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ABSTRACT

Major strands of recent macroeconomic theory hinge on the relation of workers' efforts to their wages, but there has been no direct general evidence on this relation. This study uses data from household surveys for 1975 and 1981 that include detailed time diaries to examine how changes in the use of time on the job affect wages. Additional time spent by the average worker relaxing at work has no impact on earnings (and is presumably unproductive). Additional on-the-job leisure does raise earnings of workers whose break time is very short. Only among union workers, for whom additional leisure time (in unscheduled breaks only) appears productive, does this pattern differ. The results suggest that further growth in on-the-job leisure will reduce productivity (output per hour paid-for), that monitoring workers can yield returns to the firm, but that entirely eliminating breaks is counterproductive.

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I. Introduction

Since World War II there has been a rapid increase in two types of leisure that may affect workers' productivity while they are actually working. The first of these is the well-known increase in paid time off from work --- vacations, holidays and sick days. In larger manufacturing firms (U.S. Chamber of Commerce, 1953, 1987) this type of payment for not working increased from 5.4 percent of total payroll cost in 1953 to 10.2 percent in 1986. (Comparable figures for paid holidays and sick time alone are 2.1 and 4.4 percent.) The less well-known source of increase is the rise in time spent at work but not working. In the same survey this source of paid on-the-job leisure increased from 2.1 to 3.3 percent of payroll costs.

In Hamermesh (1986) I analyzed workers' demand for mixing work with leisure on the job and paid leisure off the job. However, no one has examined how on-the-job leisure affects production or the demand side of the labor market.[1] Time spent on the job relaxing (loafing?) can increase workers' productivity by enabling them to rest when they are physically or mentally fatigued. To the extent that this productivity-enhancing effect exists, it has implications for issues of interest to labor economists and economists generally. First, and simplest, how does the structure of pay differ along the dimension of the allocation of time at work? That is, do we observe pay differences that are related to the amount of time workers spend on scheduled and unscheduled breaks?

Of particular recent interest to macroeconomists and labor economists too has been the role of shirking on the job and the incentives shirking gives employers to institute monitoring schemes. This question also speaks, though less directly, to the issue of efficiency wages. Yet in the burgeoning literature on the role of wage differentials in affecting worker productivity the evidence supporting the hypothesis is the documentation of interfirm wage

differentials unexplained by conventional human capital, demographic and other variables (Krueger-Summers, 1988). The hypothesis is based on how time is used in the work place; but no evidence on time use is provided. This is the first comprehensive study to relate time use to wages.

Alternative uses of time on the job also affect predictions about the impacts of various labor-market policies. Legislated reductions in the standard workweek will affect the relative demand for workers and hours differently depending on the current productivity of slack time in the work place (see Hart, 1987, p. 53). The more productive slack time is, the smaller is the margin available to employers for increasing the efficiency of hours paid for in response to an imposed change in standard hours. Increases in wage rates, be they legislated or bargained, are more costly to employers, and will have a greater disemployment effect, the lower the productivity of time on the job. Understanding the effects of on-the-job leisure on productivity informs us about the structure of the demand for workers and thus about the possible impacts of such policies as overtime pay requirements, payroll taxes, and minimum wages.

In Section II I review the work of industrial engineers and psychologists on the effects of alternative uses of time on the job on worker performance. This evidence is used to motivate an implicit-contract model in which workers and firms sort themselves according to their tastes and technologies defined over time use on the job. In Section III I describe the data used to examine the issues and present the equations that will be estimated. Section IV provides the evidence on how time is used and its effects on productivity, essentially answering whether on-the-job leisure is shirking or represents productive schmoozing --- socializing with workmates that adds to productivity (see Schrank, 1978). Section V draws inferences from the results for pay structure, shirking models and trends in time use.

II. Background and Theory

As far back as Florence (1924) industrial engineers have charted the paths of output, spoilage and other indicators of physical productivity as functions of the length of time the employee has been producing during the day. The evidence suggests that accident rates and work spoilage are lowest after breaks and at the start of a shift, and that output is highest at those times. A huge literature in industrial psychology (see McCormick-Ilgen, 1985, for a summary) has examined the effects of rest periods on the job on fatigue, boredom and other counterproductive reactions. Among workers engaged in physical tasks there is clear physiological evidence of reductions in work capacity occurring at lower levels of rest and break time. Among workers in sedentary jobs no such physiological evidence exists. Those workers do, however, report feelings of fatigue when deprived of rest periods, and the literature indicates that there are psychological benefits from rest periods that may enhance the well-being of these workers and hence their productivity.

This evidence is clearly important; but its implications for labor-market outcomes are not entirely clear. What is required is some consideration of how time use on the job affects the rewards --- higher wages --- that are the returns to productive uses of time on the job. Unless worker productivity is independent of the way time is used on the job, the phenomena must be modelled as being jointly determined by workers and employers.

Consider first a simple model of the choice of hours of productive work and wages in a world of homogeneous workers and a representive firm among those where leisure on the job is possible. The firm operates in a competitive product market. I ignore shirking/monitoring in this simple model. Let production Y be characterized by:

(1) $$Y = Y(H_w, b[H^* - H_w]),$$

where H_w is normal (non-break) hours per worker, $b \leq 1$ is a parameter indicating the productivity of on-the-job leisure, and H^* is the fixed amount of hours paid for in the firm. I make the assumptions that $Y_1(x,x) > Y_2(x,x) \geq 0$, i.e., that the marginal minute of work is uniformly more productive than the same marginal minute of on-the-job leisure. Normalizing the product price at one, and assuming that the firm has already decided how many workers to employ, I assume it maximizes $[Y - WH^*]$ subject to:

$$U(WH^*, H^*-H_w) \geq U(I^*, 0) ,$$

where U is the representative worker's utility function, W is the wage the firm pays, and I^* is earnings available in jobs where no on-the-job leisure is possible. The maximization process yields solutions for wages and on-the-job leisure:

$$\tilde{W} = F^1(b, H^*, I^*);$$

$$\tilde{H}_w = F^2(b, H^*, I^*).$$

Depending on preferences and the sizes of Y_1 and Y_2, the jointly-maximizing value of H_w can be less than H^*.

The comparative-static question of interest here is the effect of an increase in b, the productivity of on-the-job leisure, on the equilibrium values of W and H_w. One can show that an increase in b lowers both $\tilde{W}$ and $\tilde{H}_w$ given a fixed H^*. Essentially, a higher b encourages the firm to substitute on-the-job leisure for normal work, and it can still attract workers at a lower wage rate because the workers are more than willing to trade off reduced normal work for increased on-the-job leisure.

This model yields little that is testable, as we cannot observe b to link it to combinations of $\tilde{W}$ and $\tilde{H}_w$. It does, though, provide the basis for analyzing a more useful model, one characterizing an economy with heterogeneous

firms and workers in which shirking is possible and firms spend resources on monitoring their employees. Consider firm i's production technology:

(2) $$Y_i = Y_i(H_{wi}, b_i[H^*-H_{wi}]).$$

Each firm has a different production technology, Y_i. Firms cannot measure H_{wi} as well as workers, though they can observe the results of a low H_{wi}. Accordingly, they choose to spend some amount M_i on monitoring workers, so that profits are:

(3) $$\pi_i = Y_i - W_iH^* - M_i.$$

The firm uses its resources to monitor workers and improve its probability of catching slackers. I model this in terms of the probability of a worker being fired, $p(H_{wi}, M_i)$, with $p_1<0$, and with increasing M_i reducing the dispersion of p over the range of H_{wi} between 0 and H^*. Workers j maximize utility defined over the probability of keeping the job in firm i:

$$U_j = [1-p]U_j(W_iH^*, H^*-H_{wi}) + pU_j(I^*, 0).$$

Each firm maximizes profits subject to the competitively determined market locus shown in Figure 1 in $W-\frac{H_w}{H^*}$ space. The firm's isoprofit curves slope upward because it can offer a higher wage rate if it can induce its workers to spend more time on the job engaged in normal work. Workers' indifference curves slope upward because workers must receive a higher wage rate to be induced to forego more of their on-the-job leisure. As a result of both sets of behavior, WW, the market locus of equilibrium combinations $(\tilde{W}, \frac{\tilde{H}_w}{H^*})$, also slopes upward. With a fixed H^* this means that the locus of equilibrium combinations of wages and on-the-job leisure, $\tilde{W}_i$ and $\frac{\tilde{H}_{Ii}}{H^*}$, slopes downward. Implicit in this maximization is an equilibrium amount of spending on detecting shirking, $\tilde{M}_i$.

Consider what happens if b_i rises in each firm, while workers' preferences for spending time in on-the-job leisure rather than work remain unchanged. At the old equilibria the value of a dollar spent on detecting shirking decreases. Because on-the-job leisure is now more productive, competition among firms for

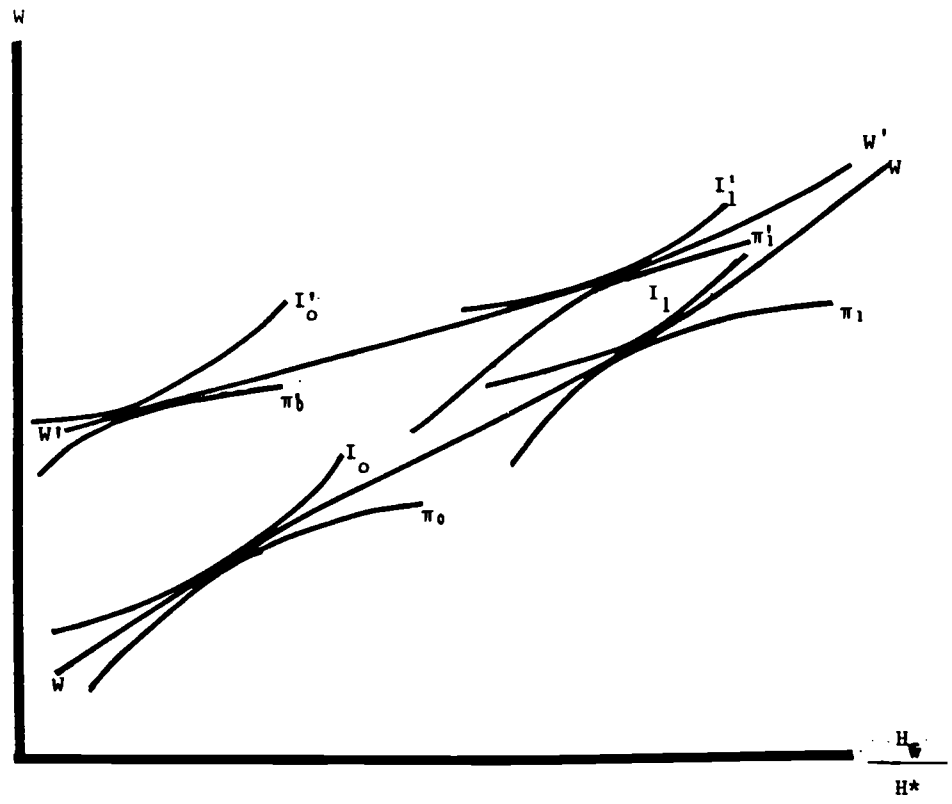

Figure 1. The Wage-Actual Work Time Locus

workers forces employers to raise the wage at each level of H_{wi} less than H^*. The competitive pressures are especially increased among firms that had already chosen a low $\tilde{H}_{wi}$ (and a high $\tilde{H}_{Ji}$), for the productivity gains are greatest in those firms. (In the extreme, at a firm in which $\tilde{H}_{wi} = H^*$, a small increase in b_i will not change the firm's choices of $\tilde{W}_i$ and $\tilde{H}_{wi}$.) The market locus in Figure 1 thus rises and rotates clockwise, becoming $W'W'$, when on-the-job leisure becomes more productive. Obversely, the negatively sloped locus of equilibrium combinations of W and $\frac{\tilde{H}_J}{H^*}$ becomes flatter also.

A simple way to see this result is to abandon our obsession with labor supply and assume that workers are indifferent between time spent at work in alternative uses, be they productive or just loafing. In that case the market locus in Figure 1 would slope upward solely because employers who use a more loafing-intensive technology will have lower output than otherwise identical firms that have higher $\frac{\tilde{H}_{wi}}{H^*}$. They can remain in business only by paying lower wages than other employers. If on-the-job loafing becomes more productive, competition will pressure them to raise wages. In the extreme case, in which we continue the assumption that workers are indifferent among uses of time on the job, but assume that all time uses are equally productive, the market locus in Figure 1 becomes horizontal.

This observation on the possible effects of productive on-the-job leisure in an implicit market gives a specific prediction: The more productive is on-the-job leisure, the flatter will be the market locus relating the wage rate to hours actually worked, holding total hours on the job constant. This means that the market locus relating wage rates and on-the-job leisure will also be flatter, other things (including total hours) equal, the more productive is on-the-job leisure. In the next Section I discuss ways of implementing these observations.

III. Data and Estimating Equations

The model to be estimated is of the standard form:

$$\ln W = G(X, T) , \tag{4}$$

where X is a vector of control variables, and T is a vector of variables that measure alternative uses of time on the job, including H_w and H_l. It is easier to estimate some of the versions of (4) by entering the time spent in each alternative use separately than by including total time on the job and the fraction spent on breaks. This requires a slight reinterpretation of the results in Section II, since total hours at work are not held constant. At the extreme, in which on-the-job leisure is as productive as normal working time (is identical to it from the employer's standpoint), demand forces alone would make the slopes of both loci the same (and positive if workers dislike spending more time on the job). However, if marginal workers find on-the-job leisure less unattractive than normal working time, we will still observe a higher positive slope for the wage--working time market locus than for the wage--on-the-job leisure market locus. The discussion in Section II suggested that, for a given distribution of tastes for normal work and on-the-job leisure, higher productivity of the latter will cause $\partial \ln W/\partial H_l$ to approach $\partial \ln W/\partial H_w$.[2] In the extreme case, if workers' distastes for time on the job are distributed independently of how that time is used, the estimated differences in these slopes will be perfect measures of the relative productivity of on-the-job leisure and normal working time. If the marginal worker has a greater distaste for additional normal working time than for additional on-the-job leisure, then $\partial \ln W/\partial H_l < \partial \ln W/\partial H_w$ even if the two uses of time are equally productive.

This discussion illustrates the difficulty of drawing inferences about the relative productivity of alternative uses of time on the job.[3] We simply cannot be sure that any differences in the slopes that we do observe are attributable to

differences in productivity rather than to differences induced by workers sorting themselves into various jobs according to their relative tastes for normal time at work and on-the-job leisure. Clearly, if we found $\partial \ln W/\partial H_1 \ll \partial \ln W/\partial H_w$, we could interpret that result as reflecting the different relative productivity of the two activities, different relative tastes for the two activities, or some combination of both. In interpreting the results I shall make the extreme assumption that workers find time spent at work equally distasteful regardless of whether it is spent in normal work activity or in on-the-job leisure. This is not necessarily correct, but I leave it to the reader to decide how large are the potential biases that this assumption imparts to my conclusions about the relative productivity of the alternative uses of time on the job. So long as on-the-job leisure is not more attractive to workers than off-the-job leisure, though, we should observe that $\partial \ln W/\partial H_1 > 0$ if OTJ leisure is productive.

The model assumes that the productivity of workers' uses of time on the job is reflected in the wage rates they receive. The output of this estimation is thus an upper bound on the difference between the productivity of normal working time and on-the-job leisure. If this upper bound is low --- an hour of this type of leisure has nearly the same effect on wages as does normal work --- we may infer that OTJ leisure is a productive use of time on the job for which employers are willing to pay. This inference would suggest that at least some shirking on the job does not harm a firm's profitability. It would provide some evidence that the role of expenditures on monitoring workers has been overstated and would undercut the importance of shirking/monitoring as an explanation for various labor-market phenomena. If, however, the upper bound is large, we may be fairly sure that OTJ leisure is not productive, especially given our assumptions about workers' indifference among uses of time on the job.

The empirical examination of time use on the job is conducted on data from the 1975-76 Time Use Study (Juster et al, 1979) and from the 1975-81 Time Use Panel Study (Juster et al, 1983). These data sets do not appear to have been used by economists outside the group that collected the data; and among the purposes to which they have been put, only one study, Stafford-Duncan (1980b), examined time use on the job. The extract that underlay that study was quite similar to the one I create from the 1975-76 sample, but those authors did not analyze the relation between wages and alternative uses of time on the job.

The 1975-76 Study obtained data from four days of time diaries kept by members of 1519 households. The days were at three-month intervals, with two being weekdays, one a Saturday and the fourth a Sunday. The data on time use are combined into "synthetic weeks," and it is these that I use in estimating (4). The 1975-81 Panel Data were collected similarly, with follow-up diaries kept for four days (again, at three-month intervals) in 1981 by 620 of the households that were included in the 1975-76 survey.

In the 1975-76 diaries workers could categorize time on the job as: Normal work; work at second job; lunch at work; coffee breaks; and other breaks --- breaks before regular work, after regular work, or other breaks during work. In the 1981 follow-up survey information on normal work time at home was also collected, and separate totals were reported for the three components of other breaks. Reporting of break time does not merely include scheduled on-the-job leisure, but instead is designed to reflect all non-normal working time while on the job. Because of this, and because time use is reported by the worker, the data on time use should include much of what economists could regard as time spent shirking. This is especially likely to be the case for the less structured category, other breaks. Any positive effects on wages of additional time spent

in other breaks would be an especially strong indication that on-the-job leisure is productive.

The data on household heads in the surveys formed the basis for the analysis. Only those who responded that their weekly work hours on the main job were at least 20 during each of the four interview waves in 1975-76 and whose actual normal work time (in the time diaries) exceeded 15 hours on that job in the synthetic week were included in the extract. Also, in order to ensure that the data describe the same workplace, only workers who kept the same employer throughout the interview year were included. These disqualifiers accounted for most of the reductions in the number of data points, with the remaining reductions due to the exclusion of household heads for whom substantial amounts (at least one full day out of the four) of time-use information was missing, or for whom data on one of the X variables was not reported. Taken together, the exclusions resulted in 343 usable observations from the 1975-76 Time Use Study.[4] Of these, 311 were employees, and 276 were employees whose only earnings were wages or salaries. The statistics and estimates are reported for all three subsamples.

These same 343 people formed the basis of the subsample from the Panel Study. With the same exclusions --- that the individual did not change employers during 1981 (though the employer in 1981 could differ from that in 1975-76); that the respondent stated that he or she worked at least at least 20 hours per week in 1980 when working and the time diaires showed at least 15 hours of normal work time; and that data on X be available --- the usable subsample contained 92 individuals, of whom 81 were employees. Because of the small size of the panel, breaking the subsample into still finer groups made no sense.

The vector X includes all the variables that have become standard controls in wage equations and for which the Time Use Study and the Panel Study provide information. Thus educational attainment, years of labor-market

experience (including a quadratic), self-reported health status, union membership, marital status (currently married or not), location in the South, whether in a large metropolitan area, and vectors of dummy variables for one-digit occupation and industry were all used as controls in estimating (4).[5]

Normal work measures time (in minutes) reported for the synthetic week (based on the four daily diaries). For the observations in 1981 this measure includes work time at home.[6] Equation (4) is estimated using reported break time in the three categories --- lunch, coffee and other --- separately, as well as with an aggregate of time spent on these three activities. The wage measure is monthly pay, and the dependent variable in all estimation is the logarithm of monthly pay. This is calculated as the sum of reported earnings on the particular job during a recent month and the monthly bonus received during that month.

IV. Wages and Time on the Job

A. The Time Use Study, 1975-76

Table 1 presents descriptive characteristics of the three subsamples from the 1975-76 Time Use Study. In addition, I present separate data for union and nonunion employees. The four categories defining time use on the job are listed in minutes per week. Together the data from the time diaries total 42.5 hours per week, somewhat less than the 44.0 hours that sample members report when asked how much time they usually work per week.[7] This discrepancy suggests that CPS-type data overestimate the amount of time devoted to market production and lead one to underestimate the amount of time spent in household production and leisure. The allocations of time on the job do not differ much among the three subsamples. However, unionized workers took distinctly more other break time on the job than did nonunion workers, and coffee breaks were more widely available and/or longer among unionized workers.

Table 1

Means and Their Standard Deviations, 1975–76 Time Use Study

	All	Employees	Employees		Employees,
			Union	Nonunion	Wages Only
Weekly Minutes of:					
Normal Work	2345	2310	2234	2336	2313
	(37)	(37)	(75)	(43)	(40)
Lunch Breaks	107	112	109	113	112
	(6)	(6)	(11)	(7)	(6)
Coffee Breaks	54	56	62	54	56
	(6)	(4)	(8)	(5)	(4)
Other Breaks	43	46	56	43	48
(before, after, other)	(4)	(6)	(9)	(8)	(7)
Usual Weekly Hours,	44.0	43.2	42.8	43.3	43.0
Main Job	(.6)	(.6)	(.93)	(.63)	.5
Pay Per Month	1121	1043	1014	1053	968
	(54)	(42)	(45)	(54)	(35)
Age	38.70	38.47	37.96	38.64	38.74
	(.63)	(.65)	(1.23)	(.77)	(.69)
Education	12.80	12.75	12.32	12.89	12.67
	(.14)	(.15)	(.33)	(.16)	(.16)
Union	.23	.25	---	---	.26
	(.02)	(.02)			(.03)
N =	343	311	78	233	276

Are the data on break times reasonable? Consider first their means. The total weekly break time, 214 minutes for employees, seems at first glance to be disturbingly low (less than 45 minutes per working day for the average employee). It is quite comparable, though, with other available data. The Chamber of Commerce survey (1987, Table 4) of larger firms shows that only 3.4 percent of payroll costs are accounted for by lunch, coffee and other paid breaks. Assuming a forty-hour week, this means those paid breaks totalled only 82 minutes per week. Even if only half of the 168 minutes of coffee and lunch breaks reported by employees in our sample are paid for, we may conclude that the Time Use Study does not understate break time.

Now consider the variability of break time across the days on which the workers kept diaries. (Remember that the typical respondent kept time diaries for two work days.) The average correlation between time on coffee breaks within a pair of diary days was .32 for the sample of 343 workers. For lunch breaks it was .27, and for the less structured other breaks it was .16. These correlations are significant, suggesting the data are not just noise. That the correlation is lower for other breaks is consistent with their less formal nature.

The differences in diary times between workers in the largest subsample and the sample consisting of employees only are striking. Self-employed workers, excluded from the second subsample, reported 2685 minutes of normal work, but only 117 minutes of break time. Self-employed workers, who presumably determine their own break time to maximize productivity, spend only half as much time on breaks as employees, and they do this during a longer workweek.

The demographic characteristics on which Table 1 provides information (and others not shown) suggest the subsamples are quite typical along most dimensions. The workers' average age and educational attainment are roughly what one observes

for steady workers in subsamples from other large micro data sets. Employees in this subsample are unionized at roughly the same rate as were all nonfarm employees in 1976 (see Hamermesh-Rees, 1988, p. 247). Along the dimensions of the other control variables too, members of this subsample are representative of household heads in the mid-1970s.

In Table 2 I show the parameter estimates of (4) for the various subsamples. Before commenting on the returns to alternative time uses on the job, it is worth noting that the returns to other characteristics of the workers accord with those found in earnings regressions on other sets of data.[8] The effects of normal working time on earnings are positive and usually significant. For the entire subsample an additional hour of normal working time in a typical week raises earnings by .71 percent. Thus the marginal benefit from additional normal work is positive, though it is well below the average wage in this subsample.

For none of the three types of breaks is the marginal effect of additional time significantly positive in the three main subsamples. Indeed, in the least-structured category of self-reported break time --- other breaks --- the marginal impact is negative and almost significant at conventional levels. From the results in Table 2 one would infer that time spent at work but not working is entirely unproductive --- it has no impact on monthly earnings. This would imply that, to the extent that breaks are not contractual (explicit or implicit) benefits, it pays employers to spend resources on monitoring workers to induce them to shift time from unproductive breaks to productive normal work.

The results for lunch and coffee breaks are similar for union and nonunion workers. For other breaks, though, the effects on wages are strikingly and significantly different. Among nonunion workers the effect is negative: Additional other breaks reduce monthly pay. Among union workers additional other breaks raise monthly pay. Given the rigid structuring of union jobs, this

Table 2

Estimates of Hedonic Wage Equations, 1975-76 Time Use Study[a/]

	All	Employees	Employees		Employees,
			Union	Nonunion	Wages Only
Normal Work	1.143×10^{-4} (2.58)	$.639 \times 10^{-4}$ (1.42)	$-.094 \times 10^{-4}$ (-.10)	$.503 \times 10^{-4}$ (.94)	$.85 \times 10^{-4}$ (1.90)
Lunch Breaks	1.143×10^{-4} (.44)	3.444×10^{-4} (1.24)	1.330×10^{-4} (.20)	4.741×10^{-4} (1.51)	3.095×10^{-4} (1.13)
Coffee Breaks	2.289×10^{-4} (.58)	$-.165 \times 10^{-4}$ (-.04)	-2.525×10^{-4} (-.30)	1.695×10^{-4} (.38)	1.555×10^{-4} (.39)
Other Breaks	-3.591×10^{-4} (-1.31)	-4.239×10^{-4} (-1.65)	17.390×10^{-4} (2.43)	-6.448×10^{-4} (-2.29)	-3.424×10^{-4} (-1.38)
$\bar{R}^2$	.410	.391	.202	.447	.387

[a/] Dependent variable is the logarithm of pay per month. t-statistics are in parentheses below the parameter estimates here and in Tables 3, 6 and 7. Also included in the regressions are measures of education, experience, health, union and marital status, sex, regional and metropolitan location, and vectors of dummy variables for 1-digit occupation and industry.

effect should not be too surprising. Unscheduled breaks are the workers' necessary and productive responses to the rigidity. This view is consistent with the notion (Stafford-Duncan, 1980a) that higher union wages are in part a compensating differential for the structure of work. In the less rigidly structured nonunion sector, these unscheduled breaks detract from performance. These results clearly suggest that OTJ leisure is shirking among nonunion workers, but may be productive leisure among unionized employees.[9]

Before accepting these conclusions we should investigate their robustness in light of the evidence from industrial psychology cited in Section II that error rates, accidents, etc. improve following breaks in long spells of continual work. It may be that a few short breaks throughout the day raise productivity in nonunion jobs too, even though the average minute of time spent in breaks is not productive. To investigate this conclusion I reestimated (4) by combining the three categories of break time into one, H_l, and by adding quadratic terms in normal working time and break time, and an interaction term between H_w and H_l.[10]

The marginal impacts of H_w and H_l on earnings at their minima, means and maxima are shown in Table 3. While the results are not very strong, they tell a somewhat different story from that suggested by the estimates in Table 2. Except for unionized workers, the initial minute of break time, evaluated at the mean normal working time in the sample, does produce higher earnings (though the effect is not very significant). Implicitly this mirrors perfectly the results from industrial psychology on the declines in productivity that come with continual, uninterrupted work. At the mean break time in these samples, though, an additional minute of break time has a much smaller positive effect on productivity; and at the maximum break time in the sample, an additional minute of break time reduces earnings. Among unionized workers the marginal effect of breaks on wages is increasing.

Table 3

Effects on Monthly Pay of One-Unit Increases in Time on the Job, 1975-76 Time-Use Study[a/]

	All Employees	Employees		Employees Wages Only
		Union	Nonunion	
Evaluated at:		d(log Wage)/dWork		
Minimum Normal Work	-.000200 (-1.41)	-.000076 (-.52)	-.000239 (-.79)	-.000195 (-1.09)	.000004 (.02)
Mean Normal Work	.000084 (1.86)	.000050 (1.08)	-.000031 (-.32)	.000033 (.62)	.000085 (1.92)
Maximum Normal Work	.000554 (2.72)	.000231 (1.23)	.000343 (.87)	.000432 (1.56)	.000202 (1.10)
		d(log Wage)/dBreak		
Minimum Break	.000402 (1.47)	.000454 (1.55)	.000007 (.01)	.000538 (1.59)	.000553 (1.94)
Mean Break	.000219 (1.07)	.000220 (1.12)	.000419 (.93)	.000263 (1.11)	.000302 (1.53)
Maximum Break	-.001379 (-1.78)	-.001399 (-1.91)	.001796 (1.32)	-.001691 (-2.09)	-.001557 (-2.19)

[a/] Based on equations containing the same controls as in Table 2, but with all break time summed, and with a complete second-order approximation on normal work and break time.

This extended investigation suggests that the total abolition of break time would reduce earnings. However, the results also indicate that additional break time beyond the average adds nothing to pay. These inferences are buttressed by our observation that break time is much less among self-employed workers, but that the self-employed do take some breaks. If we maintain the assumption that the results reflect differences in productivity between normal working time and on-the-job leisure, we can infer that, except among unionized workers, increases in break time will be unproductive. The average minute of time spent on the job but not in normal work is shirking rather than productive schmoozing. However, the results also imply that employers act rationally in not being overly zealous in monitoring workers' activities, for some break time may be productive (and excessive monitoring could reduce productivity).

B. The Time Use Panel Study, 1975-81

There are several reasons for using panel data to explore further the relation between pay and time use on the job. Most important, the cross-section estimates of the previous subsection do not allow us to separate out the effects of worker-firm specific matches and unobserved worker characteristics that may be correlated with the uses of time. For example, it seems quite reasonable to expect that workers with strong tastes for on-the-job leisure will sort themselves into firms that can provide that on-the-job leisure at little cost. We will then observe a flatter earnings--break-time market locus, holding total hours constant, than would be estimated if we could control for the characteristics of the workers and the firms that affect this sorting. Also, the use of a panel of workers allows us to examine the the stability of patterns of time use on the job. The cost of using the Panel Study is the reduction in the number of individuals included in the subsamples.[11]

In Table 4 I list the means of most of the same variables shown in Table 1. A comparison of the two tables indicates that the workers included in the subsample from the Panel Study spent about the same time on the job as did the average worker in the 1975-76 cross section. The mean amount of time spent in normal work fell sharply in this subsample between 1975-76 and 1981, and the amount of break time reported fell proportionately in both samples. While time on lunch and coffee breaks fell, though, time spent on other breaks rose.

What is most interesting about these data is the large deviation between time reported in the time diaries as having been spent on the job in 1981 (a mean of 39.7 hours) and workers' responses about how many hours they worked per week (a mean of 43.3 hours). This discrepancy is twice as great as that in the 1975-76 data (both in Table 1 and for 1975-76 for this subsample of the Panel Study). Does this change reflect increasing overreporting of hours in CPS-like data? It is true that the questions on usual weekly hours differed in the two surveys, with the 1975-76 question referring to the main job at the current time, and the 1981 question referring to weekly hours when working in 1980.[12] If we restrict the sample to people with only one job, for example, to the 73 employees who held only one job in 1981, the inferences are similar: The discrepancy between usual hours and diary reports of total work was 1.9 hours in 1975-76, but was 3.0 hours in 1981. Another possibility is that economic conditions differed between 1980 and 1981, so that usual hours reported for 1980 produce a biased comparison to the 1981 diary hours. The CPS data do show that reported average hours of workers on full-time schedules were 42.8 and 42.4 in the two years.[13] This .4 hour decrease is not sufficient to explain the increase in the gap between reported and diary hours of 1.1 hours among employees with only one job. The only remaining statistical explanation is that field workers somehow asked the questions differently in the two years and therefore elicited

Table 4

Means and Their Standard Errors, Workers in 1975-76 and 1981 Time Use Study

	All		Employees	
	1975-76	1981	1975-76	1981
Weekly Minutes of:				
Normal Work	2344 (73)	2225 (69)	2279 (74)	2174 (69)
Lunch Breaks	104 (9)	87 (9)	107 (10)	94 (10)
Coffee Breaks	50 (7)	46 (7)	53 (8)	46 (7)
Other Breaks	51 (8)	63 (8)	53 (9)	67 (9)
Usual Weekly Hours (1975-76), Main Job; Weekly Hours (1980)	44.6 (1.1)	44.0 (.9)	43.3 (.9)	43.3 (.8)
Pay per Month	1283 (120)	1933 (145)	1149 (86)	1853 (108)
Union	.28 (.05)	.35 (.05)	.31 (.05)	.37 (.05)
N =	92		81	

substantially different answers. If that conjecture is wrong, we must infer not only that there are upward biases in reported hours of work based on responses to questions about total working time that are contained in the major household surveys, but that these biases may be increasing.

There is remarkable stability in monthly earnings over the six years 1975-76 and 1981 among workers in the subsample. Table 5 shows the autocorrelations are around .80. That the six-year autocorrelations of time use by category are positive suggests that even those data do not solely represent serially independent noise.[14] It is interesting to note in these data that the autocorrelation between total break times in the two years of the panel is not far below the autocorrelation in normal working time. Also, the lowest autocorrelation coefficients are in other break time, the least structured category of time on the job that is not spent in normal work.

Equation (4) is estimated on the panel of two cross sections from the Time Use Panel Study. I assume the error structure is characterized by:

(5) $\epsilon_{it} = \mu_i + \upsilon_{it}$, i=1,...,N, t=1975, 1981,

where ϵ is the error term in (4), μ is the individual-job specific effect, and υ is an i.i.d. error term.[15] Equation (4) is estimated using a generalized least squares estimator based upon this random-effects model. The particular estimator used is essentially a weighted average of the "within" estimator (in this case, based on the differences in the variables between the two observations for each worker) and the "between" estimator (in this case, based on the averages of the variables for each individual). (See Judge et al, 1980.) The parameters are calculated as OLS estimates of (4) computed over observations for all N workers for both years from which θ times the individual means have been subtracted for all variables, where θ is the ratio of the standard errors of the "within" to the "between" estimators.

Table 5

Six-Year Autocorrelations, Pay and Time Use

	All	Employees
log (Pay Per Month)	.813	.818
Normal Work	.435	.342
Breaks	.260	.279
Lunch Breaks	.334	.358
Coffee Breaks	.238	.261
Other Breaks	.151	.164
Weekly Hours	.537	.438

The Lagrange Multiplier statistics that test for the presence of individual effects in the OLS estimators of (4) on the panel data suggest that it makes sense to worry about computing GLS estimates.[16] For the sample of 92 workers the statistic, distributed $\chi^2(1)$, equals 29.67; for the subsample of employees the statistic is 32.58. Both of these are highly significant, suggesting that there is a gain to computing GLS estimates in these data.

Table 6 shows the GLS estimates of (4) with the error structure embodied in (5).[17] The responses of earnings to increases in normal working time are estimated with about the same precision as in the cross-section data. The responses to increases in break time are even less precisely estimated than in in Table 2. The GLS estimates on the panel data reinforce the conclusion that the marginal minute of time that the average worker spends on breaks is unproductive (assuming that supply effects are not large), and that there could be a payoff to resources that employers devote to monitoring workers. As in the cross-section estimates, here too other (presumably unscheduled) breaks have the most negative effect on wages.

I also used GLS to estimate versions of (4) that contain a second-order approximation to a generalized earnings function in H_w and H_l (analogous to the results in Table 3). The marginal effects on earnings of a one-minute increase in time spent in normal work or in breaks are shown at their minima, means and maxima in Table 7 for both subsamples. These results do not confirm even the weak findings from the cross section. The marginal effects of additional minutes of break time are small and insignificant over the entire range of break time. Estimates based on the panel data, from which our estimating procedure removes potential biases produced by unobserved individual-specific components of wages, do not indicate that even a low level of time spent on breaks will increase the productivity of the average worker.

Table 6

GLS Estimates of Hedonic Wage Equations, 1975-76 and 1981[a/]

	All		Employees	
Normal Work	1.513×10^{-4} (2.94)	1.513×10^{-4} (2.88)	$.972 \times 10^{-4}$ (1.87)	$.177 \times 10^{-4}$ (.35)
All Breaks	$-.131 \times 10^{-4}$ (-.06)		1.550×10^{-4} (.67)	
Lunch Breaks		$-.939 \times 10^{-4}$ (-.23)		2.781×10^{-4} (.76)
Coffee Breaks		2.347×10^{-4} (.45)		$.992 \times 10^{-4}$ (.21)
Other Breaks		-1.122×10^{-4} (-.25)		-2.254×10^{-4} (-.58)
$\hat{\theta}$	.094	.095	.132	.118
$\bar{R}^2$ [b/]	.517	.512	.485	.553

[a/] Equations also include education, experience, union, marital and health status, and sex, and a dummy variable for 1981.

[b/] Based on $[1-\hat{\theta}]$ differences.

Table 7

Effects on Monthly Pay of One-Unit Increases in Time on the Job, GLS Estimates, 1975-76 and 1981 [a]

Evaluated at:	All	Employees
	d(log Wage)/dWork	
Minimum Normal Work	-0.000123 (-.79)	0.000162 (.04)
Mean Normal Work	0.000131 (2.46)	0.000033 (.01)
Maximum Normal Work	0.000560 (2.45)	-0.000147 (-.02)
	d(log Wage)/dBreak	
Minimum Break	-0.000065 (-.13)	-0.000103 (-.22)
Mean Break	0.000017 (.06)	-0.000022 (-.09)
Maximum Break	0.000263 (.34)	0.000206 (.30)

*Based on an equation with the same controls as in Table 6, but with a complete second-order approximation on normal work and break time.

V. Conclusions and Implications

I have found that additional time spent on breaks at work has no effect on earnings. Employers simply do not pay for increases in time on the job that is not spent in normal working activities. However, there is some evidence that time spent on breaks does raise wages: The cross-section results suggest that the marginal effect of break time on wages is positive among otherwise identical workers who spend little time on breaks. Moreover, the finding that self-employed workers do give themselves unscheduled breaks (though of much shorter duration and/or frequency than employees) also suggests that some break time is productive. Within the confines of our key assumption that workers' distastes for time spent at work are not greatly affected by how that time is spent, the empirical results support the notion that the marginal minute of break time is unproductive.

For the average worker the results strongly imply that additional time spent in on-the-job leisure represents shirking rather than productive schmoozing. This is especially so for nonunion workers. This means that employers have a substantial incentive to devote resources to monitoring workers' allocations of time on the job, as time spent on breaks does not add to firms' revenues and does produce costs. To the extent that monitoring can at the margin shift the time allocations of workers who are paid on a time-rated basis away from breaks and toward normal work, we can infer that at least some monitoring expenditures can add to profits. The apparent unproductivity of additional break time also implies that employers have ample latitude for responding to legislated cuts in standard hours or to higher overtime premia by tightening up their supervision of break time. The existence of this additional margin means that the employment effects of such legislation are even more complex than standard labor-demand models suggest. Finally, the results imply that workers who obtain additional

OTJ leisure at the expense of normal work time will see their relative pay fall (since they would be substituting unproductive for productive work time). To the extent that OTJ leisure is a normal good, an increase in the variance in full incomes will, other things equal, lead to a smaller increase in the variance of observed earnings through this mechanism.

The evidence I have produced is based on cross-section data and does not speak directly to predicting the effects of the trend toward steady increases in the fraction of time on the job that is spent in what I have termed mixed leisure --- the interspersing of leisure time with normal working time. Indirectly, though, the evidence suggests that the trend toward increased mixed leisure is costly in terms of lost output. People may well choose to spend more time at work in activities that are essentially leisure, but that choice comes at the cost of slower increases in productivity, and hence in living standards, than would otherwise occur. For the typical worker the U.S. economy is now far past the point where one can argue that additional break time raises productivity.

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FOOTNOTES

1. Hersch (1985) did include data on the number of work breaks in an equation describing the hourly earnings of a small group of piece-rate workers in one plant.

2. Note that here I am no longer assuming that total hours are fixed, as I did to ease the exposition in Section II.

3. The problems of drawing inferences from more typical hedonic equations are discussed by Biddle-Zarkin (1987).

4. The exclusions are quite similar to those in Stafford-Duncan (1980b). Their final subsample contained 375 workers, partly because their hours disqualifiers were less stringent than the ones I have used.

5. In the 1975-76 data experience was measured as age - education - 6. The provision of additional information in the Panel Study allowed the use of self-reported years of labor-market experience in 1981.

6. Of the 92 workers in the subsample of the Panel Study, only three, all of whom were self-employed, reported any working time at home.

7. Stafford-Duncan (1980b) note the same discrepancy between answers to questions about weekly hours and totals of time spent at work based on time diaries.

8. For examples, in the estimates of (4) over the entire subsample the rate of return to schooling was 6 percent, the union wage premium was 13 percent, and workers in the South earned 5 percent less than otherwise identical workers.

9. If we split the sample by industry, we cannot reject the hypothesis that the structure of (4) is the same in manufacturing as in the rest of the economy. The same qualitative conclusions are provided by tests on the subsamples of all workers and workers who receive only wages or salaries.

10. This is essentially an expanded version of the market loci estimated by Biddle-Zarkin (1987).

11. This problem is inherent in starting out with a very small basic sample. Thus Stafford (1987) had only 77 observations from the Panel Study in his work on two-parent families with young children.

12. The question in the 1975-76 data was, "How many hours do you work in your main job in an average week?" In the 1981 follow-up the question was, "How many hours did you work in 1980 when you were working?"

13. Employment and Earnings, January 1981, January 1982.

14. Whether they represent autocorrelated measurement errors or true observations cannot be inferred. However, Duncan-Hill (1985) suggest for a similar household survey that only part is measurement error.

15. It is not completely clear whether the error component μ_i refers to the individual or the match between the individual and the job. Each interpretation is probably valid for one part of the subsample but not the other. One should note, however, that 15 percent of the workers in the subsample changed one-digit industry between 1975-76 and 1981, and undoubtedly many more changed two- or three-digit industries. For at least this group the interpretation should be that μ_i represents an individual effect only.

16. The test is discussed by Judge et al (1980, p. 338).

17. Also included in the estimating equation in addition to the control variables listed in Table 6 is a dummy variable for 1981. It is worth noting that the OLS point estimates on the pooled cross-section time-series data differ little from the GLS estimates presented in the Table. Similarly, the "within" and "between" estimators suggest the same qualitative conclusions.