Vacation Day Usage Modeled by Availability and Behavior

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Paid vacation has shown to be an important benefit to employees. The average employee in the US is offered only a small amount of paid vacation, but some firms have successfully implemented an unlimited vacation policy. I explore behavioral factors that can account for this and focus particularly on how paid vacation days given effect vacation taken. Using survey data from the Panel Study of Income Dynamics and the U.S. Bureau of Labor Statistics National Compensation Survey, I find empirical support for the claim that vacation days taken decrease with days given after a threshold. I use this model to evaluate case studies of real startups and show that reports from these startups are in line with my models predictions.

Introduction

US employees have significantly less access to paid vacation than their counterparts in many other OECD countries. In 2012, less than eighty percent of US private sector employees received any paid vacation at all, with an average of only thirteen paid vacation days received (Ray et al., 2013). This average allotment was an increase of just one day from 2006 (Ray and Schmitt, 2007). Furthermore, there are no laws in the US guaranteeing any paid vacation or holiday leave.

In contrast, all European Union countries have a legal vacation day floor of twenty days per year, with many countries such as the UK (that offers twenty-eight days) and France (which offers thirty) offering far more (Ray et al., 2013).

One possible explanation is that US citizens do not value vacation days, but paid vacation has been shown to be a very important benefit in the eyes of US employees. A nationwide survey of working age Americans revealed that ninety-six percent of employees believe taking paid time off to be important, and more than half characterized taking paid time off as very important (Travel Effect, 2014).

Despite this reported emphasis on vacation, a full forty percent of employees intend to leave some of their paid vacation unused, even when twenty six percent of the population report that unused vacation days are lost at the end of the year (Travel Effect, 2014). Why do employees not fully exercise this benefit?

Two reasons each cited by more than a third of participants for not taking vacation days were the fear of coming back to large amounts of work and the view that only they could perform the job that needs to be done (Travel Effect, 2014). Furthermore,

thirty three percent of employees reported that the companies for which they worked, and not they themselves, had control over their use paid time off (Travel Effect, 2014).

A more plausible explanation for the lack of legally mandated paid vacation is pressure from the firms. In the 2012, the average amount of paid vacation given to employees in their first year at a company was only ten days (Giezen, 2013). The small amount of paid vacation offered plus the employee-reported structural barriers to taking vacation demonstrate that firms want to minimize the amount of vacation that their employees are taking.

Starkly contrasting this, however, is the existence of unlimited paid vacation policies. Although less than one percent of companies currently offer unlimited paid vacation, some of the companies that do—including Virgin Group, Netflix, and Evernote—are quite large and very well known (Vasel, 2014; Shellenbarger, 2011). Employees at these companies are no less susceptible to skimping on vacation though, for reasons including lean staffing, fear of returning to large workloads, and expectations of working remotely while on "vacation" (Shellenbarger, 2011).

Altonji and Usui (2005) showed that an extra week of paid vacation given to employees translated roughly into one extra week of vacation days used. These results, however, are inconsistent with Shellenbarger's (2011) report of employees with unlimited vacation not utilizing the benefit. If a week of paid vacation translated to a week of vacation taken, then any employee under an "unlimited" benefit package would never go to work.

Shellenbarger (2011) mentions that a common amount of vacation days taken by employees under unlimited vacation packages is three to five weeks. Though this is still more than the private sector average (Ray et al., 2013), it indicates that either,

somewhere in between 3 weeks and 5 weeks, the shape of the benefit usage changes drastically, or that at a certain point, additional vacation days would decrease the amount of vacation a particular employee would take.

If a clear method can be identified to decrease the amount of vacation days taken by increasing the number of paid days allowed, it would reduce labor cost and strengthen firms' benefits packages. This would also increase employee happiness due to the value that employees place on vacation days. Because of this, such a method would have large implications for the labor market. Thus, this report studies the effects of paid vacation days on total days of vacation taken. My hypothesis is that after a certain point, additional paid time off will decrease total vacation time.

Literature Review

A classic utility maximizing model would predict that all employees generally take all paid vacation days that are given to them. Because of this, it is necessary to employ behavioral explanations when examining the effects of vacation days given on employees' vacation day usage. The three behavioral factors I will use to explain the relationship will be fairness, reciprocity, and self signalling.

Fairness explains how individuals strive to attain a standard of equity, rewarding behavior seen as fair and punishing behavior seen as unfair. This can explain why employees receiving excellent paid vacation packages will leave days unused, taking only a fair amount. Fairness also underscores the importance in firms of offering competitive vacation packages to avoid becoming subject to employee punishment.

Reciprocity shows that employees will treat firms with the same level of kindness that firms give to employees. This predicts that when employees are given generous benefits, they will work hard to be generous to the firm by volunteering extra work (and taking less paid vacation).

Self signalling shows that employees will intentionally elect to forgo vacation days in order to signal to themselves that they are hard workers. This also couples well with the previous two factors in that rewarding employers or showing kindness to your company will result in even further underutilization of paid vacation days.

Fairness

Geanakoplos et al. (1989) established a model of psychological games as a revision to standard game theory, ultimately providing a model that could handle fairness. In their model, they allow for players to have emotions that depend on their beliefs, but still uphold sequential rationality—the idea that future decisions not in the interest of a player can be disregarded, or future actions of players will be rational. A specific game depicted in their report is the “Bravery Game”. In this game, player one can choose a bold action or a timid action, and will be judged by their peers (player two). Not only does the utility of player one depend on their action, but also upon the actions reception, so they will only choose the bold action if they are sufficiently confident that player two prefers it to the timid action. This relates to the workplace where employees only choose to take a vacation when sufficiently confident that their employer or coworkers will condone this as a wise decision.

Rabin (1993) builds on Geanakoplos et al.'s model to create an explicit model of fairness in game theory. In his model, Rabin outlines three key facts: individuals willing incur disutility to reward kindness of others, the same is true to punish unkindness of others, and both of these motivations are stronger when the utility sacrificed is less. For his first fact, Rabin cites voluntary water reduction in droughts and contributions to public goods. Furthermore, he describes how his model can account for a "gift giving" equilibrium in a marketplace where employers offer high wages, and employees reward this with high efforts.

A "gift giving" equilibrium could also be achieved with vacation days offered instead of high wages. This model explains how employees given very generous vacation benefit packages will reward their fair employers (at the expense of extra work hours) by taking fewer vacation days than allotted.

On the other hand, if employers are unkind and offer few paid vacation days, employees will go out of their way to punish this behaviour. This could take the form of full use of vacation days or even contributing less effort in the office, despite the possible cost of repercussion. Strong evidence for this willingness to go out of ones way to punish unfair behavior comes from studies of ultimatum games.

The standard form of an ultimatum game includes two players and a sum of money. Player one proposes an allocation of the given money divided between the two players, then player two can accept or reject. If player two accepts the agreed amounts are allocated to both players, but if player two reject no money is awarded to either player. Thaler (1988) explored ultimatum games in depth. He discovered that, contrary to what pure self-interest models predict, player two will frequently reject positive offers if viewed as unfair, thus surrendering the positive allocation of money to punish player

one. Thaler also details how, given the choice to evenly share ten dollars with a stranger that had given an even allocation in a prior ultimatum game versus splitting twelve dollars with a stranger that had given an uneven allocation in an ultimatum game, seventy-four percent of participants chose to sacrifice the extra dollar to share with the fair individual.

Thaler's work also shows strong support for Rabin's (1993) model of fairness where individuals show a diminished willingness to incur disutility to reward or punish behavior when the necessary sacrifice is large. Thaler found that in ultimate games, player two's are much more likely to (hypothetically) reject a ten cent allocation with a sum of one dollar than to reject a one million dollar allocation with a sum of ten million dollars (Rabin, 1993). This supports a scenario where an employer offering unlimited vacation is in some other way viewed as unfair, but employees still take few vacation days because the chance of losing this highly valued job is too much of a cost to punish the unfair behavior.

Fehr and Schmidt (1999) went from Rabin's model of fairness and added agents with "inequity aversion". In their model, the population has a fraction of individuals that care about fairness, which is modeled as a self-centered aversion to inequality. Fehr and Schmidt demonstrate the power of their model with a public goods game in which all players are asked to contribute to a public good, and the benefit everyone receives from this public good is a fraction of the total contributions. They show experimentally that in the basic version of this game, seventy three percent of all subjects choose no contributions and are free riders.

Fehr and Schmidt (1999) then add a second step to this game by revealing all contributions to every player, then letting each player individually punish any other

player(s) they desire by sacrificing an amount equal to a fraction of their chosen punishment. Under this game, roughly eighty percent of the players cooperate fully (allocate all of their endowment to the public good). The motivation for such widespread cooperation can be explained by the use of punishments by the inequity averse players. The majority of punishments were targeted at the free riders; higher punishments given to those with lower contributions.

In Fehr and Schmidt's first experiment, they show that only twenty seven percent of participants have an internal motivation to achieve fairness (inequity aversion). Yet their second experiment shows the consensus that it is in everyone's best interest to act fairly when choices are known and punishments are possible. In any company, vacation packages offered are necessarily known by employees, so it is important for fair choices on the end of the firm even when only a fraction of employees are motivated by inequity aversion.

Reciprocity

Acting with reciprocity means being nicer and cooperative to individuals who act friendly and meaner to those who show hostility. Reciprocity is so strong in human behavior, that Gouldner (1960) suggests that it is in fact a universal psychological norm. Gouldner does acknowledge that the norm of reciprocity suggests that individuals would more likely associate with those that are able to reciprocate, that is, people would only associate with others of high ability. However, he concludes that not observing this in practice can be explained by other psychological norms, and he emphasizes the potential for reciprocity to add stability to social systems.

Viewing reciprocity as a psychological phenomena, Hoffman et al. (1998) show evidence that it could be an evolutionary trait. They discuss how there is social benefit to be gained from cooperation, but there is often individual benefit to be gained from defecting or free-riding, therefore altruism will be selected against, as it allows cheating. However, reciprocity punishes cheaters while encouraging cooperation, and therefore Hoffman et al. demonstrate how reciprocity can lead to higher individual well being, and therefore how it can be an evolutionary trait.

Reciprocity as an evolutionary trait and psychological norm predicts a strong and consistent responses to actions directly affecting an individual. In the workplace, reciprocity implies a very strong, predictable effect of kindness towards kind employers and unkindness towards unkind employers.

Fehr and Gächter (2000) discuss at length how reciprocity is more than just cooperation to achieve a greater outcome or revenge to deter future losses, similar to Rabin's (1993) model of fairness. They also model how reciprocity can be used in and of itself as a technique for reinforcing contracts. Fehr et al. (1997) show this experimentally. To test this, they use a game where firms set wages, employees set effort levels, and then firms can reward or punish the effort. In these games, they demonstrate that higher initial wages are followed by higher effort levels. Additionally, the anticipation of the firm reciprocating leads employees to put forth higher effort levels than when the firm cannot reward or punish the effort.

This empirical evidence is consistent with employers offering good benefit packages and employees reciprocating by working hard and not using all of their vacation days. Firms can then reciprocate back to the employees in the form of raises or other benefits. Fehr and Schmidt (1999) also demonstrate that their model of inequity

aversion can be extended to predict the results of Fehr et al. (1997) using inequity aversion.

A familiar modern example of reciprocity is Costco and its use of free samples. Free samples given out at stores have been shown to boost sales by up to two thousand percent (Pinsker, 2014). These sample not only allow customers to learn more about the products, but also evoke reciprocal responses. When stores offer customers free food, the customers feel at least somewhat compelled to buy the stores' products.

The other side of this phenomena is very similar to the case of fairness. If firms act unkindly to employees by offering few paid vacation days, employees will respond by being uncooperative.

Self Signalling

A self signalling action is one taken specifically to reinforce an individual's view of a trait or quality of themselves, regardless of whether or not this action actually has bearing on the trait. Self signalling can be used as a way of diagnosing characteristics, and therefore utility can be gained from this alone (Bodner and Prelec, 2003). This leads to a total utility function that is divided between diagnostic utility and outcome utility.

This divide can show why resolutions can often feel very rewarding, but not be carried out. Outcome utility is discounted for the future and for uncertainty, but the diagnostic utility of a resolution is reaped immediately (Bodner and Prelec, 2003). Self signalling can also lead to an individual gaining utility from the actions of others with whom they identify. If someone similar to an individual self signals, this same signal

seems more probably for the original individual to perform, and thus that person gains utility from the actions of others. (Bodner and Prelec, 2003)

The role of identity in economics is further explored by Akerlof and Kranton (2000). In their model, everyone chooses or is assigned various identities. Individuals all gain utility from actions that solidify their membership in a certain identity (e.g. male identifying individuals acting manly). Conversely, members of a group have been demonstrated to experience disutility when their identity is insulted (Akerlof and Kranton, 2000). Some common examples Akerlof and Kranton give of the role of identity are achieving titles (such as doctor, lawyer, or military rank), advertisements trying to associate products with identities to make them appear more favorable, and the strength of political identities. This ties well into the workplace, where individuals want to identify with their coworkers and therefore work harder to affirm their membership of this identity.

Ariely et al. (2009) provide complementary empirical evidence, showing the power of self signalling for a cause. In their experiment, participants performed a task of clicking keyboard buttons to accumulate a small sum of money for a charity. Groups were split by charity between the NRA and the Red Cross. The participants were also randomly divided into groups that would either publicly state which charity they were assigned and how many clicks they performed, or remain private. Ariely et al. showed that individuals work harder when they believe in the charity, signaling to themselves that they were doing good. Ariely et al. also showed that individuals exerted the same effort when performing publicly or privately, further evidencing that the signalling was for their own benefit.

Gneezy et al. (2012) showed evidence for self signalling in determining prices. In their experiments with “pay what you want” pricing scheme (where buyers select any amount to pay for a good), Gneezy et al. demonstrated that individuals will forgo the purchase of goods that they had previously been willing to buy at a fixed cost. This is explained by the individuals deriving utility from fair behavior, and thus unwilling to set a low price (that they would deem unfair) for the good in question. Parallel to this, in an employment scenario, workers may exert extra effort to signal to themselves that they are good employees.

Conclusion

These three factors have been shown to be strongly at play when employees are choosing how many vacation days to take. Because of this, and because of shortcomings of classical utility maximization models especially when dealing with unlimited paid vacation, behavioral models must be taken into account when looking at vacation days taken as modeled by paid vacation given. The drive to act fairly to nice employers, the desire to reciprocate kindness of a firm, and the utility derived from signalling a strong work ethic to oneself all support my hypothesis of vacation days taken decreasing with added paid vacation available after a certain point.

Model

To examine vacation day usage and availability, I will use three different models. My first will be based off of data from the Panel Study of Income Dynamics (PSID) from

the year 1984. My second will combine data from the PSID with data from the National Compensation Survey (NCS) (Bureau of Labor Statistics, 2011) using data in both studies from the year 2011. The results from analyses of the 1984 data can be used to evaluate the results from 2011 data, and thus measuring the feasibility of merging the NCS and PSID data sets.

Having run regressions on the survey data, I will compare the resulting models to an anecdotal data set that I gathered from various technology startups. This comparison will be used to corroborate conclusions from my regressions and also as a means of measuring these models against the possibility of unlimited vacation.

Equation

The year 1984 was the most recent year that the PSID asked both about vacation days allotted and number of vacation days taken. Because of that, I will use this data to test my main hypothesis by running a linear regression. The model chosen is:

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{1i}^2 + \beta_3 x_{2i} + \beta_4 x_{3i} + \beta_5 x_{4i} + \beta_6 x_{5i}$$

In this model, y is vacation time taken. x_1 is the number of vacation days that the employee is given. Adding an x_1^2 term allows the model to incorporate a gradual decline as vacation days increase. x_2 is the age of the individual. x_3 is the number of people in the individual's family. x_4 is a dummy variable to denote gender (1 meaning female, 0 meaning male). x_5 is the individual's total taxable household income. (This information is represented in depth in Table A.2)

I predict that β_1 will be positive and β_2 will be negative in accordance with my hypothesis above. Because older people tend to be more risk averse (Deakin et al., 2004)

the fear of losing their job or coming back to too much work—reasons listed to avoid vacation (Travel Effect)—will be stronger, thus β_3 is predicted to be negative. Though the elderly take more vacations (Fleischer and Seiler, 2002), this is expected to have little effect because my study my population is limited to employees. β_4 is predicted to be positive because family size is shown to increase domestic travel (Soest and Kooreman, 1987), which accounts for 95.0% of travel in America (data from ATS). β_5 is predicted to be negative, as women have been shown to work harder with less reciprocation than men will, compounding the effect of reciprocation towards employers and decreasing vacation time (Ashwin et al., 2013). Larger household income has been shown to be correlated with more vacations and vacation expenditures (Soest and Kooreman, 1987), so β_6 is predicted to be positive.

To gain insight into these effects on recent data, my next analysis will be done using data from 2011. The model will be exactly the same, however instead of knowing the number of paid vacation days that the respondents were given, this data will be merged into the PSID responses based on industry average.

Methods

The first analysis looked only at the data from the PSID year 1984. The variables used from this study are V10474: 'does your job have paid vacation', V10475: 'how much paid vacation (in hours)', V10553: 'did you take vacation', V10554: 'how much vacation did you take (in weeks)', V10419: 'age', V10222: 'number of people in your family unit', V10277: 'total taxable income in 1983', V10420: 'sex', and V10463: 'hourly pay (wage)'. (For full description of all used PSID variables, see Table A.1)

The variable ‘is female’ used in my analysis is a dummy variable for sex, 1 being female, 0 being male. The variable ‘vacation’ is the number of days the respondent spent on vacation, obtained from weeks of vacation. The variable ‘paid vacation’ is the number of days of paid vacation days available to the individual by their employer, obtained similarly, but only looking at values greater than 0. The variable ‘salary’ is yearly salary obtained from wage (this was examined initially, but later dropped due to autocorrelation). The variables ‘age’, ‘family size’, and ‘income’ are kept. All data for unemployed individuals or individuals that did not receive paid vacation were dropped (For full description of these variables, see Table A.2).

This process was repeated for the data from the PSID year 2011. All of the above variables were recomputed, with the exception of ‘paid vacation’, because this question was removed from the PSID after 1984. Instead, industry averages were calculated from the BLS’s NCS. The census codes for industries listed in the PSID were transformed into NAICS codes, and then these codes were binned into the larger, overarching categories listed in the NCS. In this way, every response in the PSID data set was assigned an amount of paid vacation days equal to the average of the respondent’s industry.

Altonji and Usui (2005) showed that paid vacation given at an employee’s current job is unrelated to paid vacation given in past jobs when controlling for occupation. This is strong evidence that vacation policies are largely uniform across firms in the same industry. Because of this uniformity, assigning a number of paid vacation days based on industry average is expected to be a reasonable approximation of the real value.

After all the 2011 data was merged, I generated scatter matrices (Figures A.1 and A.2) and correlation matrices (Tables 1 and 2) for all variables from both years in order to

identify any potential autocorrelation. Additionally, I ran an OLS regression to check for coefficients with low significance, and I calculated the condition number.

	vacation	paid_vacation	age	fam_size	is_female	income83	salary
vacation	1.000	0.182	0.156	-0.018	0.060	0.139	0.141
paid_vacation		1.000	0.128	0.017	-0.068	0.171	0.215
age			1.000	0.047	0.023	0.216	0.230
fam_size				1.000	-0.338	0.131	0.089
is_female					1.000	-0.389	-0.285
income83						1.000	0.775
salary							1.000

Table 1: Correlation Matrix 1984
Note: every cell contains the correlation (r) between the row and column headers.

	vacation	paid_vacation	age	fam_size	is_female	income10	salary
vacation	1.000	0.051	0.123	-0.003	-0.069	0.109	0.142
paid_vacation		1.000	-0.065	-0.050	0.113	0.003	0.069
age			1.000	-0.032	-0.069	0.281	0.239
fam_size				1.000	-0.356	0.163	0.091
is_female					1.000	-0.361	-0.197
income10						1.000	0.731
salary							1.000

Table 2: Correlation Matrix 2011
Note: every cell contains the correlation (r) between the row and column headers.

The data sets from both years had strong autocorrelation, most notably between salary and income. Salary had a less significant coefficient and more overall correlation with other variables, so salary was dropped from the regression to address the issue of autocorrelation. All other variables were kept.

The data was then tested with the Breusch–Pagan test for heteroskedasticity. In both years, the data was found to be homoskedastic (in 1984: p<.001, in 2011: p<.05). Tables 3 and 4 show the summary statistics of the final variables.

Variable	Mean	STD	Min	Median	Max
vacation	14.760	14.643	0.0	10	135.000
paid_vacation	3.277	1.938	0.2	3	30.025
age	37.673	11.171	19.0	35	76.000
fam_size	2.882	1.448	1.0	3	12.000
is_female	0.203	0.403	0.0	0	1.000
income83	32500.483	20482.959	1399.0	29000	221920.000
salary	23400.254	12402.249	2500.0	21170	112000.000

Table 3: Summary Statistics 1984
Notes: units top to bottom are days, days, years, people, (none), dollars, and dollars per year. See Table A.2 for an in depth description of variables.

Variable	Mean	STD	Min	Median	Max
vacation	12.166	15.456	0.00	10	230.000
paid_vacation	13.862	2.274	9.25	14	17.917
age	41.796	11.718	19.00	40	84.000
fam_size	2.779	1.409	1.00	2	9.000
is_female	0.228	0.420	0.00	0	1.000
income10	93802.409	63941.306	1000.00	80000	399000.000
salary	65477.161	40887.889	1200.00	55000	360000.000

Table 4: Summary Statistics 2011
Notes: units top to bottom are days, days, years, people, (none), dollars, and dollars per year. See Table A.2 for an in depth description of variables.

Results

The final regressions for both 1984 and 2011 show support for my hypothesis. Table 5 shows the results of these regressions:

Variable	1984 Coefficients	2011 Coefficients
intercept	1.632	-25.192*
	(1.806)	(10.008)
paid vacation	1.265*	4.316**
	(0.583)	(1.495)
(paid vacation)^2	-0.007	-0.144*
	(0.046)	(0.055)
age	0.136***	0.137**
	(0.034)	(0.044)
family size	-0.033	-0.266
	(0.239)	(0.236)
is female	4.400***	-2.125*
	(1.101)	(0.993)
income	0.000***	0.000
	(0.000)	(0.000)

Table 5: OLS results, with vacation taken (in days) as dependent variable. Notes: $n_{1984} = 1420$ and $n_{2011} = 1953$. Robust standard errors in parentheses. *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

The data show that age has the opposite effect as predicted. However, though this is a statistically significant effect, the small coefficients show that a fifteen year increase in age accounts for just a two day increase in vacation taken. The deviation from my

original prediction could be due to individuals having better jobs as they are older and thus farther along their career paths.

Family size ultimately had no effect on the number of vacation days taken. It would take an increase of thirty family members in 1984 or four in 2011 to reduce vacation taken by a full day. Furthermore, neither of the coefficients were significant.

In 1984, females took around four and a half more vacation days than males, but in 2011, females took two fewer vacation days than men. It seems likely that this change may be due to a shift in societal norms that occurred in the twenty-seven year gap between surveys. If females in 2011 were taking more full time jobs, they may have had less time for vacation. This difference may also have been the result of the industry aggregation for calculating paid days given in 2011. Perhaps in some industries, females take significantly more vacation days than the average.

In both regressions, additional days of paid vacation increased the amount of vacation days taken up to a point, but the square term (β_2) is negative, so this effect reverses. In the 1984 data, additional days of paid vacation start to decrease the number days taken after ninety days. However, looking at the 2011 data, increasing the number of paid vacation days given from 15 to 20 will decrease the total number of vacation days taken by about four.

When looking at the coefficients between the two regressions, several large differences are apparent. β_0, β_1, β_2, and β_5 all are drastically different between the two studied years. To test whether the observations of these variables are truly different, I ran a Student's *t*-test on all variables in the regression (Table 6).

Variable	t-statistic	Two-Tailed p-Value
vacation	3.543	0.000
paid vacation	-139.194	0.000
age	-10.934	0.000
fam size	2.281	0.023
is female	-1.145	0.252
income83	-35.074	0.000

Table 6: Student's t-test results for all variables.
Notes: Each row is a comparison of the given variable between the years 1984 and 2011. The null hypothesis is that the differences in the data sets are due to randomness, not a difference in the population.

Table 6 shows that for every variable except is_female, I can reject the null hypothesis that the test statistic follows the Student's t-distribution, thus concluding that the sets of data are significantly different. Additionally, the large magnitude of the test statistic for paid vacation indicates that the merging of paid vacation from industry averages resulted in largely different values than the true values measure in the PSID 1984.

In both years, however, the results are extremely promising for my hypothesis. The behaviour of decreasing number of vacation days taken after a generous benefits package from an employer is consistent with the models of self signalling, fairness, and reciprocity.

Discussion

Startup Data

In addition to the analyses of the survey data, I also contacted startups to ask for their vacation plans and employee vacation usages. This was met with limited success for a number of reasons. The vast majority of contacted companies didn't respond at all. Many companies responded that this data was sensitive and that it could not be shared due to either security or legal reasons.

Many startups replied confirming that they did indeed use an unlimited vacation plan, however that the days taken were not tracked—employees were allowed to take vacation with no further steps than getting an okay from a departmental manager.

However, several companies did reply with rough data. None of the response I received reported average employees taking more than four weeks, with the most common number of weeks taken being two. On top of this, one company even reported that using more than four weeks of vacation was considered too many (though they had never had an issue with this as employees took far fewer). These responses show that the employees themselves are in fact putting a limit on their "unlimited" vacation day policies.

Beyond the responses collected directly from startups, community question and answer sites also provide insight into how many vacation days are taken under unlimited policies. (Why is it so much easier to see who answered a question on Quora then to see who asked the question?, 2012) Answers to the original poster's question also fall within the two to four week range.

Plugging the mean values for all demographic variables in the 1984 data into the regression produces the following equation for modeling vacation:

$$vacation\_taken = -0.007 * paid\_vacation^2 + 1.265 * paid\_vacation + 7.55322$$

Using this equation, I plugged in four weeks of vacation data to find what amount of paid vacation (under otherwise average conditions) would result in this number of vacation days taken. The solution is just over two weeks, so it seems that the employees at these companies with unlimited vacation are taking the same amount of vacation as employees at other companies under a two week paid vacation plan.

One startup reported a very different scenario. They had previously offered unlimited paid vacation days, but "several employees [took] advantage of [this] policy" so they were in the process of transitioning to a limited vacation plan. Abusing an unlimited vacation plan goes against my model and falls into the predictive scope of classical utility maximization models.

This single case of failed unlimited vacation plan raises question for future examination. Perhaps this phenomenon is more common than I observed. Or if this type of situation truly is rare, a comprehensive study of why such policies may fail would have tremendous implications for business practices.

Limitations

There are several limitations of this study, specifically limitations arising from the available data. The PSID 1984 only recorded granularity of vacation taken in weeks (see Table A.1). This coarse granularity contributed to the low predictive power of my regression. The R^2 value was 0.071, meaning that this model explained 7.1% of the

variation in vacation days taken. Furthermore, this data is now over thirty years old and, as shown in Table 6, many of the variables are different ($p<.05$) than those in 2011.

A statistical limitation with the analyses done is the dearth of data points with high values of paid vacation. The sparsity of data in the upper range of paid vacation values means that this model is less accurate at predicting values in this range, and thus at predicting results of unlimited paid vacation or even more than one hundred days of paid vacation.

Another large limitation is that the PSID 2011 did not included number of paid vacation days. The data merged from the NCS were very large industry averages, and all responses from the PSID needed to be binned into one of the twenty-eight unique industry categorizations of the NCS. This was likely a large contributing factor to the model for the data from 2011 only explaining 3% of the variability in vacation days taken.

Finally, due to unlimited vacation policies generally being implemented without a tracking mechanism, the data on vacation days taken in companies that actually offer unlimited vacation can only be used to show anecdotal support for my hypothesis. However, the results of my study highlight the importance of future work.

Suppose a firm was offering a vacation package of three paid weeks annually. This study suggests that switching to an unlimited paid vacation plan would result in employees taking fewer total vacation days, thus lowering cost of labor for the firm while allowing the firm to offer a more appealing employee benefit package. This possibility underscores the potential for future studies on the effects of paid vacation on the number of vacation days taken.

Conclusion

Paid vacation time has been demonstrated to be an extremely important employee benefit to US employees. (Travel Effect, 2014) On top of this, behavioral factors such as fairness and reciprocity predict strong employee backlash towards employers offering substandard benefit packages.

However, the average US firm offers relatively paid vacation days by global OECD country standards. Despite the low vacation day allotment, paid leave still accounts for 6.9% of labor costs in the US. (BLS, 2014). The firms tendency to minimize total costs is a factor driving this disconnect between the employee held importance of vacation days and the firms' willingness to provide this benefit.

On the other hand, a small percentage of companies offer an unlimited vacation plan. (Vasel, 2014; Shellenbarger, 2011) Businesses that have successfully implemented this find that employees, when given unlimited vacation, still only take a reasonable amount.

My paper presents a model based on reciprocity, fairness, and self signalling where employees will decrease the number of vacation days they take in absolute terms after a certain availability of paid vacation days. Data from the PSID show empirical support for this, and data gathered from startups with implemented unlimited paid vacation plans also show anecdotal support for this hypothesis.

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Appendix

Data

Industry vacation days data from the BLS NCS can be found here:

http://data.bls.gov/cgi-bin/dsrv?nb

My data was accessed on February 1, 2015.

All data from the PSID can be downloaded here:

http://simba.isr.umich.edu/Zips/ZipMain.aspx

My data was accessed on February 12, 2015.

For full description of all PSID variables used, see Table A.1

For full description of all variables used in my regressions, see Table A.2

The most recent full code for this paper (data cleaning, all formatting, statistical analyses, and all table and figure creation) can be found here:

https://github.com/Machyne/econ_comps

Tables and Figures

Year	Variable	Description
1984	V10474	whether or not job has paid vacation
	V10475	amount of paid vacation gicen (in hours)
	V10553	whether or not paid vacation was taken
	V10554	how much vacation was taken (in weeks)
	V10419	age (in years)
	V10222	number of people in family unit
	V10277	total taxable income in 1983 (in dollars)
	V10420	sex (male or female)
	V10463	salary (dollars per hour)
	V10453	whether or not the respondent is employed
2011	ER47480	industry code*
	ER47630	whether or not the respondent took vacation
	ER47631	how much vacation was taken (in days)
	ER47633	how much vacation was taken (in weeks)
	ER47635	how much vacation was taken (in months)
	ER47317	age (in years)
	ER47316	number of people in family unit
	ER52259	total taxable income in 2011 (in dollars)
	ER47318	sex (male or female)
	ER47495	salary received (multiple units)
	ER47496	salary unit (unit for salary)
	ER47448	whether or not the respondent is employed

Table A.1: All PSID variables used with descriptions
*: 3-digit industry code from *2000 Census of Population and Housing: Alphabetical Index Of Industries And Occupations*

Variable	Name	Description
y	vacation	amount of vacation taken (days)
x_1	paid_vacation	amount of paid vacation available (days)
x_2	age	age (years)
x_3	fam_size	number of people in family unit
x_4	is_female	1: female, 0: male
x_5	income83 / income10	total taxable income in given year (dollars)

Table A.2: All variables used in my regressions with descriptions

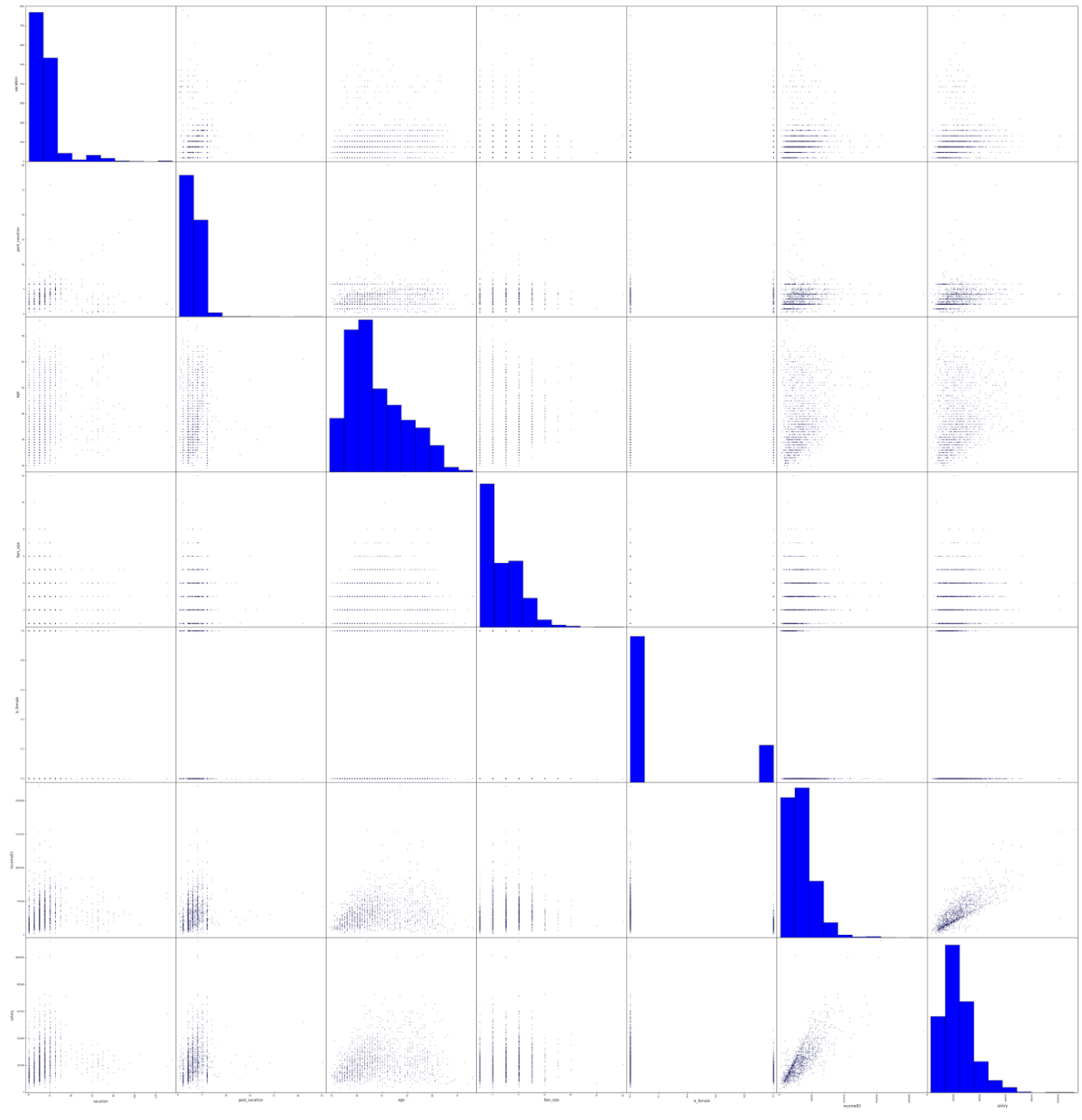

Figure A.1: Scatter matrix of every variable in 1984 data set.
Notes: Diagonals are histograms of the variable.
Axes (top to bottom / left to right) are vacation, paid_vacation, age, fam_size,
is_female, and income83.

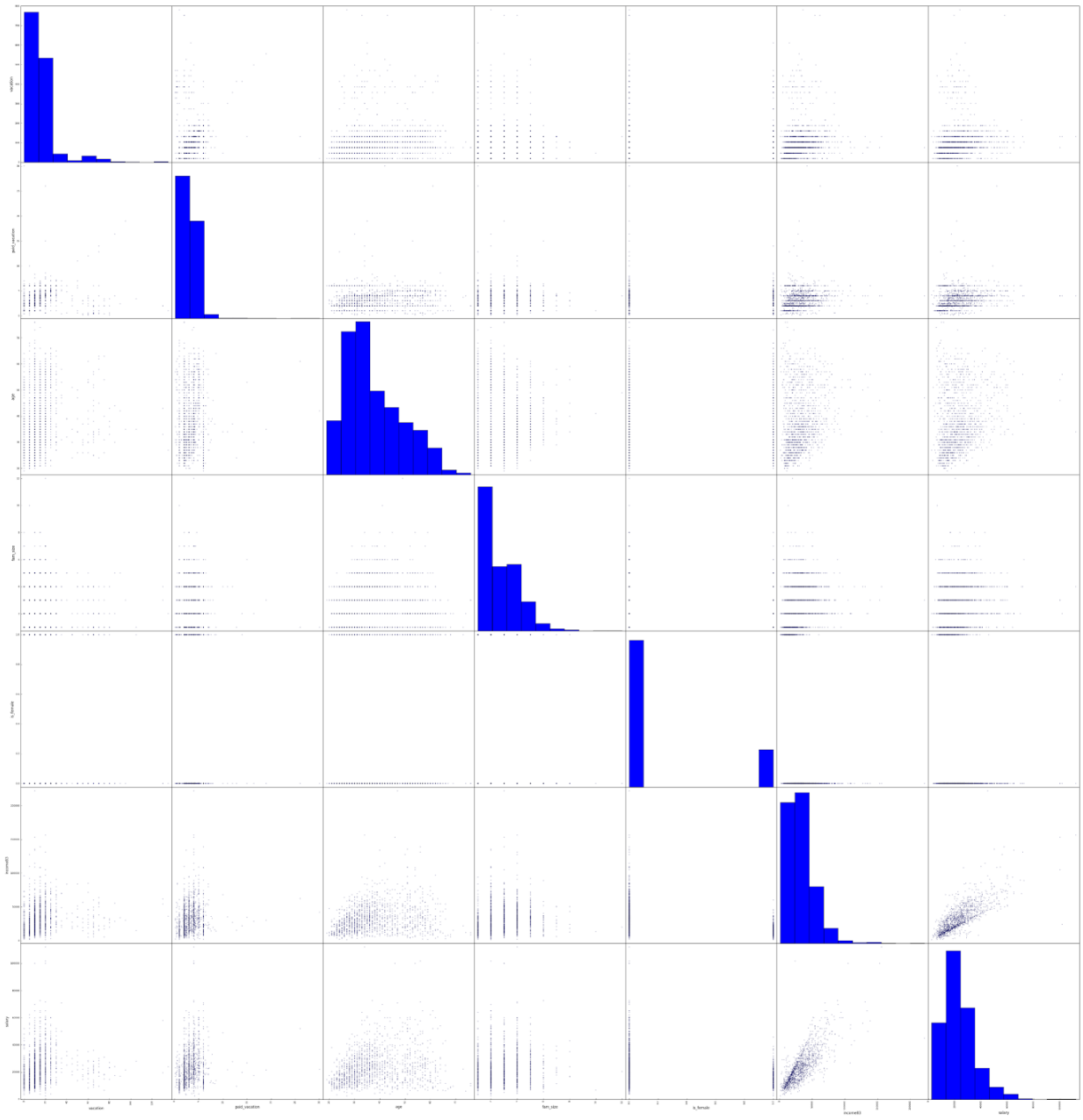

Figure A.2: Scatter matrix of every variable in 2011 data set.
Notes: Diagonals are histograms of the variable. Axes (top to bottom / left to right) are vacation, paid_vacation, age, fam_size, is_female, and income10.