the period June 2002–July 2003, as the estimation period refers to the period in which the lotteries were held. 5,275 observations on 410 workers satisfy this criterion. Second, as equations (5) and (6) include  $\bar{S}_i$ , the average individual rate of absence prior to April 2002, we further restricted observations to the workers who were employed before April 2002. In addition, for each worker we must have at least two monthly observations, so that we can exploit the panel character of the sample. This restriction reduces the sample to 4,932 observations. Third, we excluded the monthly observations in which a worker was on sick leave on all working days of the previous month. Workers who suffer from long-term illness cannot respond to the incentive at all. We therefore assume that workers in protracted illness are not part of the population of workers who are capable of responding to the monthly lottery. This assumption is in line with Jacobson (1989). The selected sample we use for the empirical analysis consists of 4,650 monthly observa-

<sup>14</sup>The estimation period includes June 2002. The specification gives a more efficient estimate than that described in Wooldridge (2002:495), which is estimated for  $m = 1, \dots, M$  (that is, July 2002–July 2003). In this alternative specification, the individual effect is the sum of a random individual effect and the dependent variable in the first period of observation. We estimated the model at the monthly level, as it corresponds to the frequency of the lotteries and thus to the frequency of the state variables. It is sufficient to obtain a consistent estimate of the incentive effect. We have not estimated the model at the daily level, so that we abstract from end-of-the-month effects (Prendergast 1999). Daily data on absences would result in severe autocorrelation due to the persistence of absences across days. The use of monthly data avoids this pitfall.

<sup>15</sup>Thus,  $Z_{i,m}^\rho = [1 + \rho(1 - P_w) + \rho^2(1 - P_w)^2]Z1_{i,m} + [\rho + \rho^2(1 - P_w)]Z2_{i,m} + \rho^2Z3_{i,m}$ . This equation is used from July 2002 onward. In the starting-up period of the lottery the incentive is  $Z_m^\rho = [1 + \rho(1 - P_w) + \rho^2(1 - P_w)^2](1 - S_{m-1})E_m + \rho^2S_{m-1}E_m$ .

Table 1. Summary Statistics.

<b>A. Entire Sample</b>				
<i>Independent Variable</i>	<i>Not Selected in Sample</i>	<i>Ineligible for Lottery</i>	<i>Eligible for Lottery</i>	<i>After Winning</i>
Monthly Incidence of Sick Leave	0.539 (0.020)	0.269 (0.012)	0.099 (0.006)	0.092 (0.012)
Rate of Sick Leave	0.415 (0.018)	0.103 (0.006)	0.025 (0.002)	0.026 (0.005)
Low Job Level (1 if Job < 7)	0.893 (0.012)	0.864 (0.009)	0.697 (0.009)	0.748 (0.018)
Tenure (in years)	6.71 (0.37)	11.91 (0.25)	14.25 (0.19)	13.44 (0.39)
Age (in years)	38.39 (0.33)	40.68 (0.24)	42.52 (0.18)	42.92 (0.41)
Part-Time (Part-Time = 1)	0.126 (0.013)	0.174 (0.010)	0.186 (0.007)	0.183 (0.016)
Gender (Woman = 1)	0.186 (0.016)	0.194 (0.011)	0.184 (0.007)	0.166 (0.015)
Non-Native Parents (Non-Native Parents = 1)	0.429 (0.020)	0.364 (0.013)	0.297 (0.009)	0.366 (0.020)
Plant Indicator (1 = Smaller)	0.390 (0.020)	0.349 (0.013)	0.436 (0.010)	0.490 (0.020)
Number of Observations	625	1,356	2,698	596
<b>B. Selected Sample</b>				
<i>Independent Variable</i>	<i>All Workers</i>		<i>Lottery Winners</i>	
Monthly Incidence of Sick Leave	0.148 (0.005)		0.075 (0.006)	
Rate of Sick Leave	0.048 (0.002)		0.020 (0.003)	
Duration after Winning the Lottery (in months)	—		2.31 (0.091)	
Low Job Level (1 If Job < 7)	0.752 (0.006)		0.749 (0.012)	
Tenure (in years)	13.46 (0.14)		13.93 (0.28)	
Age (in years)	42.03 (0.14)		42.59 (0.28)	
Part-Time (Part-Time = 1)	0.177 (0.006)		0.181 (0.011)	
Gender (Woman = 1)	0.185 (0.006)		0.170 (0.011)	
Non-Native Parents (Non-Native Parents = 1)	0.325 (0.007)		0.356 (0.013)	
Plant Indicator (1 = Smaller)	0.418 (0.007)		0.481 (0.014)	
Number of Workers	366		93	
Number of Observations	4,650		1,271	

Notes: Period: June 2002–July 2003. Standard errors of means are in parentheses.

tions from 366 workers over the period June 2002–July 2003.<sup>16</sup>

The upper panel of Table 1 shows averages of the observed characteristics for the entire population.<sup>17</sup> Column (1) shows that the unselected 625 observations differ from the selected observations in some respects. Sick leave is substantially higher in this subset, an expected result since this selection includes workers who were absent on all working

days of the previous month. In addition, compared with the workers who are included in our sample, those in the excluded group occupy lower-level jobs, have shorter tenure, and are younger, on average. The same basic differences, albeit less pronounced, distinguish the group in column (2) (workers who are ineligible for the lottery due to absence) from the groups in columns (3) and (4) (respectively, participants in the lottery and workers who are ineligible because they previously won). The averages do not differ substantially across the latter two columns.

The lower panel displays the averages for both selected samples. For all workers, the average monthly incidence of sick leave is 14.8% (the rate is 4.8%). The average tenure is 13.5 years; the average age, 42.0 years;<sup>18</sup> the

<sup>16</sup>Our analysis of a subsample of winners consists of 93 workers; it does not contain information on five workers who had won the lottery but were not employed with the firm before April 2002. There are 1,317 observations for June 2002–July 2003. The other two restrictions lead to a selected sample with 1,271 observations.

<sup>17</sup>For all of these monthly observations, the worker was employed with the firm on all of the working days of the calendar month. Workers who were hired (or left the firm) during a month are included in the sample from the first calendar month after hiring up to and including the month before separation.

<sup>18</sup>We have the date of birth as well as the exact date of entry to the firm for each worker. Thus, both age and tenure slightly change over the period of investigation.



Table 3. Marginal Effects on Current Incidence and Rate of Absenteeism of Absence Incidence in the Previous Months, All Workers (Equation (5)).  
(Dependent Variable:  $S_{i,m}$ )

Independent Variable	Probit, Random Effects				Tobit, Random Effects, <sup>a</sup> All Workers	
	All Workers	All Workers	Female Workers <sup>b</sup>	Male Workers <sup>b</sup>	Effect on Incidence	Effect on Rate
Z1 (state 1)	0.013 (0.018)	0.005 (0.031)	-0.007 (0.071)	0.011 (0.034)	0.012 (0.029)	0.004 (0.010)
Z2 (state 2)	0.033 (0.027)	0.021 (0.041)	0.036 (0.095)	0.026 (0.047)	0.038 (0.034)	0.013 (0.011)
Z3 (state 3)	0.131 (0.034)***	0.146 (0.053)***	0.083 (0.101)	0.167 (0.063)***	0.164 (0.031)***	0.054 (0.010)***
2003*Z1	—	0.016 (0.038)	0.233 (0.144)	-0.021 (0.037)	0.008 (0.034)	0.003 (0.011)
2003*Z2	—	0.017 (0.047)	0.053 (0.141)	-0.001 (0.047)	0.015 (0.041)	0.005 (0.014)
2003*Z3	—	-0.023 (0.034)	0.388 (0.202)*	-0.069 (0.024)***	-0.020 (0.037)	-0.006 (0.012)
$\bar{S}_j$ (avg., July 2001– March 2002)	0.125 (0.024)***	0.126 (0.024)***	0.201 (0.056)***	0.107 (0.027)***	0.109 (0.020)***	0.036 (0.007)***
Tenure	-0.003 (0.001)***	-0.003 (0.001)***	-0.003 (0.002)	-0.003 (0.001)***	-0.003 (0.001)***	-0.001 (0.0002)***
Age	0.001 (0.001)	0.001 (0.001)	0.003 (0.002)	0.001 (0.001)	0.0013 (0.0067)*	0.00043 (0.00022)*
Part-Time	-0.015 (0.017)	-0.015 (0.017)	-0.015 (0.036)	-0.010 (0.022)	-0.011 (0.015)	-0.004 (0.005)
Female	0.044 (0.020)**	0.044 (0.020)**	—	—	0.040 (0.014)***	0.013 (0.005)***
Non-Native Parents	-0.018 (0.013)	-0.018 (0.013)	0.019 (0.035)	-0.018 (0.014)	-0.006 (0.011)	-0.002 (0.004)
Smaller Plant	0.030 (0.033)	0.029 (0.033)	0.108 (0.056)*	-0.010 (0.032)	0.030 (0.028)	0.010 (0.009)
$\sigma_a$	0.256 (0.056)	0.259 (0.056)	0.133 (0.059)	0.263 (0.061)	0.010 (0.001)	
$\sigma_a^2 / (\sigma_a^2 + \sigma_\epsilon^2)$	0.062 (0.025)	0.063 (0.025)	0.017 (0.015)	0.065 (0.028)	0.0003 (0.0001)	
(Pseudo) R-Squared	0.062	0.062	0.142	0.063	—	
Number of Independent Variables	55	58	47	47	58	
Log Likelihood	-1,721.704	-1,720.200	-306.999	-1,382.312	-1,597.118	

Notes: Estimation period: June 2002–July 2003. Estimates are based on 4,650 observations from 366 employees. The table does not report the estimated coefficients on 13 calendar month dummies, 11 job level dummies, and 21 department dummies; all of them are jointly statistically significantly different from zero at the 5% level. Standard errors are in parentheses.

<sup>a</sup>Dependent variable: rate of sick leave.

<sup>b</sup>Additional grouping of 3 job level dummies and 7 department dummies. Men and women based on 3,792 and 858 observations, respectively.

\*Statistically significantly different from zero at the .10 level; \*\*at the .05 level; \*\*\*at the .01 level.

proportion of workers having a part-time job, 17.7%; the proportion female, 18.5%; the proportion with non-native parents, 32.5%; and the proportion employed in the smaller

plant, 41.8%.<sup>19</sup> The incidence and rate of

<sup>19</sup>In addition,  $X_i$  includes 22 dummies for the worker's department and 12 dummies for job level, corresponding

sick leave are considerably smaller for the winners (7.5% and 2.0%, respectively) than for all workers. On average, the winners are observed for 2.31 months after winning the lottery.

Table 2 shows the average probability of sick leave (in terms of both its monthly incidence and its monthly rate) of the transition matrix  $M$  of equation (3). In state 3, the average incidence is 0.337 for all workers. A transition from state 3 to state 2 is associated with a reduction in incidence of 13.4 percentage points; a change from state 2 to state 1 leads to a 9.4 percentage point decrease. Among winners, the incidence of monthly absence falls by 19.0 percentage points—a substantial effect—in the transition from state 3 to state 2, and by 4.6 percentage points in the transition from state 2 to state 1. We also computed the counterfactual probabilities of being in states 1–3 for workers who had already won the lottery and thus were ineligible to participate. This analysis shows that after employees won, absence incidence among them increased. Moreover, a transition from state 2 to state 1 did not reduce absenteeism. These findings suggest that the effect of the lottery on absence behavior did not persist after winning.

### Estimation Results I: The Incentive Effect for All Workers

We now discuss the estimates from equations (5) and (6) for all workers. In addition, as we will argue later on, we use tobit estimation to calculate the effect of the lottery on the rate of attendance in cost-benefit terms.

First, the random effects probit estimate of the reduced-form model (that is, equation 5) in Table 3 (first column) indicates that the incidence of absenteeism was influenced by  $Z_3$ . It implies that the incidence of absenteeism was 13.1 percentage points higher for state 3 than for the reference category, which is absorbing state 4. The coefficients on the first and second states are statistically insignificant. The finding that a substantial

decrease in the incidence of absenteeism is associated with movement from state 3 to state 2 is in line with the descriptive statistics shown in Table 2. The second column of Table 3 includes three cross-terms in the state variables and an indicator for 2003 (the remaining 7 months of the lottery).<sup>20</sup> The outcomes demonstrate that the effect of the lottery did not diminish over time, as the cross-terms are jointly statistically insignificant ( $\chi^2_{(3)} = 3.00$ ;  $p = 0.39$ ).

With respect to the remaining regression parameters, we find that for each additional year of tenure, the monthly incidence of absenteeism decreased by 0.3 percentage point. The incidence of absenteeism was 4.4 percentage points higher for female workers than for their male co-workers. The indicators describing calendar time effects, job level, and the various departments of the firm are jointly significantly different from zero. With respect to the unobserved worker-specific effect, the average incidence over the period July 2001–March 2002 is statistically significant; the variation of the unobserved worker-specific effect is 6.3% of the total variation of the error term.

We re-estimated equation (5) separately by gender; see columns (3) and (4) of Table 3. The estimated coefficients on  $Z_3$  and indicator 2003\* $Z_3$  imply that the response to the lottery was greater for men than for women, which is in line with the findings of related studies (Price 2008; Ichino and Moretti 2009).

<sup>20</sup>The estimated coefficients on the state variables might pick up serial correlation for reasons other than the incentive effect. Neither of two robustness checks points in this direction, however. First, we compared the coefficient estimates with estimates from a probit model that does not control for individual random effects. If the incentive variable picked up any remaining serial correlation, the differences between the two estimates would be substantial. The estimated parameters on the state variables do not differ substantially, however. As a second check, we re-estimated equation (5) as a linear probability model with random effects in which the standard errors are corrected for serial correlation (the Newey West correction). This procedure yields acceptable predictions of the dependent variable (a negative value is obtained for about 5% of the estimates). The estimated parameters of this model are in line with those of the random effects probit specification.

to salary scales. We do not observe the (exact) wages that are earned.

Table 4. Marginal Effects on Current Incidence and Rate of Absenteeism with Structural Parameter Restrictions on Absence in the Previous Months: Estimates of Equation (6) for All Workers. (Dependent Variable:  $S_{i,m}$ )

Independent Variable	Probit, Random Effects	Probit, Random Effects	Tobit, Random Effects <sup>a</sup>	
			Effect on Incidence	Effect on Rate
$Z^p$ , $\rho = 0.28$	-0.026 (0.009)***	-0.043 (0.012)***	-0.070 (0.011)***	-0.024 (0.004)***
2003* $Z^p$ , $\rho = 0.28$	—	0.033 (0.016)**	0.037 (0.015)**	0.013 (0.005)**
$\bar{S}_i$ (avg., July 2001–March 2002)	0.138 (0.026)***	0.139 (0.026)***	0.132 (0.020)***	0.045 (0.007)***
$\sigma_a$	0.379 (0.043)	0.373 (0.043)		0.062 (0.010)
$\sigma_a^2 / (\sigma_a^2 + \sigma_e^2)$	0.125 (0.025)	0.122 (0.025)		0.012 (0.004)
(Pseudo) R-Squared	0.052	0.053		—
Number of Independent Variables	53	54		54
Log Likelihood	-1,739.348	-1,737.109		-1,647.815

Notes: Estimation period: June 2002–July 2003. Estimates are based on 4,650 observations from 366 employees. All further control variables are unreported, as the estimated coefficients do not differ appreciably from the estimates in Table 3. Standard errors are in parentheses.

<sup>a</sup>Dependent variable: rate of sick leave.

\*Statistically significantly different from zero at the .10 level; \*\*at the .05 level; \*\*\*at the .01 level.

Next, we consider the estimates of equation (6) for which the structural parameter restrictions are imposed. For various values of  $\rho$ , we calculated the corresponding value of the log likelihood.<sup>21</sup> For  $\rho = 0$ , the value of the log likelihood is -1,737.770; for  $\rho = 1$ , -1,739.549. The maximum value of the log likelihood is -1,737.109 for  $\rho = 0.28$ . This implies that for the likelihood ratio test with  $H0:\rho = 0$  and  $H1:\rho > 0$  the null cannot be rejected ( $\chi^2_{(1)} = 1.32$ ;  $p = 0.25$ ). On the other hand, for  $H0:\rho = 1$  and  $H1:\rho < 1$ , the null can be rejected ( $\chi^2_{(1)} = 4.88$ ;  $p = 0.03$ ). Obviously, the finding that  $\rho$  is close to zero cannot be explained within the standard context of discounting. Instead, it suggests the presence of hyperbolic discounting, as it seems that workers were predominantly driven by

the first upcoming lottery. It is also possible that workers were not fully aware of how current absenteeism affected their eligibility for future lotteries.<sup>22</sup>

Table 4 presents the estimated parameters for  $\rho = 0.28$ . The random effects probit estimates indicate that the coefficient on the lottery incentive is significantly different from zero and economically substantial. Participation in the lottery induced workers to report sick less frequently, with the initial effect amounting to a 2.6 percentage point reduction in the monthly sickness incidence relative to state 4 (the reference category). Their average sickness incidence was 14.8% (see Table 1). Unlike the esti-

<sup>21</sup>We included a  $P_w$  equal to 0.036 (see equation (7) and Table 2). Remarkably, changes to this value barely affect the estimates. For example, for  $P_w = 0.10$ ,  $\rho$  becomes 0.25. These results suggest that our estimation results are unaffected by workers' misperception of the probability of winning the lottery.

<sup>22</sup>As our semi-structural model is overidentified, we can test for the presence of hyperbolic discounting by allowing the discount rate to change over time. Under the assumption of hyperbolic discounting, the instantaneous discount factor would be very small, whereas its value would be larger in the subsequent periods. Given the structural model restrictions and the estimated values of  $Z1$ ,  $Z2$ , and  $Z3$ , however, such an approach does not provide us with tractable structural parameter values.

mates of the unrestricted model (see the second column of Table 3), the estimates reported in the second column of Table 4 suggest that the incentive of the lottery decreased over time.<sup>23</sup> The coefficient on the incentive variable is  $-0.043$  for the period June 2002–December 2002 (the first seven calendar months of the lottery), and it becomes  $-0.010$  for the remaining seven months in 2003.<sup>24</sup> There are two possible explanations for the apparent reduction in the incentive effect. First, workers may have initially overestimated their odds of winning. Second, as time went by and the pool of eligible workers decreased, workers' interest in participation may have declined as they became aware that they were going to win one of the future lotteries anyway.<sup>25</sup>

We can make a back-of-the-envelope calculation of the relative costs and benefits of the lottery. As a measure of the benefits, we calculate the increase in attendance of workers who would have been absent had it not been for the lottery. We re-estimated the model using a random effects tobit specification, in which the dependent variable is the rate of absence (as a fraction of working days). Columns (3) and (4) of Table 4 show the parameter estimates (expressed as marginal effects) for sickness incidence and the sickness rate. The impact on the sickness rate is  $-2.4$  percentage points in

2002 and  $-1.1$  percentage points in 2003.<sup>26</sup> For a 50% participation rate in the lottery (see Figure 2) and monthly salary of 1,800 Euros, the increase in attendance implies a labor "savings" equivalent to a total monthly payment of about 8,100 Euros in 2002 and about 3,700 Euros in 2003.<sup>27</sup> This estimate may overstate the actual monthly gain in production associated with the lottery (as measured by the disruption costs and substitute worker wages avoided), but in order for the lottery to have benefited the firm, it only needed to achieve monthly gains exceeding its monthly costs, which were a mere 525 Euros. As the monthly value of the increase in attendance (in terms of the wage) dwarfs the monthly costs, we would argue that the lottery was beneficial to the firm.

### Estimation Results II: Absenteeism after Winning

In the following analysis, we focus on lottery winners in order to evaluate how, if at all, absence behavior changed in the aftermath of a lottery win, when the worker was no longer eligible to participate. Thus, all workers in the sample for this analysis have reached absorbing state 4. Generally, since for all specifications in Table 5 the variation of the unobserved worker-specific effect is negligible or equal to zero, we infer that the subsample of winners is closer to homogeneous than is the entire sample. Moreover, as the number of winners is not very much larger than the total number of explanatory variables, we used a more parsimonious specification with fewer explanatory variables. We excluded the 21 department indicators, since they are not jointly statistically significant. Furthermore, we replaced the 11 indicators for job level by a single indicator for job levels below 7.

<sup>26</sup>The estimated impact of the lottery incentive on incidence is  $-7.0$  percentage points in 2002 and  $-3.3$  percentage points in 2003. The estimated coefficients on the sickness incidence cannot be distinguished statistically from those in the random effects probit model. Thus, the incentive effect equally affected the incidences of sickness spells of short and long durations.

<sup>27</sup>The savings equal  $377 \times 2.4\% \times 50\% \times 1,800$  Euros = 8,143 Euros per month. For 2003, the monthly savings were 3,732 Euros.

<sup>23</sup>Additional estimates show no difference in the interaction effect of the incentive variable across various specific groups of workers (by age, tenure, part-time status, parents' nativity, and job level). The absence of any cross-effect with job level indicates there is no income-dependent heterogeneity in workers' responses to the incentive.

<sup>24</sup>As a robustness check, we included observations in which a worker was on sick leave on all working days of the previous month, resulting in a sample with a considerably higher mean probability of remaining in state 3. This broader sample consists of 4,932 observations. For equation (5), the estimated parameter on  $Z3$  becomes 0.270 (0.062) (the coefficients on all other state variables are statistically insignificant); for equation (6) the relevant parameter estimates are  $-0.095$  (0.013) on  $Z^p$  and 0.047 (0.017) on  $2003 * Z^p$ .

<sup>25</sup>Another possible explanation for the smaller incentive effect is that extrinsic motivation has crowded out the intrinsic motivation of workers not to report sick. Ineligibility for the upcoming lottery may predispose winners to report sick more often.

Table 5. Marginal Effects on Current Incidence and Rate of Absenteeism of Absence in the Previous Months: Estimates of Equation (5) for Winners Only.  
(Dependent Variable:  $S_{i,m}$ )

Independent Variable	Tobit, Random Effects <sup>a</sup>			
	Probit, Random Effects	Probit, Random Effects	Effect on Incidence	Effect on Rate
Z1 (State 1)	-0.087 (0.021)***	-0.091 (0.026)***	-0.090 (0.026)***	-0.024 (0.007)***
Z2 (State 2)	-0.042 (0.010)***	-0.044 (0.011)***	-0.078 (0.042)*	-0.020 (0.011)*
Z3 (State 3)	0.007 (0.032)	0.014 (0.041)	0.014 (0.034)	0.004 (0.009)
2003*Z1	—	0.013 (0.044)	0.017 (0.037)	0.005 (0.010)
2003*Z2	—	0.020 (0.089)	0.008 (0.070)	0.002 (0.018)
2003*Z3	—	-0.026 (0.031)	-0.006 (0.053)	-0.002 (0.014)
<i>dur</i>	0.013 (0.004)***	0.014 (0.005)***	0.014 (0.005)**	0.004 (0.001)***
$\bar{S}_i$ (avg., July 2001–March 2002)	0.059 (0.026)**	0.061 (0.026)**	0.058 (0.025)**	0.015 (0.007)**
$\overline{dur}_i$ (avg., June 2002–July 2003)	-0.023 (0.006)***	-0.023 (0.006)***	-0.022 (0.006)***	-0.006 (0.002)***
Low Job Level (1 if job level < 7)	0.038 (0.013)***	0.039 (0.013)***	0.037 (0.017)**	0.010 (0.005)**
$\sigma_a$	0.102 (0.026)	0.105 (0.031)		0.008 (0.006)
$\sigma_a^2 / (\sigma_a^2 + \sigma_e^2)$	0.010 (0.005)	0.011 (0.006)		0.0002 (0.0003)
(Pseudo) R-Squared	0.114	0.115		—
Number of Independent Variables	26	29		29
Log Likelihood	-292.726	-292.726		-263.175

Notes: Estimation period: June 2002–July 2003. Estimates are based on 1,271 observations from 93 employees. All further control variables are unreported, as the estimated coefficients do not differ appreciably from the estimates in Table 3. Standard errors are in parentheses.

<sup>a</sup>Dependent variable: rate of sick leave.

\*Statistically significantly different from zero at the .10 level; \*\*at the .05 level; \*\*\*at the .01 level.

The random effects estimates of equation (5) indicate the following. First, the estimated parameters on Z1, Z2, and Z3 imply that the incidence of absenteeism was lowest in state 1 and highest in state 3, indicating that the lottery induced lower absence among workers who had not yet won than among those who had.<sup>28</sup> Absence was 9.1 percent-

age points lower in state 1 than in state 4 (which is fully exogenous for the sample of lottery winners). In state 2, absence was 4.4 percentage points lower. Second, the cross-terms suggest that the lottery incentive did not change in 2003 relative to 2002. Third, after winning the lottery, the worker was in state 4, which is the reference category for the three state variables in equation (5). The variable *dur* registers the number of months since the worker's transition to state 4. The estimated coefficient on *dur* indicates that

<sup>28</sup>We also re-estimated equation (6) for the winners.  $\rho$ , the rate of time preference among winners, was about the same as that in the entire sample.

absence increased by 1.4 percentage points for every month after a worker won the lottery.<sup>29</sup> This estimation result is in line with the winners' estimated transition probabilities in Table 2, which shows that  $P_1$  was substantially larger in the period after winning than in the period before winning (during which the lottery was held). Thus, the estimates suggest that reductions in absence among workers anticipating the lottery did not persist after they won the lottery.

### Conclusion

The contribution of this paper to the literature on absence from work due to sickness is twofold. First, we have developed a model in which workers' attendance is favorably affected when good attendance makes them eligible to participate in upcoming lotteries. To identify the lottery effect empirically, we have compared groups with differing states of eligibility for participation. The lottery we investigated, initiated by a Dutch manufacturer in 2002, featured only modest monetary rewards for winners (albeit its non-monetary rewards may have been more substantial), and yet led to a sizeable reduction in absence.<sup>30</sup> The results of our semi-structural empirical model imply that the incentive effect (which depends on past absenteeism and can be defined by structural parameters) was highest for workers whose attendance made them eligible for all three upcoming lotteries.

Our estimates indicate that, relative to the employees' absence records before the lottery, the monthly incidence of sickness absence decreased by 4.3 percentage points in the lottery's first seven months and by 1.0 percentage point in its subsequent seven months. These effects correspond to reduc-

tions in the rate of absence of 2.4 and 1.1 percentage points, respectively. In the period in which the lottery was held, the incidence and the rate of absence were, on average 14.8% and 4.8%, respectively. We speculate that the impact on absence rates declined either because workers initially overestimated their odds of winning or because they eventually realized that they were going to win one of the future lotteries anyway. We cannot reject the null hypothesis that workers' behavior was driven by the first upcoming lottery (of the three lotteries for which they might have been eligible). In any event, workers evidently did not weigh all of the upcoming lotteries equally.

This study's second contribution to the literature is its tracking of behavior after termination of the incentive. Among workers who won the lottery, absence rates that had declined before they won rose afterward. Indeed, the estimates suggest a post-win increase in absence. The lottery may have displaced workers' intrinsic motivation for not reporting sick with explicit incentives. If so, winning the lottery would have removed the explicit incentives, resulting in an increased propensity to call in sick.

All in all, our results suggest that the lottery was beneficial to the firm. Its costs were substantially smaller than the benefits associated with the higher attendance rate. However, the effect of the lottery diminished after some time: the estimated effect of the incentive variable—although still statistically significant—tended toward zero after some months. Furthermore, we have found that winning workers tended to have a higher rate of absence after winning the lottery. The firm dropped the lottery, probably both because of its decreasing impact on absenteeism and because of the rule that workers were allowed only one win, which gradually reduced the pool of eligibles. This kind of incentive system might have a longer-lasting effect on absenteeism if the lottery winners remained eligible for future lotteries or if the criteria for participation in the lottery were loosened by, for example, extending participation to workers who do not report sick for two months rather than three months.

<sup>29</sup>Additional estimates show that the estimated coefficient on the quadratic of *duris* is statistically insignificant.

<sup>30</sup>One of these non-monetary rewards may be the public announcement of the winners' names. Furthermore, the satisfaction workers derive from taking home more monetary compensation than their co-workers may be out of proportion to the amount of money involved.

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