THE IMPACT OF WEATHER CONDITIONS

ON WORKER ABSENTEEISM

EINAR ÖRN EINARSSON

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Abstract

The issue of worker absenteeism has been recognized as a serious economic problem, yet it has been the focus of surprisingly little research. In a sample of 1500 workers from seven different companies in Iceland, on average 2.9 percent of the workers were absent each day. Economists have cited wages, workplace security and worker happiness as the most important variables for determining worker absenteeism. This paper determines the effect of a number of variables on worker absenteeism, including differences in wages, union membership, workplace security and holidays, but particularly the effect of weather. By matching data on worker absenteeism with weather information, this paper demonstrates that weather can help explain why some workers are absent. This paper finds that when the weather is especially cold the percentage of absent workers increases by one-half percent.

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I. Introduction

Worker absenteeism is a serious concern for many companies, yet it has been the focus of surprisingly little research. Those who have studied worker absenteeism have found that, at any given time, on average 3.5 percent of the work force in the United States are absent. (Hedges, 1977) In a number of industries, daily rates of absenteeism are as high as 20 percent. (Lawler, 1971) Previous studies have focused on the effects of factors such as wages, workplace security and union membership on worker absenteeism. This paper examines the factors that would be expected to affect absenteeism, including differences in wages, union membership, workplace security and holidays, but it particularly considers the effect of weather, which may affect a worker's mood, and through that, his decision to attend work each day.

Every company has to deal with the problems stemming from worker absenteeism. Since the majority of absences are unpredictable, companies need to adjust their productions or services when faced with sudden surges in worker absenteeism. When a worker is absent, the company faces a number of unexpected costs. Firstly, the task that a worker was assigned gets delayed. Additionally, the company may also have to move other employees around or hire temporary employees to fulfill the responsibilities of the absent worker. Both these options are likely to be costly for the company; in each case the company loses time and money paying for the employment and training of temporary workers. By moving employees between positions their current work is interrupted as they are trained to do the absent employees' jobs. The third option for the company is to let the worker, who was absent, work extra hours once

he returns. However, this option is also expensive for the company because it has to pay the worker more for overtime while still delaying the task.

Prior studies on worker absenteeism have shown that attendance is influenced by two major factors: a) attendance motivation and b) ability to come to work. (Steers & Rhodes, 1978) The main focus of this study will be to determine the effects of weather on worker absenteeism. Motivation for attendance is based on a number of economic factors, such as wages, reward systems, job satisfaction and various internal and external pressures to attend. (Steers & Rhodes, 1978) However, given that a certain worker is unhappy at his job, why does he choose to attend work on any particular day? Every worker knows that even though he is entitled to a number of sick days, an employer will soon become impatient and start suspecting that the worker is simply skipping work, if a worker is frequently absent during a short time period.

The weather plays a huge part in people's lives, especially in a country like Iceland where it can instantly change. The weather affects vacation plans, traffic, recreational activities, and is often the subject of numerous superficial conversations. The impact of weather on a person's mood has been the focus of a number of psychological studies. Psychologists have been able to show that sunshine, temperature and humidity can affect a person's mood. Michael Cunningham discovered that hours of sunshine are positively correlated with a positive mood. (Cunningham, 1979) Howarth and Hoffman (1984) showed that humidity and temperature have an effect on concentration, co-operation, anxiety and optimism. Edward Saunders (1993) even showed that the weather has an impact on stock prices through the mood of the traders. It

therefore seems reasonable to conclude that the weather outside affects whether or not a worker decides to go to work that day.

This paper combines information about the weather in Reykjavik, Iceland, for each day of 2000 and 2001 with information about worker absenteeism from eight different companies that same day. Based on that information, conclusions can be drawn as to whether workers are more likely to be absent when weather conditions are favorable or unfavorable. The data collected from companies in this study was processed from time clock software used by the companies. Therefore, the data used in this study should be more accurate than in studies that have used surveys of employees (Allen, 1981) or surveys of employers (Chaudhury & Ng, 1992). Both these types of surveys ask an employer or employee how many days an employee was absent during the last month. This type of data collection is bound to be inaccurate, since memory may not serve the parties very well.

This paper proceeds as follows: section II reviews the previous literature about the determinants of worker absenteeism along with psychological studies on the effects of weather on a person's mood; sections III and IV describe the data and the basic models used in this study; section V explains the empirical process; sections VI, VII and VIII detail and discuss the empirical results and suggest how the findings of this paper may aid further research; and section IX concludes the paper with discussions about key findings of the study.

II. Previous Work

Research on worker absenteeism is limited. Some articles have tried to measure absenteeism and its costs over weekly or monthly periods, while other studies have tried

to determine the effects of wages, unionization, regulation and worker security on worker absenteeism. However, there have been no studies that have tried to determine the effects of the weather on worker absenteeism. Psychological studies have shown that the weather affects people's mood, and economists have shown that the weather affects workers' decisions, as shown in the study on weather and stock prices on Wall Street.

Steven G. Allen developed a labor-leisure model to help explain the reasons for worker absenteeism. He studied the effects of four factors on worker absenteeism: marginal earnings, occupational safety, flexibility of the work schedule and personal characteristics. Allen concluded that absence rates were directly linked with marginal earnings, occupational safety and flexibility of the work schedule. He found that worker absenteeism is higher for workers with low wages, those who work in unsafe workplaces and those who work the same hours every day. Younger workers and those with poor health also have higher rates of absenteeism. However, Allen concludes that there is not a significant link between various demographics (race, marital status, education) and absenteeism. However, Allen's study is limited in that it only spans two weeks and the workers themselves were the ones to report the rates of absenteeism. (Allen, 1981)

The article *Absenteeism predictors: least squares, rank regression, and model selection results* suggests a model for absenteeism based on Allen's labor-leisure model. The authors used information provided by Canadian firms and concluded that firms with more part-time employees and those with a better employee/employer relationship have a lower absenteeism rate. Their results also suggest that high-wage and non-union companies have lower rates of absenteeism. (Chaudhury & Ng, 1992)

Drago and Wooden use information about workers in Australia, Canada, New Zealand and the USA to determine absenteeism for employees who work in groups. They conclude that among group workers, workgroup cohesion (the degree to which employees work together closely and harmoniously) is associated with a low rate of absenteeism if job satisfaction is high, but a high rate of absenteeism if job satisfaction is low. The data also suggests that male, low-tenure, part-time and high-wage employees have lower rates of absenteeism. (Drago & Wooden, 1992)

Allen examined the effects of union membership on absenteeism rates. The assumptions are that union members might be more likely to be absent, since they face fewer penalties for absence than non-union workers. However, union workers might be more likely to be absent less often because they are empowered through the union and have a better work schedule. Allen's results suggest that union workers are at least 29 percent more likely to be absent than non-union workers. (Allen, 1984)

Robert Smith studied the possibility that some workers conceal their injuries that occur off-the-job, and then claim that they occurred on the job in order to collect workers' compensation. Smith studied the differences between the reporting of injuries that can be concealed and whose treatment can be delayed, and injuries that cannot be concealed or whose treatment cannot be delayed, during different days of the week. He concludes that over eight percent of the injuries reported on Mondays and after holidays actually happened off-the-job during the previous weekend or holiday. (Smith, 1989)

In *Major Influences on Employee Attendance: A Process Model,* the authors try to determine the economic and psychological factors that affect both voluntary and involuntary absenteeism by researching previous literature on worker absenteeism. The

authors argue against the claim that absenteeism is primarily caused by job dissatisfaction and that it shares a common root with turnover rate. The authors conclude that absenteeism is dependent on two factors: the ability to come to work (even workers who want to attend work may be unable to because of illness, family responsibilities and transportation problems) and attendance motivation. Attendance motivation depends on satisfaction with the job situation and various internal and external pressures to attend. These pressures include economic conditions, company reward systems, personal work ethic and organizational commitments. (Steers & Rhodes, 1978)

In *Weather, Mood, and helping behavior: Quasi Experiments with the Sunshine Samaritan,* the author finds a relationship between weather variables (such as temperature, humidity, wind velocity and sunshine) and a person's behavior. The author examined a group of people eating at restaurants, and registered the differences in the amount of tip left behind during different weather conditions. Judging by the gratuity left behind the author concluded that people were generally in a better mood when the temperature was high, the sun was shining, humidity was low, and when the wind velocity was low. He also found that older people and women were more likely to eat out when the sun was shining. (Cunningham, 1979)

The best-known economic study that relates weather to workers' behavior is Edward Saunders's study of the correlation between stock prices and the weather surrounding Wall Street. Saunders uses information about the weather outside the New York Stock Exchange along with stock price indices to determine the effects of weather on stocks. From his research, Saunders discovered that fluctuations in stock prices were not fully correlated with economic news. He concluded that because of the weather's

effects on traders' moods, stock prices went up when the weather outside was nice, and down when the weather outside was unfavorable. (Saunders, 1993)

III. Description of the model

The model that is used in this paper to estimate the effects of weather conditions on worker absenteeism is:

Percentage of workers absent = b_0 + b_1 (dummy for day before off) + b_2 (dummy for cold weather) + b_3 (dummy for warm weather) + b_4 (spring dummy variable) + b_5 (fall dummy variable) + b_6 (winter dummy variable) + b_{7-13} (seven different company dummies)

The dependent variable measures the percentage of workers absent in a company every day. The dummy variable "day before off" was created to examine the effects on worker absenteeism of having had the day before off. It is equal to one if the worker had the day before off (weekends or holidays) and zero if the worker had work the previous day. The coefficient on the dummy variable for "day before off" measures whether a larger or smaller percentage of workers are absent when they had the day before off compared to days when they had work the day before.

The coefficient on the dummies for cold and warm weather measure the effect of warm and cold weather on worker absenteeism using mild temperatures as a base variable. The dummy variables for the three seasons measure seasonal effects on worker absenteeism. The coefficients on the seasonal variables measure whether worker absenteeism increases or decreases during winter, fall and spring, using summer as a base variable. The dummy variables for the different companies are included to prevent a bias because of differences in wages, worker happiness and the size of companies. The

coefficients on the company variables measure whether a larger or smaller percent of workers are absent in that particular company compared to the base company (company number eight). Because of a confidentiality agreement with the companies, their names cannot be displayed.

The weather information in the data set included weather for every day of 2000 and 2001. However, the numbers for worker absenteeism are only for weekdays; therefore, weather information for weekends was dropped. Information about wages, profit and worker satisfaction was only available for five out of the eight companies in the study, so three companies are dropped from the model when measuring the effects of wages and worker happiness on worker absenteeism.

Given the similarities between the companies surveyed it is possible to factor out three of the variables that have most commonly been used to explain worker absenteeism, workplace security, regulation and unionization. Almost all of the workers surveyed are office workers. Given that the risks of working in an office are extremely limited, the issue of workplace security can be discarded when examining the determinants of labor absenteeism in this study. Also, the workers are all union-members and all work under the same regulations that are set by the Icelandic government.

IV. Data

In order to get data on worker absenteeism, 30 companies in Reykjavik, Iceland, were contacted by email. Those that did not respond were contacted again. The companies were asked to provide data on how many workers were absent on each day of the year. Out of the 30 companies, 12 never responded despite being contacted repeatedly, ten declined the request and eight provided the information requested. The

eight companies that provided data used statistics from their time clock software. The numbers for worker absenteeism only include unexpected absenteeism, which includes when the worker calls in sick or is absent without explanation. The numbers do not include summer vacations that are planned in advance. Seven companies provided data for the year 2001, one company for the year 2000 and one for both years. Information about company size, average wages and worker happiness is reported in table A.1 in the appendix.

Information about company size, average wages, revenue and profit was collected from *300 Stærstu,* a guide of the three hundred largest companies in Iceland that is compiled by *Frjáls Verslun,* an Icelandic business magazine. ("300 Stærstu", 2001) The magazine collects the data by researching tax reports that are made public by the Icelandic government every year. Since some of the companies in the sample are privately owned, it was necessary to use the information in the magazine, rather than information from stock markets.

Information about worker happiness is taken from a survey made by the largest union in Iceland, ("Fyrirtæki ársins", 2001). Workers are surveyed on a number of issues related to workplace happiness and employer/employee relations, such as wages, the employer's respect for his employees and the employee's pride in his job. These numbers should give a relatively accurate portrait of workers' happiness. However, it must be noted that these numbers are averages for each company and may therefore not adequately reflect the happiness of individual employees.

TABLE 1

Definitions, means, and standard deviations of absenteeism and various company variables

Variable	Definition	Mean	Standard Deviation	Min	Max
Absent	Percentage of workers absent each day	2.88%	2.82%	0	42.42%
Size	Number of employees in a company	194	127	57	423
Wage	Average monthly wage in each company	231,090	40,361	183,000	305,000
Revenue	Total company revenue (in thousands of kronur) [1]	7,342,085	11,600,000	775,000	35,092,000
Union grade	Company score in union survey of employees – a measure of workers' happiness	3.88209	.3576826	3.32	4.54

Seasonal dummy variables were created to account for the possible differences in worker absenteeism between the four seasons. Both years were split into four seasons and the appropriate dummy variables were created. The dummy variable for December-February was named Winter, March-May Spring, June-August Summer, and September-November Fall.

The Icelandic Meteorological Office provided data on weather conditions (temperature, rainfall, cloud coverage, wind speed, and hours of sunshine) in Reykjavik, Iceland. Definitions, means and standard deviations of weather variables are reported in table A.2 in the appendix. The data from the eight companies and data from *The Icelandic Meteorological Office* were combined in a panel dataset, using company number as the panel variable.

In order to measure the effects of weather on absenteeism a number of dummy variables were created by splitting the weather data into three parts. First, an average variable was created, and it included a range of one standard deviation above and below

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[1] On May 10, 2002 one U.S dollar was equal to 91.14 Icelandic kronur.

the mean. Then a low dummy was created, including all events that were lower than one standard deviation from the mean. Finally, a high dummy was created for all the observations above one standard deviation from the mean.

TABLE 2

Definitions, range and occurrences of weather dummy variables

Variable	Definition	Range		Occurrences
Cold6	Temperature at 6 AM is below average	-10.5	-1	421
Avg6	Temperature at 6 AM is around the average	-0.9	8.9	1387
Warm6	Temperature at 6 AM is above average	9	13.1	430
Sunny	Hours of sunshine above average	8.5	17.6	426
Cloudy	Hours of sunshine around the average	0.1	8.4	1185
No sun	Hours of sunshine below average (no sun)	0	0	627
Sunny6	Cloud coverage at 6AM is below average	0	1	273
Cloudavg6	Cloud coverage at 6AM is around the average	2	7	1276
Cloudy6	Cloud coverage at 6AM is above average	8	9	689

V. Empirical tests

The panel data models used in this paper are estimated using Feasible Generalized Least Squares regressions. In order to avoid the problem of serial correlation in the data, the regressions employ Autoregressive Process of Order One, AR (1), to model the error term. This method is adapted because of the fact that there are 499 time variables, while the panel variables (a number for the eight different companies) in the regressions only number eight. Serial correlation is expected in a number of variables, including number of workers absent, because many of the absent workers may be absent more than one day at a time.

The first regression estimates the effects of wages, having had the day before off, worker happiness and the size of the company on worker absenteeism. The second

regression reported in this paper includes company, holiday and seasonal variables along with temperature dummies, and estimates the effect of warm and cold weather on worker absenteeism. In order to see how well the company dummy variables pick up factors, such as wages, worker happiness and company size, a third regression was run that adds the three variables to the variables present in regression number two.

To check for the effects of other weather variables, such as sunshine, rainfall and wind speed, a number of regressions were run. These regressions included the company dummies, holiday and seasonal dummies along with the weather variables mentioned above.

It should be noted that there is no guarantee that the companies that provided data represent a random sample. Since the companies chose to provide the information, they may consider absenteeism an important issue or may consider the rate of absenteeism to be low enough so to not embarrass its employees. Because only 26 percent of the companies contacted provided data, a sample selection bias may be present in this survey. However, the numbers on absenteeism provided in this study should be more reliable than those in previous studies. This study uses reports from computerized time clocks, but other studies have used surveys of employees (Allen, 1981) or surveys of employers (Chaudhury & Ng, 1992) that may be inaccurate.

VI. Empirical results

In order to examine the variables that are normally considered when determining worker absenteeism, the following model was estimated:

Percentage of workers absent = b_0 + b_1 (dummy for day before off) + b_2 (company grade in union survey) + b_3 (average company wage) + b_4 (company size)

This first regression is designed to determine how the data on worker absenteeism responds to wages, company size and worker happiness, variables often used in empirical studies on worker absenteeism. This regression only includes five companies since information about wages and worker happiness was not available for the other three. The results of this regression are reported in Table 3.

TABLE 3

Regression 1

Cross-Sectional time-series Feasible GLS regression, AR (1)

Dependent variable: Percentage of employees in a company absent each day

Variable	Coefficient	Standard Dev	Z	95% Confidence Interval	
Constant	.2593275	.0167004	15.53	.22659	.2920
Day before off dummy variable	.0050986	.000832	6.13	.00346	.0067
Company grade in union survey on worker happiness	-.0433737	.0046905	-9.25	-.05256	-.0341
Average company wage	-.000000162	.0000000348	-4.65	.00000023	-.000000094
Number of employees in company	-.0001198	.0000116	-10.34	-.00014	-.00007

The coefficients on size, wages and worker happiness are all negative. This means that workers with higher wages are less often absent. There is also a negative correlation between absenteeism and the grade that the workers gave their company in the union study. Therefore, the workers that are happier at their work are less often absent. Also, as the company gets bigger, a smaller percentage of workers are absent.

As stated above, the basic model used to determine the effect of weather on worker absenteeism is:

Percentage of workers absent = b_0 + b_1 (dummy for day before off) + b_2 (dummy for cold weather) + b_3 (dummy for warm weather) + b_4 (spring dummy variable) + b_5 (fall dummy variable) + b_6 (winter dummy variable) + b_{7-13} (seven different company dummies)

The results of this regression are reported in table 4.

TABLE 4

Regression 2

Cross-Sectional time-series Feasible GLS regression, AR (1)

Dependent variable: Percentage of employees in a company absent each day

Variable	Coefficient	St.Dev	Z	95% Confidence Interval	
Constant	.0014695	.0024323	0.6	-0.0032977	.0062367
Day before off dummy variable	.0049319	.0008153	6.05	0.003334	.0065299
Company number 1	.0562963	.002946	19.11	.0505222	.0620704
Company number 2	.0095088	.0025502	3.73	.0045106	.0145071
Company number 3	.0046674	.002946	1.58	-.0011068	.0104415
Company number 4	.0181277	.0029375	6.17	.0123703	.0238851
Company number 5	.0263109	.002946	8.93	.0205368	.0320851
Company number 6	.0444013	.002946	15.07	.0386272	.0501754
Company number 7	.0334351	.002946	11.35	.0276609	.0392092
Fall dummy variable	.0046101	.0018971	2.43	.0008919	.0083283
Winter dummy variable	.0052114	.0020141	2.59	.0012639	.009159
Spring dummy variable	.0012996	.0019867	.065	-.0025942	.0051934
Dummy for above average temperature	.0018398	.0010979	1.68	-.0003119	.0039916
Dummy for below average temperature	.0047071	.0012267	3.84	.0023029	.0071114

The coefficient on the holiday variable is positive and statistically significant, proving that more workers are absent on Mondays or after a holiday. In fact, the percentage of workers absent goes up by ½ percentage point after a weekend or a holiday. The company dummies are included in the regression to control for differences between the companies, but the values of their coefficients are not very interesting for the results of this paper. The seasonal variables all have a positive coefficient using summer as a base variable. Worker absenteeism increases in the winter and fall, and the

coefficients are statistically significant at the 5% level. However, the coefficient on

spring is statistically insignificant. Both the coefficients for above average temperature

and below average are positive, but the coefficient on above average temperature is

insignificant. The coefficient on below average temperature is positive and significant

even at the one percent level. This data proves that more workers are absent when the

weather is cold.

The third regression was run to determine how well the company variables picked

up the differences in wages, worker happiness and company size. This was a regression

of "day before off dummy", company dummies, weather dummies, seasonal dummies,

wages, company size and worker happiness on the percentage of workers absent. The

results of this regression are reported in table 5.

TABLE 5

Regression 3

Cross-Sectional time-series Feasible GLS regression, AR(1)

Dependent variable: Percentage of employees in a company absent each day

Variable	Coefficient	St.Dev	Z	95% Confidence Interval	
Constant	.1233047	.0066132	18.65	.110343	.1362664
Day before off dummy variable	.0050468	.0008612	5.86	.0033589	.0067348
Company number 2	-.0205615	.0020778	-9.90	-.024634	-.0164891
Average company wage	-3.68e-07	2.46e-08	-14.94	-4.16e-07	-3.2e-07
Number of employees in company	-.0000436	7.67e-06	-5.68	-.0000586	-.0000285
Fall dummy variable	.0082275	.0025832	3.19	.0031645	.0132904
Winter dummy variable	.0076544	.0027203	2.81	.0023227	.0129861
Spring dummy variable	.0026182	.0026737	.98	-.0026222	.0078587
Dummy for above average temperature	.0013473	.0012198	1.13	-.0010164	.0037651
Dummy for below average temperature	.0049702	.0013556	3.67	.0023132	.0076272

Due to serial correlation a number of independent variables were dropped

automatically. The variables that were dropped are: dummies for companies 1,3,4,5,6

and 7 and measure of worker happiness (union grade). The only company dummy remaining was the one for company 2, proving the assumption made in regression two that company dummies do a good job of picking up differences in wages and worker happiness between the eight companies.

In addition to the regressions reported in this paper, a number of regressions were run in order to test the effects of other weather variables on the rates of worker absenteeism. These regressions were based on similar models as the one in regression two, but instead of the dummy variables on temperature, variables on sunshine, cloud coverage and wind speed were included in the model. However, the coefficients on these variables were either statistically insignificant or very small; therefore, the results from these regressions are not reported in this paper.

VII. Discussion of the empirical results

The results of the first regression of wages, worker happiness and company size on worker absenteeism are in line with previous studies. Worker absenteeism decreases as workers earn more and as workers are happier at their jobs. The negative effect of higher wages on worker absenteeism is in line with previous studies. Steven Allen (1981) discovered a similar relationship between higher wages and a lower rate of absenteeism. This paper also finds that when workers are happier (as measured by the union study of worker happiness), they are absent less often, which is similar to the results obtained by Chaudhury and Ng (1992). However, the fact that the coefficient on company size is negative is surprising. One would think that in smaller companies repeated absenteeism would be more obvious and therefore workers would be absent less often. However, that does not seem to be the case in this data set.

The results from the three regressions also show that there is significant evidence for a jump in worker absenteeism after weekends and holidays. Many workers may want to lengthen their weekends in order to be able to travel, or they may carry injuries that occurred during the weekend. The fact that almost ½ percent more workers are absent after a weekend or holiday suggests that moving national holidays to Mondays, instead of celebrating them in the middle of the week, may decrease absenteeism. The fact that there will be a surge in absenteeism on Mondays and after holidays also suggests that employers should try to be better prepared for absenteeism on these days.

The results from the main regressions imply that more workers are absent when the weather is especially cold. By including the dummy variables for each company, the regression factors out the effects of unionization, wages and worker happiness (this assumption is proved in regression three). According to Steers & Rhodes' review of the literature on worker absenteeism, those variables are among the most important external economic pressures that determine worker absenteeism. (Steers & Rhodes, 1978) Having factored them out, we can focus on the weather as a possible reason for worker absenteeism.

Every worker tries to make an optimal choice between labor and leisure. However, most workers have to work a certain number of hours every week, and that number of hours is often non-negotiable. Therefore, many workers may choose to be absent a certain number of days in order to satisfy their optimal selection of labor and leisure. Because of Iceland's labor regulations, every worker gets paid in full for a certain amount of days that he is sick (or claims to be). That number of days increases as the worker stays with the same employer and goes up to six months every year after he

has worked with the same company for ten years[2]. Since repeated days of absenteeism are likely to be noticed, a worker who is intentionally absent has to choose the days he does not attend carefully. The results of the regressions have shown that inclement weather has a positive effect on worker absenteeism. A worker may wake up in the morning and see the severe weather outside and decide that his time is better spent in bed or doing work around his house. However, when the weather is exceptionally nice there is no significant change in worker absenteeism.

The fact that all but one company variable is dropped, due to serial correlation in the third regression, supports the assumption made in regression two that company variables pick up the differences in wages and workers' happiness. Therefore, we are able to focus on weather effects in regression two, and we can ignore the effects of wages and worker happiness when drawing conclusions from that regression.

The regressions that were run using weather variables other than temperature show that the other weather variables, excluding temperature, have little effect on worker absenteeism. The only weather variable that is statistically significant is the effect of wind speed on worker absenteeism. The coefficient on wind speed is positive, which supports the hypothesis that more workers are absent when the weather is bad. However, the coefficient is very small and therefore the regression is not reported in this paper.

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[2] Every worker is entitled to two days of sick leave every month of the year. After working one year for the same employer that worker is entitled to two months every year and that number goes up to six months after working for the same employer for ten years.

VIII. Suggestions for further research

Since more and more companies are adopting computerized time clocks, data on worker absenteeism will become more readily available. An interesting finding of this paper is that ½ percent more workers are absent after a weekend or holiday. Unlike the United States, national holidays in Iceland are not moved to a Monday or Friday. That means that when a national holiday occurs on a Wednesday, workers are given Wednesday off, but have to return to work on Thursday. Therefore, employers may see a surge in absenteeism both on Monday and Thursday of the same week. This may suggest that a change in Icelandic vacation law may be a good idea.

However, to fully understand the benefits of moving national holidays to a Monday or Friday and how they will induce a drop in worker absenteeism, more specific research has to be done. To determine the effects of such a change in laws, a comparison between a country like Iceland and a country that moves holidays to Mondays, such as the United States, is necessary. The research could also include other factors that might induce a change in regulation, such as whether tourism increases during three-day weekends, as opposed to national holidays in the middle of the week. If the researcher is able to show that there is a significant economic benefit from moving holidays to Mondays, it should be hard for the national legislature to oppose such a change in legislation.

IX. Conclusions

The results presented in this paper support the hypothesis that weather influences worker absenteeism. The main finding is that more workers are absent when the weather

is severe. When the temperature is more than one standard deviation lower than the average temperature, almost ½ percent more workers are absent from work. However, there is no significant change in absenteeism between the days when the temperature is around the average and when it is above average. This paper also finds that absenteeism goes up after weekends and holidays by almost ½ percent.

What are possible explanations for higher absenteeism during bad weather? Psychological studies have shown that when the weather is bad, people become more pessimistic, less cooperative and lose concentration. (Howarth and Hoffman, 1984) The bad weather outside, when a worker wakes up, may change his mood. He may feel more pessimistic and feel he will not be able to fulfill his duties adequately; therefore he chooses not to go to work.

The results of this paper show that weather should be considered as a factor when trying to determine worker absenteeism. They also suggest that simply looking at wages, legislation, unionization and worker happiness is inadequate when studying worker absenteeism. The results of this paper suggest that the issue may be more complicated, and that unexpected surges in absenteeism may be caused by factors, such as the weather that employers have no control over.

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XI. Appendix

TABLE A.1

Definitions, means, and standard deviations of weather variables

Variable	Definition	Mean	Standard Deviation	Min	Max
Temp	Temperature at 6 AM (Celsius)	3.982663	5.005907	-10.5	13.1
Temp	Temperature at 6 AM (converted to Fahrenheit)	39.16879	41.01063	13.1	55.58
Cloud	Cloud coverage at 6AM (measured in ninths, 0 means a clear sky, 9 means clouded)	5.748436	2.560084	0	9
Sunshine	Hours of sunshine for the whole day	4.026005	4.563137	0	17.6
Wind speed	Wind speed at 6 AM (meters/second)	4.099955	3.082298	0	16.5

TABLE A.2

Company size, number of employees, yearly wages and worker happiness.

Company	Number of employees	Average monthly wages	Worker happiness
Company Number 1	66	193,000	3.61
Company Number 2	240	226,000	4.00
Company Number 3	57	305,000	4.54
Company Number 4	423	253,000	3.32
Company Number 5	61	N/A	4.00
Company Number 6	67	N/A	N/A
Company Number 7	312	183,000	3.71
Company Number 8	275	N/A	N/A