Not Working at Work: Loafing, Unemployment and Labor Productivity

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Abstract: Using the American Time Use Survey (ATUS) 2003-12, we estimate time spent by workers in non-work while on the job. Non-work time is substantial and varies positively with the local unemployment rate. While the average time spent by workers in non-work conditional on any positive non-work rises with the unemployment rate, the fraction of workers who report time in non-work varies pro-cyclically, declining in recessions. These results are consistent with a model in which heterogeneous workers are paid efficiency wages to refrain from loafing on the job. That model correctly predicts relationships of the incidence and conditional amounts of non-work with wage rates and measures of unemployment benefits in state data linked to the ATUS, and it is consistent with observed occupational differences in non-work.

I.   Introduction

The relationship between labor-market slack and worker effort is a hoary topic in macroeconomics and labor economics. The notion of labor hoarding—retaining workers during times of low product demand even though their labor input is reduced—goes back at least 50 years and has been adduced as an explanation for pro-cyclical changes in labor productivity—productivity falling as unemployment rises. (See Biddle, 2014, for a thought-historical discussion of this concept.) The notion that unemployment provides workers an incentive to expend extra effort to avoid firing—the idea of efficiency wages—was described formally in the now-classic study by Shapiro and Stiglitz (1984). More generally it perhaps even goes back to the reserve army of the unemployed implied by Marx (1867) in Chapter 23 of *Das Kapital*.[1] It implies counter-cyclical changes—that labor productivity and effort rise with as unemployment rises. Both of these strands in economic thought describe the relationship between unemployment in a labor market and worker effort (and presumably labor productivity). Yet their implications are contradictory.

A large empirical literature has inferred from lags in employment adjustment behind shocks to output that labor hoarding is important (Hamermesh, 1993, Chapter 7). A much smaller literature has used the theory of efficiency wages to examine how wages respond to workers' opportunities (e.g., Cappelli and Chauvin, 1991). No study to date has examined directly how effort at work responds to differences or changes in unemployment.[2] The reason is simple: Until very recently no large-scale data set has been available detailing what workers do on the job and providing such information as unemployment varies.

This paper asks and answers the following questions: 1) On what do American workers spend time on the job when they are *not working*? 2) Does non-work vary significantly across demographic groups? 3) Most important, how does non-work vary with local labor market conditions, as measured by the unemployment rate? 4) Is there a model which can account consistently for any regularities that

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[1]A recent sociological study, Paulsen (2015), presents cases illustrating the role and reasons for people loafing on the job. Pencavel (2014) and Lazear *et al* (2015) analyze changes in effort and productivity in single firms.

[2]Hamermesh (1990) did, however, examine cross-sectional differences in the allocation of time on the job.

we observe? 5) What are the implications of these findings for aggregate labor productivity and macroeconomic behavior generally?

II.   Data and Descriptive Statistics

Since 2003, the American Time Use Survey (ATUS) has generated time diaries of large monthly samples of individuals showing what they are doing and where they are located. (See Hamermesh *et al*, 2005, for a description of these data, and Aguiar *et al* (2013) for use of them to examine some cyclical aspects of time use.) It thus allows the first examination of how workers spend time on the job, its relationship to their demographic and job characteristics, and its variation with differences and changes in unemployment. Throughout this study we use various sub-samples from the ATUS, which over the period 2003-2012 collected 136,960 monthly diaries of former Current Population Survey (CPS) respondents' activities on one particular day between two to five months after their final rotation in the CPS. Because we are concentrating on activities while the respondent was at work, the only diaries included are those for days when a respondent reported some time at the workplace. Since half the diary days in the ATUS are on weekends when relatively few respondents are working, this restriction cuts the sample greatly, leaving us with 41,111 usable diaries. Moreover, since our focus is on employee productivity, for most of this study we exclude the self-employed (most of the remaining excluded observations) and those diaries without information on usual weekly hours of work, which reduces the sample to 35,548 usable observations. Thus for a typical month in the sample period after 2003 we have around 250 observations.[3]

Obtaining responses about what the respondent was doing at each moment of the diary day, the ATUS then codes them into over 400 distinct activities. Respondents also note where they were while performing each activity, with one of the possible locations being "at the workplace." We focus on primary activities performed at that location, defining total time at work as all time spent at the workplace. We then divide time at the workplace into time spent working and time spent not working.[4] The latter is divided into time spent eating, at leisure and exercising, cleaning, and in other non-work

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[3]The ATUS collected more diaries in its first year, generating about 450 usable diaries each month in 2003.

[4]Time spent working includes time spent in "Work Related Activities" or ATUS codes 50000-50299. Work-related activities include socializing and eating as a part of the job.

activities.[5] In the ATUS, eating at work can be a primary activity, a secondary activity to working or a part of the job. Non-work time at work which is spent eating corresponds to a response of eating as a primary activity at the workplace. Non-work time at work also includes activities that might be viewed as investment in future productivity but that are not currently productive, such as cleaning and perhaps exercising, as well as others such as gossiping, web-surfing and chatting that are less likely to be productive.

Table 1 presents sample means and their standard errors of the proportions of time spent at the workplace in these four activities and in actual work, along with the time spent at work and other variables that are central to our analysis. All the statistics are calculated using the ATUS sampling weights, thus accounting for disproportionate sampling across days of the week, for standard CPS weighting and for differential non-response to the ATUS by former CPS participants. The first thing to note is that the typical day at work lasts about eight hours and twenty minutes, a statistic that yields a five-day workweek of 41.74 hours, which is consistent with the mean usual weekly hours of 41.38 hours reported retrospectively by employees in the sample.[6]

Sample respondents report spending nearly seven percent of time at the workplace not working, amounting to thirty-four minutes per day. Roughly half of this time is spent eating at the workplace, the other half is spent in leisure, exercise, cleaning and other non-work activities. These three latter activities are so rare that henceforth we concentrate on the twofold division between eating and non-work non-eating time at work. While thirty-four minutes per day at the workplace not working seems low, most eating reported during the work day as a primary activity probably occurs away from the workplace and thus is not specifically assignable to the job in these data. To the extent that eating away

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[5]In the original data, non-work time on the job is divided into the following broad primary activities: Personal care; household production; care-giving; educational activities; shopping; services; eating, leisure, exercising and sport, and volunteering and religious activities. Several of these are observed so infrequently as to prevent them from being analyzed separately, so that we combine them into the fifth (other) category of non-work time on the job. Household production is not considered an act at work.

[6]This near-equality differs from the result in the literature that recall weekly hours exceed diary hours (Juster and Stafford, 1991; Frazis and Stewart, 2004). The difference may arise because we restrict the workday to the time respondents spend at the workplace in any activity.

from the workplace during work hours varies cyclically, it will be reflected in cyclical variations in the length of the day at the workplace.

As Figure 1 shows, there are a substantial number of zeros in the responses, 33.7 percent of the sample, and much of our subsequent analysis focuses on this fact. The conditional mean amount of positive non-work time is slightly over 50 minutes per day. Beyond that, the distribution is skewed to the right, with a tiny fraction of respondents even reporting not working the entire time on the job.[7] 30.8 percent of the respondents reported eating at the workplace but no other non-work time, 14.6 percent reported other non-work but no eating on the job, and 20.9 percent reported both eating and other non-work time on the job.

Throughout this study, the central forcing variable is the local unemployment rate, measured as the jobless rate in the state where the worker resides.[8] The average unemployment rate in the sample is 6.6 percent, but it varies over a wide range—from barely two to over fourteen percent. Mostly because of the Great Recession, there is substantial variation in unemployment, which allows us to examine how non-work responds to changing local labor-market conditions.

III.   Non-work and its Relationship with Unemployment over Time and Space

Before presenting evidence on the cyclical behavior of non-work time at work, it is important to remember that economic theory is ambiguous about the sign of the relationship between non-work and business cycle conditions proxied by, say, the local unemployment rate. This is because workers and their employers have different interests in non-work. If initiated by the worker, non-work might be interpreted as "loafing," "shirking" or "goofing off on the job." A raft of theories predicts a negative relationship between local labor market conditions and shirking. The most prominent of these are Calvo (1981), Akerlof (1982), Shapiro and Stiglitz (1984) and Bowles (1985). In this vein, high unemployment signals a lower value of utility in the state of unemployment, either because the incidence or duration (or both) of joblessness is high. To avoid landing in the state, workers exert higher

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[7]We cannot exclude the 1.3 percent of respondents who reported loafing all day from the basic results, since that would involve truncating on the dependent variable. In unreported estimates, however, none of the conclusions changes qualitatively if this group is excluded.

[8]Experiments with the one-month unemployment rate consistently yielded weaker fits, so we limit the reported results to those based on the three-month average.

effort when employed, in order to curry favor with their employers, to increase their productivity, or to reduce the probability of detection when they do shirk. Because effort is unobservable and/or monitoring is costly, firms accept this outcome passively, with few or no layoffs of shirkers occurring in equilibrium.

Alternatively, firms may find non-work by workers in certain states of the world to be desirable. Firms face variable and imperfectly forecastable demand for their products, while producing with workers who represent substantial investments in human capital, search effort and other considerable resources. In an economic downturn which is perceived as temporary, it is easy to show that a layoff, even if temporary, is an inferior choice to maintaining employment, possibly even at standard hours.[9] This behavior is often referred to as labor hoarding. In this case, firms assign workers to "unproductive" tasks such as cleaning, maintenance, painting, etc. or even tolerate more non-work initiated by their workers

In Table 2 we present evidence on the cyclical behavior of non-work in the United States based on the ATUS. This cyclical behavior is measured by the response of non-work time at the workplace to variations in local labor-market conditions. We assume that workers take those conditions as given, and we note that they vary across both time and space.[10] In the data most of the variation in unemployment is across time: Temporal movements account for two-thirds of the variance. Only twelve percent of the variance in unemployment rates is idiosyncratic at the state and month level.

The initial least-squares estimates, the results shown in Column (1), simply relate the proportion of non-work time at work to the state unemployment rate.[11] There is a highly significant positive

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[9]Burda and Hunt (2011) showed that while firms in Germany retained workers during the Great Recession, hours worked declined by less than would be expected given the decline in output, so that hourly productivity fell in a recession for the first time since 1970. In the U.S. Gordon (1981) documented a decline in labor productivity in every postwar recession up to that point in time; Galí and van Rens (2014) find that the correlation between the business cycle and productivity since 1990 has become negative.

[10]We cannot rule out that workers might self-select via migration, effectively choosing regions in which unemployment is lower and thus affecting the conditions under which they work. The same argument applies to employers and capital mobility. This possibility would bias the estimated impact of unemployment toward zero.

[11]All the results in this section remain qualitatively identical if we use minutes of the various types of non-work time rather than their proportions of the workday as the dependent variables. Similarly, using more flexible representations of usual weekly hours and time spent at work does not alter the results, nor does deleting the quadratic in time at work from the estimates in Columns (2) and (3) change the central conclusions.

association of unemployment with non-work time on the job. Over the entire range of unemployment observed in the data, the estimate suggests that the proportion of non-work time will vary by 0.013 (on a mean of 0.069).

The estimates in Column (1) fail to account for the possible co-variation of time spent in non-work with the amount of work performed and with workers' demographic characteristics. The equation underlying the estimates in Column (2) includes quadratic terms in usual weekly hours and time at work on the diary day; indicators of race and ethnicity; a vector of indicators of educational attainment; a quadratic in potential experience (age – education – 6), indicators of gender and marital status and their interaction, and an indicator of metropolitan residence.[12]

A longer usual workweek significantly increases the fraction of work time not working up to 42 usual weekly hours, with decreases thereafter. Conditional on usual hours, however, spending more time at work in a day decreases the proportion of time spent in non-work activities, but only up to 5.8 hours of work time per day. Beyond that, and thus for 85 percent of the sample, additional time on the job increases the share of time spent not working. Whether because of boredom, fatigue or something else, the marginal effect of additional work time on non-work activities is increasing for most employees as the workday lengthens.[13]

The estimates on the indicators of gender and marital status, and their interaction, are small and individually and jointly insignificant here and in all subsequent estimates, so we do not report them in later tables. African-Americans and Hispanics, however, report spending higher fractions of their time at work not working than do other workers with otherwise identical demographic characteristics and with workdays and workweeks of the same length. Not only are these effects highly significant statistically, they are also large, implying a proportion of non-work time 15 to 20 percent above the average. Additional schooling attainment monotonically decreases the reported proportion of work time

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[12]In the Table we only report those estimates that are economically interesting. One should also note that, unsurprisingly, the estimates vary negligibly if we use a quadratic in age instead of potential experience. The estimates using the latter do, however, describe variations in time not working slightly better than do those including age.

[13]This finding is consistent with older evidence from the scientific management literature charting workers' productivity over the work day (Florence, 1958).

spent not working. Here too the differences are substantial, with the proportion among employees with graduate degrees being about 30 percent below that of high-school dropouts.

While the estimated impact of unemployment does change with the addition of these covariates, their unsurprisingly very weak correlation with state unemployment rates guarantees that their inclusion does not qualitatively alter the estimated effect of unemployment on non-work time.[14] The inference may understate the magnitude of this effect: As unemployment rises, even holding demographic characteristics constant, workers who retain their jobs may be those who report less non-work at work, creating a compositional effect that negatively biases the estimated impact of unemployment on non-work time.

In Column (3) we add vectors of fixed effects for occupation, industry, state and month to the estimating equation in Column (2). Each of the four vectors of indicators is jointly statistically significant: There are substantial differences across occupations, industries and states in the (conditional) proportion of time at work spent not working. Even with these additions, however, over half of the estimated positive effect of unemployment on time not worked remains.[15]

These estimates have aggregated all non-work time at work; yet one might expect different responses to changing unemployment of the partly biological activity, eating at work, and the broader category, other non-work time on the job. We thus re-estimate the basic model, first using the proportion of time at work spent eating as the dependent variable, then using the proportion of time at work spent in other non-work time. In each case we first include the vectors of work time and demographic measures that were added to the estimates shown in Column (2), then add the same four vectors of fixed effects included in the estimates shown in Column (3).

The results, presented in Columns (4)-(7) of Table 2, are striking. The overwhelming majority of the effect of changing unemployment on non-work time at work operates through its impact on other

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[14]The covariates included in Column (2) describe 0.92 percent of the variation in state unemployment rates over time.

[15]Almost the entire drop in the estimate arises from the inclusion of state fixed effects. Re-estimating the model excluding state effects, the estimated impact of unemployment is essentially unchanged from that in Column (2).

non-work time—i.e., on leisure on the job. Eating at the workplace is affected much less.[16] Moreover, the effects of differences in workers' demographic characteristics on non-work time also operate mainly through other non-work time, not through eating at work.

As Table 1 and Figure 1 showed, there are many zeros in these data. That fact might suggest estimating these models using tobit, but that is problematic for two reasons: 1) There is no reason to assume that the impacts of unemployment (or of any of the other regressors included in Table 2) on the probability of non-work and its conditional mean work in the same direction. That difficulty suggests using a more free-form technique, either the all-in-one approach suggested by Cragg (1971), or separate treatment of the probability of non-work and its mean conditional on its occurrence; 2) The zeros may result partly from the limitation of the diaries to a single day (Stewart, 2013), who argues that estimating a probit on the incidence of non-work and a regression on the amount of non-work among those non-zero observations circumvents this difficulty. Since that approach handles both problems, we follow it here.

Table 3 presents the probit derivatives of the variables' impacts on the probability of non-work on the job, and regression coefficients describing their effects on the amount of non-work for the two-thirds of the sample respondents who report positive non-work. The independent variables are the same as those included in the regressions in Table 2. The probit and the conditional regression results both exclude and include vectors of fixed effects describing occupations, industries, states and months of the year. The differences between these results and those in Columns (2) and (3) from the unconditional regressions are remarkable. While higher unemployment is positively associated with the proportion of time at work reported non-working, it reduces the probability that a worker spends any time not working. This reduction is more than offset by the increased proportion of time not working by those who state that they spent some time not working as the unemployment rate rises.

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[16]One might be concerned that employees change the amount of non-work multi-tasking that they do as unemployment changes. The ATUS does not provide information on secondary activities in most months; but for 2006 and 2007, as part of the Eating and Health Module, it collected information on secondary eating, including at work. Of the employees in our sample in those years, 41 percent report some secondary eating and/or drinking at work. Among those who do, the average amount of time spent in these secondary activities is almost exactly two hours per day. Although this activity is important, re-estimates of the models in Table 2 show that variations in secondary eating are independent of differences in unemployment rates across states and over these two years.

Unlike in the unconditional regressions, the negative impact on the probability of not-working and the positive impact on the conditional mean are robust to the inclusion of all the vectors of fixed effects. Moreover, the effects are economically important: Over the range of unemployment in the sample, the probability of not working falls by 0.061 on a mean of 0.337, while the fraction of time not working rises by 0.020 on a conditional mean of 0.100.[17] Our results also show that the demographic differences observed in Table 2 stem mostly from demographic differences in the probability of reporting non-work time as opposed to the amount of time spent by those reporting non-work. That is especially the case for differences in educational attainment; but even the racial/ethnic effects, while significant on both the probability and the conditional mean, are much stronger on the former.[18]

One possible explanation for the differences between minority and majority workers is that relative (to the discriminatory market wage) the reservation wages of minorities exceed those of majority workers (as shown by Holzer, 1986). This would reduce the incentive for minorities to avoid shirking and lead to the observed effect of minority status showing up chiefly on the extensive margin of shirking. Alternatively, legal protections for minorities might reduce the risk of firing when a minority shirks, thus increasing the incentives for shirking.

The results displayed in Table 2 showed that the positive effect of higher unemployment on time spent not working was mainly on other non-work time rather than on time spent eating at work. Table 4 presents estimates of effects on the probabilities of eating at work and engaging in other non-work, and on their conditional means. In all cases we present only the specifications expanded to include all the vectors of fixed effects. The negative impacts of unemployment on the probabilities of eating at work and engaging in other non-work are essentially identical. The differences observed in Table 2 result from the greater responsiveness of other non-work time to differences in unemployment among

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[17]If we delete the roughly 1/6 of the respondents who are public employees, the coefficients on the unemployment rate in the regressions in column (3) of Table 2 and column (4) of Table 3 rise substantially in absolute value, as one might expect. The probit derivative in column (2) of Table 3 rises too, but only slightly.

[18]Do these effects arise from a greater willingness of minorities and the less educated to report non-work time on the job? We cannot be sure, of course; but African-American (Hispanic) workers report 0.52 (0.001) fewer different activities per day than otherwise identical workers, on a mean of 19 activities. Those with graduate degrees (college degrees) report 1.76 (1.44) more activities per day than high-school dropouts. In short, the likelihood of reporting an activity is opposite the impact of these demographics on the propensity to report on-the-job loafing.

those who report other non-work than from the responses of time spent eating: The impact on other non-work time is three times as large as that on time spent eating at work.[19]

To summarize our central finding, higher unemployment is robustly associated with a greater fraction of time at work spent not working, with most of the effect coming from greater time at work in leisure, cleaning up, etc. Since higher unemployment, other things equal, is also associated with less time at work (in this sample each extra percentage point of unemployment reduces the workday by 2.4 minutes per day), this finding suggests that employers are allowing workers to spend smaller fractions of the workday actually working. An important and surprising pair of subsidiary findings is that higher unemployment reduces the likelihood of non-work, while increasing the conditional amount of non-work sufficiently to generate the net positive relationship between unemployment and non-work on the job.

IV. A Suggestive Model of Non-Work (Loafing)

Our results imply contradictory and offsetting motives for non-work on the job over the business cycle or at different states of the labor market. Workers engage in non-work less frequently in bad times (when the rate of unemployment is higher), but given that they do so, they tend to do more of it. An efficiency wage model with heterogeneous preferences is consistent with these apparently contradictory findings.

A. Preliminaries

We envision an environment in which workers' effort cannot be monitored perfectly, but their *aggregate* productivity is an observable outcome of the state of the business cycle or the local labor market as well as of the fraction of their time spent in non-work activities. In our model, workers are heterogeneous and, in the spirit of Shapiro and Stiglitz (1984), can choose to spend a fraction of working time in non-work. Individual workers are risk-neutral and receive utility from consumption goods purchased with their wages, as well as from leisure on the job (non-work). Each worker is endowed

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[19]The demographic effects are generally in the same directions on both the incidence and intensity of the two types of non-work, but there are some changes from the overall patterns observed in Table 3. That is especially true for the racial/ethnic indicators. African-Americans' greater amounts of both types of non-work arise entirely from their greater likelihood of eating at work and doing other non-work; among Hispanics the effect arises from their greater likelihood of eating at work and a higher conditional mean amount of other non-work in which they engage.

with one unit of time and, if employed, receives a wage *w* plus the monetary equivalent of time spent in leisure on the job (non-work or "loafing"), denoted as ℓ_i. Workers are indexed by $i \in [0,1]$ in increasing order of ℓ_i, so $i > j$ implies $\ell_i > \ell_j$ for all *i* and *j*. Without loss of generality, the index could represent the percentile of the worker in the distribution of preferred loafing times; in our example, the index is the "name" of the individual worker in question and equals the preferred loafing time (as a fraction of total available labor effort). If undetected, worker *i* is assumed to prefer enjoying this fixed amount of non-work ℓ_i and exerting work effort $e_i = 1 - \ell_i$ to exerting full effort $e_i = 1$. The worker retains her valuation of non-work ℓ_i for the duration of the job.

In each period, a worker *i* chooses between loafing and receiving income equivalent $w + \ell_i$, or not loafing at all and receiving *w*. With exogenous probability θ management monitors workers; if they are found loafing, they are fired. Employment relationships also end exogenously with probability δ. Unemployed workers receive income equivalent in value to *b* and are indistinguishable from other workers on the basis of employment or non-work history. They find jobs at rate *f*, which, given the stock of employment, a separation rate, and an exogenous labor force, is determined endogenously by a steady-state condition to be described below.

B. To Loaf or Not to Loaf: That is the Question

For an arbitrary worker $i \in (0,1)$ earning wage w_i, it is straightforward to compute steady-state valuations of the three possible labor-force states/strategies: Employment without any non-work (V_i^N), employment with non-work (V_i^S), and unemployment (V^U):

$$V_i^N = \frac{w_i}{1+r} + \frac{\delta}{1+r}V^U + \frac{1-\delta}{1+r}V_i^N \quad , \tag{1}$$

$$V_i^S = \frac{w_i + \ell_i}{1+r} + \frac{\theta + \delta}{1+r}V^U + \frac{1-\theta-\delta}{1+r}V_i^S \quad , \tag{2}$$

$$V^U = \frac{b}{1+r} + \frac{f}{1+r}V^E + \frac{1-f}{1+r}V^U \quad , \tag{3}$$

where

$$V^E = E\left[\max_{\ell_i \in \{0,\ell_i\}} \left\{ V_i^S, V_i^N \right\} \right] \tag{4}$$

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represents the expected value of employment from the perspective of an unemployed person who does not know her future value of ℓ_i, but knows that she will choose the strategy that maximizes expected utility going forward.

Given this set of behavioral assumptions, each worker i is characterized by a "no-loafing wage." If paid above this wage, the worker's valuation of not loafing at all dominates that of loafing:

$$V_i^N \geq V_i^S. \tag{5}$$

As in Shapiro and Stiglitz (1984), this "no-loafing condition" (NLC), defines the cutoff or minimal threshold wage $\overline{w}_i$ at which worker i is indifferent between loafing and not loafing, i.e., $V_i^N = V_i^S$. In Appendix A the "NLC wage" for worker i is shown to be:

$$\overline{w}_i = b + (r + \delta + f)\frac{E\ell_i}{\theta} + (r + \delta)\frac{\ell_i - E\ell_i}{\theta} \tag{6}$$

The NLC wage depends positively on income in unemployment b, the interest rate r, exogenous job turnover δ, the outflow rate from unemployment f, and the worker's expected valuation of loafing $E\ell_i$ as well as the deviation of her current value from the mean, $\ell_i - E\ell_i$. It depends negatively on θ, the probability of detection.

C. Aggregate Loafing and the Steady-State Flow Equilibrium

The NLC wage represents a threshold above which a worker *i* will not loaf at all. Inverting (6) yields the identity of the "marginal loafer" for whom $\bar{w}_i = w$, i.e., who is indifferent between loafing her preferred amount and not loafing at all:

$$\bar{\ell} = \frac{\theta(w - b) - fE\ell_i}{r + \delta} \quad . \tag{7}$$

At wage *w*, all workers for whom $\bar{w}_i > w$ (or, equivalently, $\ell_i > \bar{\ell}$) will spend time ℓ_i in non-work on the job. Let $g(\ell_i)$ be the density of workers on the support of preferred loafing time [0,1] and *G* be the associated c.d.f. Using (7), we can derive the following, all contingent on the common wage *w*:

1) *The fraction of workers loafing, γ,* given by the mass of workers whose NLC wage exceeds *w*:

$$\gamma = \int_{\bar{\ell}}^1 g(\ell_i)d\ell_i = 1 - G(\bar{\ell}) \quad .$$

2) *The aggregate volume of loafing, $\ell(w)$,* : $\ell(w) = \int_{\bar{\ell}}^1 \ell_i g(\ell_i)d\ell_i$

3) *Aggregate effort, e(w):* $e(w) = 1 - \int_{\bar{\ell}}^1 \ell_i g(\ell_i)d\ell_i$

4) *The conditional mean amount of loafing for those loafing, ϕ:* $\phi = E[\ell_i | \ell_i > 0] = \dfrac{\int_{\bar{\ell}}^1 \ell_i g(\ell_i)d\ell_i}{1 - G(\bar{\ell})}$

.

In the steady state, the outflow rate *f*, expressed as a fraction of the unemployed, endogenously equates gross outflows and inflows into unemployment. Outflows are the product of *f* and $(\bar{L} - L)$, where $\bar{L}$ and *L* are the exogenous labor force and employment respectively. The mass of workers who flow into unemployment equals that of workers who lose their jobs through exogenous separation (δL) plus those who are monitored and were loafing (for whom $\bar{w}_i > w$), with mass of $\theta\gamma L = \theta(1 - G(\bar{\ell}))L$. The flow rate out of unemployment *f* is therefore given by:

$$f = \frac{(\delta + \theta\gamma)L}{\bar{L} - L} = (\delta + \theta\gamma)(u^{-1} - 1) .[20]$$

(8)

By inspection, an increase in unemployment has two opposing effects on the outflow rate. In the first instance, it decreases f directly via the steady-state unemployment flow condition. Yet lower f will *increase* the expected duration of unemployment and cost of loafing. This second-order effect reduces the fraction of loafers (γ) and lowers the inflow into unemployment due to shirkers who are caught, and renders the overall effect on f of a rise in unemployment, strictly speaking, ambiguous. Without further restricting the model, we will assume that the first-order effect dominates:

Assumption: In equilibrium, the outflow rate f is decreasing in the unemployment rate: $\partial f/\partial u < 0$.

In Appendix A we show that a sufficient condition for this assumption is that the elasticity of loafing with respect to the outflow rate in general equilibrium is less than unity; i.e., $\frac{\partial\gamma}{\partial f}\left(\frac{f}{\gamma}\right) < 1$.

D. Predictions

With these results and assuming $\partial f/\partial u \leq 0$, we can prove the following propositions, which will help interpret our findings and point to further empirical implications for loafing:

Proposition 1: *Loafing and unemployment*. Holding the wage constant, the fraction of workers who loaf depends negatively on the unemployment rate.

Proof: This and subsequent proofs can be found in Appendix A.

Proposition 1 is a partial equilibrium relationship which holds all other factors constant including the wage. A rise in unemployment lowers the outflow rate out of unemployment, thereby raising the no-shirking wage and reducing the fraction of workers for whom shirking is the more attractive option.

Proposition 2: *Loafing, wages, and unemployment income*. Holding the rate of outflow constant, the fraction of workers who loaf depends negatively on the wage and positively on income in unemployment: $\frac{\partial\gamma}{\partial w} < 0$ and $\frac{\partial\gamma}{\partial b} > 0$.

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[20]We assume that separations occur exogenously before monitoring.

Proposition 2 holds that an increase in the wage will, *ceteris paribus*, deter some workers who were previously enjoying non-work from doing so. Similarly an increase in unemployment income will increase the mass of workers who enjoy positive non-work.

Proposition 3: *Conditional mean loafing and unemployment*. Holding the wage constant, the conditional mean of non-work on the job by those with positive non-work is increasing in the unemployment rate: $\dfrac{\partial \phi}{\partial u} > 0$.

Proposition 4: *Conditional mean loafing, wages and unemployment income*. Holding the outflow rate constant, the conditional mean of non-work on the job by those with positive non-work is increasing in the wage and decreasing in income in unemployment: $\dfrac{\partial \phi}{\partial w} > 0$ and $\dfrac{\partial \phi}{\partial b} < 0$ **.**

E. An Example

For the purpose of illustration, consider the case of a uniformly distributed preferred level of loafing, i.e., $g(\ell_i) = 1$. Then $E\ell_i = \frac{1}{2}$, G($\bar{\ell}$) $= \bar{\ell}$, and the fraction of loafing workers is $\gamma = 1 - \bar{\ell} =$

$1 - \dfrac{\theta(w-b) - \frac{1}{2}f}{r + \delta}$, where $(r+\delta+\frac{1}{2} f)/\theta > (w-b) > 0$ is imposed to ensure meaningful values. Total

loafing at a wage w is $\ell(w) = \int_{\bar{\ell}}^{1} \ell_i d\ell_i = \frac{1}{2}\left[1 - \left(\dfrac{\theta(w-b) - \frac{1}{2}f}{r + \delta}\right)^2\right]$, depicted as the unshaded area in

Figure 2. Since total available labor is 1 and non-work is the trapezoid ABCD, the total amount of effort

is given by $e(w) = \frac{1}{2}\left[1 + \left(\dfrac{\theta(w-b) - \frac{1}{2}f}{r + \delta}\right)^2\right]$, so $e'(w) > 0$. The average loafing of a worker conditional

on any loafing is $\phi = \dfrac{\int_{\bar{\ell}}^{1} d\ell_i}{1 - \bar{\ell}} = \frac{1}{2}\left[1 + \left(\dfrac{\theta(w-b) - \frac{1}{2}f}{r + \delta}\right)\right]$. Holding the wage constant, higher

unemployment leads to lower outflows, which means fewer workers are loafing; but among those who are loafing, the average amount of loafing is higher.
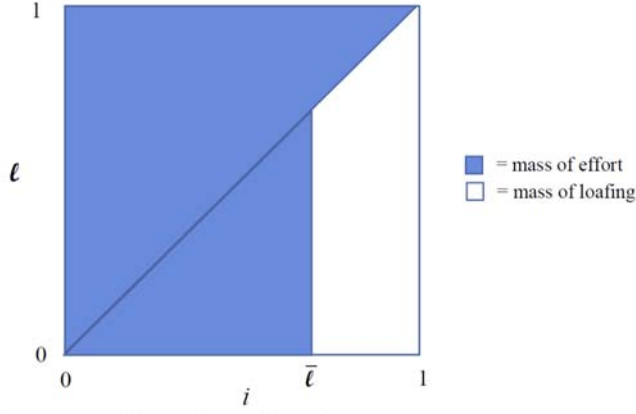
Figure 2. Effort and Loafing when $\ell(i)=i$

F. Accounting for Countercyclical Aggregate Loafing—Loafing with Peers

Our theoretical model, which makes no recourse to arguments involving labor hoarding, can explain both the negative influence of unemployment on γ, the fraction of workers who report any loafing at all, and the positive influence on ϕ, the mean value of their loafing conditional on it being positive. Yet we also found that changes at the intensive margin (volume of loafing of each loafer) dominate those at the extensive margin (incidence), implying a positive overall dependence of unconditional mean loafing, $\gamma\phi$, on the unemployment rate. In the model presented above this is impossible, since for each individual i the amount of preferred shirking, if positive, is fixed at ℓ_i.[21]

A variable intensive margin can be readily incorporated into our model while continuing to eschew any explicit reference to the firm's decision (although we do not deny that such effects could also be operative). Assume that, in addition to heterogeneity in the levels of the gain in utility from loafing, the preferred level of loafing varies independently of the loafers' identities. We assume that the level of local labor-market slack imparts a *peer effect* on the preferred level of loafing, perhaps resulting from the shame of being seen by colleagues, friends and others goofing off on the job. This cost links the preferred amount of loafing negatively to the state of the business cycle. In busy times when the

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[21]The effect of unemployment on aggregate effort at wage w is

$$\frac{\partial e(w)}{\partial u} = \frac{\partial}{\partial u}\left(1 - \int_{\bar{\ell}}^{1}\ell_i g(\ell_i)d\ell_i\right) = \bar{\ell}g(\bar{\ell})\frac{\partial\bar{\ell}}{\partial f}\frac{\partial f}{\partial u},$$ which is strictly positive since $\dfrac{\partial\bar{\ell}}{\partial f}$ and $\dfrac{\partial f}{\partial u}$ are both

negative.

labor market is tight and others are working hard, being seen loafing by friends on the job is more likely

to be embarrassing. In contrast, in slack times, this cost will be smaller since others are working less

too.[22]

To capture this behavioral feature in our model, we assume that $\ell_i = \ell_i - \varepsilon(u)$ with $\varepsilon(u) > 0$

and $\varepsilon'(u) < 0$. When unemployment rises, the preferred level of loafing of each individual worker rises

as well. The individual's gain from non-loafing when the wage is w remains:

$$V_i^N = \frac{w}{1+r} + \frac{\delta}{1+r}V^U + \frac{1-\delta}{1+r}V_i^N \qquad . \qquad\qquad (1')$$

The equation for loafing becomes:

$$V_i^S = \frac{w + \ell_i - \varepsilon(u)}{1+r} + \frac{\theta+\delta}{1+r}V^U + \frac{1-\theta-\delta}{1+r}V_i^S \ .$$

As before:

$$V^U = \frac{b}{1+r} + \frac{f}{1+r}V^E + \frac{1-f}{1+r}V^U \qquad ,$$

where

$$V^E = E\left[\max_{\ell_i \in \{0,\ell_i\}}\left\{V_i^S, V_i^N\right\}\right]$$

represents the expected value of employment from the perspective of an unemployed person. The NLC

now implies:

$$\overline{w}_i \geq \frac{r+\delta}{\theta}\ell_i - \varepsilon(u) + \frac{f}{\theta}E\ell_i + b \ ,$$

and the no-loafing threshold becomes:

$$\overline{\ell} = \frac{\theta\big(w + \varepsilon(u) - b\big) - fE\ell}{r+\delta} \quad .$$

As before, an increase in unemployment lowers f, which raises the loafing threshold at any wage

and thereby reduces loafing, but at the same time it reduces the social cost ("peer effect"), which raises

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[22]This is consistent with the importance of peer effects at work, pointed out eighty years ago by Mathewson (1931) and recently demonstrated by Mas and Moretti (2009). It would be straightforward to model this in a more direct fashion, allowing ℓ_i to depend positively on ϕ - salient loafing by colleagues provides a fillip to one's own loafing. An equivalent outcome would arise if firms hoarded labor over the business cycle (Fay and Medoff 1984) and "tolerated" slack in bad times, which was taken up uniformly by workers choosing to loaf, regardless of the extent.

the amount of loafing by the amount ε', conditional on doing any loafing at all. Aggregate effort at wage w is now $e(w) = 1 - \int_{\bar{\ell}}^{1} (\ell_i - \varepsilon(u)) g(i) di$. Higher unemployment thus has an ambiguous effect on total loafing.[23]

Figure 3 shows this phenomenon within the toy model that we illustrated in Figure 2. A higher unemployment rate increases loafing conditional on positive loafing, while reducing the mass of loafers (extensive margin) via a higher threshold. This leads to an ambiguous net effect on non-work and total effort depending on the relative sizes of the two shifts.[24]
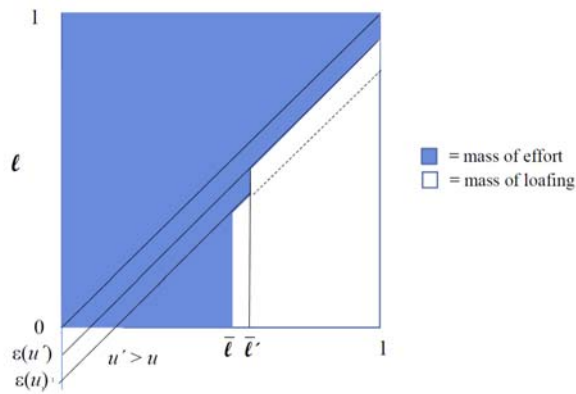
Figure 3. Effort and Loafing in the Toy Model with a Cyclically Sensitive Fixed Cost of Loafing (ε), $u' > u$

V. Applications

The model in Section IV suggests several testable implications that we can examine using the ATUS data. Also, the results in Section III have implications for the ongoing debate over the cyclicality of labor productivity (see, e.g., Hagedorn and Manovskii, 2011; Galí and van Rens, 2014). We deal with these two issues in turn in this Section.

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[23]The effect of unemployment on total effort holding the wage constant, $e(w) = 1 - \int_{\bar{\ell}}^{1} (\ell_i - \varepsilon(u)) g(i) di$ w is

given by $-\varepsilon' \bar{\ell} + \bar{\ell} g(\bar{\ell}) \left[\frac{\partial \bar{\ell}}{\partial f} \frac{\partial f}{\partial u} + \frac{\partial \bar{\ell}}{\partial \varepsilon} \varepsilon' \right]$, which has an ambiguous sign.

[24]Even the expanded model is only partial equilibrium. In Appendix B, we endogenize the wage by embedding the model in a general equilibrium framework.

A. *Unemployment Insurance and Goofing Off*

Propositions 2 and 4 in Section IV can be tested by expanding the equations presented in Tables 2 and 3 to include proxies for the wage rate and unemployment income. Rather than adding the wage rate itself, which would generate errors due to division bias, we add weekly earnings. Since a quadratic in weekly hours is already included, weekly earnings in this context become a measure of the worker's hourly wage rate.

The relevant measure of unemployment insurance (UI) income for each worker depends on complicated formulas typically linking her most recent year's pattern of earnings and employment to state-specific regulations that are revised annually. The ATUS lacks worker-specific earnings histories; *faute de mieux* we therefore experiment with two measures of the UI income that might represent the average benefit available to an unemployed worker. The first, the annual state-specific maximum weekly benefit amount (*maxWBA*), is set legislatively. Given the relatively low benefit ceilings that characterize most states' programs, roughly half of UI recipients receive maximum benefits, so that this measure could be a good proxy for the incentives described in the model of Section IV. An alternative measure is the average weekly benefit amount (*averageWBA*) paid in each state each year.[25] We experiment with this too, although it is not as clean a measure as *maxWBA*, since it depends partly on state-specific variation in unemployment.

We re-estimate the models in Column (3) of Table 2 and Columns (2) and (4) of Table 3, adding each worker's usual weekly earnings and sequentially the *maxWBA* and *averageWBA* in the state in the particular year. For both *maxWBA* and *averageWB*A we present estimates of the determinants of the unconditional mean of the percentage of non-work time, the incidence of non-work (the extensive margin) and its conditional mean (the intensive margin). We measure these and weekly earnings in thousands of dollars for ease of presenting the parameter estimates, noting that their raw means are $384, $281 and $858 respectively. While the results are very similar for both measures of UI benefits, the explanatory power is slightly higher when we include *maxWBA*.

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[25]These data represent an extension of the sample used by Kroft and Notowidigdo (2011).

Section IV generated no predictions about the determinants of the unconditional mean of non-work time; and we see in Columns (1) and (4) of Table 5 that the inclusion of neither *maxWBA* nor *averageWBA* has a significant impact on this outcome. Even with all the demographic controls, however, conditional on hours of work those with higher weekly earnings (implicitly a higher wage rate) spend a smaller fraction of their time at the workplace in non-work.[26] (Those whose earnings are above a regression line are more likely to be high-effort workers, although causation in this bivariate relationship is difficult to determine.)

Proposition 2 suggested that the incidence of non-work will fall with increases in the wage rate and rise with increases in income when unemployed. The estimates in Columns (2) and (5) of Table 5 represent strong evidence in support of this Proposition. Controlling for education and other characteristics, workers with higher wage rates are less likely to engage in any goofing off on the diary day in the ATUS. Workers in states and at times where the maximum (average) UI benefit is higher conditional on their earnings and hours are more likely to spend part of their day at work in non-work. This seems to be a strong confirmation of the model in Section IV and, more generally, of the role of incentives to shirk in determining workers' and firms' behavior.

Proposition 4 implied that the amount of non-work, conditional on it being positive, would increase in unemployment income and decrease in the wage rate. The former implication is supported by the results in Columns (3) and (6) of Table 5: Other things equal, including a large vector of demographic, industry and occupational characteristics, the conditional fraction of non-work is lower among workers with higher hourly wages. The only part of Propositions 1-4 that is not supported by the data is the relationship between unemployment income and conditional non-work time: As Table 5 shows, unemployment income exhibits no correlation with conditional non-work time, only with its incidence.

B. *Heterogeneity of Loafing*

The estimates in Section III suggest substantial heterogeneity in loafing along demographic, geographic, occupational and industrial dimensions. We explicitly excluded the self-employed from

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[26]The inclusion of weekly earnings and the UI variables does not qualitatively alter any of the inferences about the effects of the demographic and other variables on the amount and incidence of non-work time that were based on the estimates in Tables 2 and 3.

our empirical analysis, both because we wished to concentrate on how the employment relationship expresses differences and changes in loafing, and because we wished later to focus on causes of changing employee productivity. Yet the existence of self-employed individuals – who by definition are not subject to efficiency-wage considerations – suggests an additional test of the theory: They will behave qualitatively and quantitatively differently from employees. To test this, we estimate the same equations for the self-employed respondents who reported time at the workplace, of whom there are 3347 with complete information on work-days in the ATUS 2003-12.

The estimates of the same expanded models that appeared in Column (3) of Table (2) and Columns (2) and (4) Table 3 yield parameter estimates on the unemployment rate of 0.0027 (s.e.=0.0015), -0.0036 (s.e.=0.0061) and 0.00448 (s.e.=0.0022). Most interesting is the fact that the impact at the extensive margin is smaller than that shown in Column (2) of Table 3 for employees. This should be expected in light of the theoretical discussion: Having no employer, the self-employed are not monitored and do not face disincentives to shirk when unemployment increases. On the other hand, the impact at the intensive margin is larger than that shown in Column (4) of Table 3. This too would be expected, although the model in Section IV is not relevant here, as when unemployment is high and demand is slack, self-employed individuals might spend less time working at work, instead waiting for work or for customers.

In the equations presented in Tables 2 and 3 the parameter estimates of the vector of occupational indicators were highly significant statistically. Figures 4a, 4b and 4c present these estimates for the net impact, the extensive margin and the intensive margin respectively, with management as the excluded occupation. Remembering that the equations already hold constant a large vector of demographic characteristics, these parameter estimates suggest an interesting pattern of heterogeneity across occupations. First, except for protective services, workers in all other occupations loaf more on the job than do managers, other things equal. Second, and most striking, the occupational differences in the net amount of loafing arise almost entirely from differences at the extensive margin. The pattern at this margin is consistent with what seem easily predictable occupational differences in the ease of monitoring potential shirkers. It is plausible that the monitoring technology is the weakest,

and the tolerance of slack to be the highest, in farming, fishing and forestry, in production and extraction and in construction.

C. Cyclical Movements in Labor Productivity Since 2003

The nature of cyclical changes in labor productivity has been a focus of macroeconomic controversy for over half a century (e.g., Okun, 1962). Labor-hoarding motives suggest that output per worker-hour paid will fall in recessions, while the reduction in shirking incentives coupled with diminishing marginal productivity suggests it will rise when workers are laid off. Our model implies the outcome will be ambiguous, depending on the relative sizes of the impacts at the extensive margin (counter-cyclical productivity per hour at work through greater incentives against shirking) and the intensive margin (pro-cyclical productivity per hour at work through increased loafing by retained workers).

In the model presented in Section IV, there are four distinct effects of an exogenous increase in labor productivity, characterized in Appendix B. First, it raises labor productivity directly, leading to more hiring. Second, competitive firms will expand production and hire more labor in response, which tends to reduce labor productivity at the margin. The third and fourth effects arise in a general equilibrium context. As employment rises unambiguously, wages rise unambiguously, enhancing effort and acting as a fillip to higher productivity. Fourth, unemployment falls, increasing labor turnover and reducing the cost of shirking, with the increase in loafing putting a damper on productivity. The net result of these effects is ambiguous.[27]

Our estimates demonstrate that the impact at the intensive margin dominates that at the extensive margin, so that we would expect pro-cyclical labor productivity if we measure it as output per **hour on the job**. To examine how our finding might alter measures of productivity change over the cycle, we extend the measures of labor productivity generated by Burda *et al* (2013) to account for cyclical variation in non-work at work. Most crucially, in our adjustment we measure labor productivity as output per hour at work and working—i.e., per **hour of actual effort**. We concentrate on labor

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[27]In Appendix B we show that the partial derivative of average productivity with respect to a homothetic outward shift in the production function is ambiguous for the reasons cited in the text.

productivity in 2006:IV, when the U. S. unemployment rate in our data reached its cyclical low, and 2010:I, when it reached its high.[28]

The first row of Table 6 presents the BLS index of labor productivity in the business sector (using a base of 2003:I = 100) for these two quarters and its peak-trough percentage change. The second row lists a calculation based on a number of changes by Cociuba *et al* (2012) using detailed modifications of the BLS series that account carefully for hours actually at work among civilian workers. The third row shows calculations that adjust the measures in the second row to account for time at work as reported by ATUS respondents in their diaries, which we view as more reliable than one-week retrospective reports of time on the job, based on Burda *et al* (2013). All of these measures confirm that labor productivity rose during the Great Recession.

Amending these calculations to account for non-work time at work, the purpose of this exercise, will increase the estimated counter-cyclicality of labor productivity, measured as output per hour of effort (since we showed that the net impact of higher unemployment is to raise non-work time at work), but the question is: By how much? Taking the change in unemployment over this cycle, and using the estimates in Column (1) of Table 2 as indicating the maximum possible cyclicality of non-work time at work, the fourth row of Table 6 shows the adjusted indexes of labor productivity.[29] As the final column of Table 6 shows, accounting for the counter-cyclicality of non-work time at work sharply increases the estimated counter-cyclicality of labor productivity. Indeed, it nearly doubles its variation during the Great Recession compared to the Cociuba *et al* (2012) measure, and increases it by 25 percent compared to the BLS measure. Even with much less counter-cyclicality of non-work (based on the estimates in Column (3) of Table 2), accounting for this phenomenon in the sixth row of Table 6 still shows substantial effects on the estimated change in labor productivity over the cycle. The main conclusion is that the standard neoclassical prediction holds up when worker effort is measured correctly.

D. The Changing Cyclical Behavior of Labor Productivity

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[28]Aggregate unemployment reached its cyclical minimum of 4.4 percent in a number of months between October 2006 and May 2007. Its cyclical maximum was reached in October 2009. We use the minimum and maximum in the ATUS sample for convenience, although the use of these dates hardly alters the inferences qualitatively.

[29]These are calculated so that they equal the measure in Row 3 at the average unemployment rate during this period. Changing the basis does not change the estimated cyclical change in this adjusted index.

We can decompose the rise in productivity with higher unemployment into the increase caused by the rise in non-work time at the intensive margin and the drop generated at the extensive margin. As the fifth and bottom rows of Table 6 show, movements at the intensive margin generate effects on productivity (per hour of actual effort) that double the counter-cyclicality of productivity as compared to the less comprehensive measures in Rows 1-3. The decomposition demonstrates that the cyclicality of productivity will depend crucially on the relative importance of movements along the extensive and intensive margins.

The increase in labor productivity in the wake of the Great Recession stands in contradiction to an earlier, conventional wisdom that labor productivity and total factor productivity in general are pro-cyclical (e.g., Cooley and Prescott, 1995, Gordon, 2003, Ch. 8). Our estimates hint that this reversal in the correlation could be due to changing strengths of behavior at the intensive and extensive margins – in the pre-1990 period, the intensive margin may have dominated the extensive margin. Our model points to parameters such as worker turnover (δ or f) as well as the monitoring intensity (θ) or income in unemployment as causal in this regard.

VI. Concluding Remarks

In this investigation, we have focused on measuring changes in effort exerted by workers as the labor market loosens or tightens. This would appear to be a simple measurement issue, one that would have been reflected in official aggregate data for many years. It has not been. With the now twelve-year-old large-scale study of time use, the American Time Use Survey, we can begin to examine this issue in a way that was heretofore impossible, since that survey provides information on time use on the job. In particular, these new data allow us to measure the cyclical variability of time not working while at the workplace.

There is some evidence that non-work time at work is counter-cyclical, consistent with the dominance of labor hoarding over the role of workers' incentives to reduce shirking at times when its cost rises due to reduced external opportunities. Within this net result, however, lie highly significant but opposite-signed impacts of higher unemployment. The role of shirking is reflected strongly in the pro-cyclical variation in the incidence of non-work time; but among those who shirk at all, the intensity of their non-work is strongly counter-cyclical. These empirical results can be rationalized by a model

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of interactions between employers and workers in which higher unemployment reduces the incentive for heterogeneous workers to shirk, so that those who choose to continue shirking as unemployment rises are those whose preferences for shirking are strongest.

The model also generates predictions about how additional external opportunities, in the form of prospective unemployment benefits, affect the incidence and intensity of non-work on the job. In general they suggest that higher unemployment benefits lead unsurprisingly to more non-work on the job, but they also lead those who do shirk to do less of it. These predictions are mostly supported when we match the time-use data to various parameterizations of states' unemployment insurance systems. Other models might be constructed that explain all of the phenomena we have documented and still others, and that would be a worthwhile additional development.

We use the estimates to develop a new measure of labor productivity, relating it to changing unemployment and showing that, at least during the period encompassing the Great Recession, labor productivity was even more counter-cyclical than suggested by previous estimates. No doubt there are many other applications of this new approach to measuring effort on the job that might be carried out. For example, we have shown striking demographic differences in the share of work time devoted to non-work. These might be used to re-estimate hourly wage differentials among different races/ethnicities; they might be employed to adjust measures of the returns to education; or they could be used to re-examine the returns to on-the-job training. We leave this large set of potential extensions and applications, along with the derivation of additional predictions from our model, to others.

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APPENDIX A

A1. Necessary and sufficient conditions for the assumption $\partial f/\partial u < 0$ to hold in equilibrium.

Remark. The assumption holds if and only if the elasticity of loafing with respect to the outflow rate $(\partial f/\partial u)(u/f)$ in general equilibrium is not larger than $1 + \delta f/\theta\gamma$. Since the second term is positive, a sufficient condition that the elasticity is greater than unity.

Proof. Differentiate totally equation (8) which defines f, and solve for df/du:

$$\frac{df}{du} = -\frac{(\delta + \theta\gamma)u^{-2}}{1 - \theta(u^{-1} - 1)\dfrac{d\gamma}{df}}.$$

For $df/du < 0$ it is necessary and sufficient that $\dfrac{d\gamma}{df} < \dfrac{1}{\theta(u^{-1} - 1)}$. But since $u = (\delta + \theta\gamma)/(\delta + \theta\gamma + f)$ in the

steady state, we have $\dfrac{d\gamma}{df} < \dfrac{\delta + \theta\gamma}{\theta f} = \dfrac{\gamma}{f}\left(\dfrac{\delta f}{\theta\gamma} + 1\right)$, which can be rewritten in elasticity form as:

$$\frac{d\gamma}{df}\left(\frac{f}{\gamma}\right) < 1 + \frac{\delta f}{\theta\gamma}.$$

A2. Proofs of Propositions 1-4.

Proposition 1: *Loafing and unemployment*. Holding the wage constant, the fraction of workers who loaf depends negatively on the unemployment rate.

Proof: Differentiate totally $\gamma = 1 - G(\bar{\ell})$, set all but $d\gamma$, df and du to zero, and use

$$\bar{\ell} = \frac{\theta(w - b) - fE\ell_i}{r + \delta}$$

to obtain $\dfrac{d\gamma}{du} = g(\bar{\ell})\dfrac{\theta(w-b)}{(r+\delta)^2}\dfrac{df}{du}$, which has the same sign as $\dfrac{df}{du}$ (negative).

Proposition 2: *Loafing, wages, and unemployment income*. Holding the rate of outflow constant, the fraction of workers who loaf depends negatively on the wage and positively on income in unemployment: $\dfrac{\partial\gamma}{\partial w} < 0$ and $\dfrac{\partial\gamma}{\partial b} > 0$.

Proof: Differentiate γ totally, set all differentials except dw and db respectively equal to zero and solve,

using $\bar{\ell} = \dfrac{\theta(w - b) - fE\ell_i}{r + \delta}$: $\dfrac{d\gamma}{dw} = -\dfrac{\theta g(\bar{\ell})}{r + \delta} < 0$; similarly, $\dfrac{d\gamma}{db} = \dfrac{\theta g(\bar{\ell})}{r + \delta} > 0$.

Proposition 3: *Conditional mean loafing and unemployment*. Holding the wage constant, the conditional mean of non-work on the job for those with positive non-work is increasing in the unemployment rate: $\dfrac{\partial\phi}{\partial u} > 0$.

Proof. Differentiate ϕ using Leibniz's Rule yields $\dfrac{\partial \phi}{\partial u} = \dfrac{-g(\bar{\ell})\dfrac{\partial \bar{\ell}}{\partial f}\dfrac{\partial f}{\partial u}}{1-G(\bar{\ell})} - \dfrac{\int_{\bar{\ell}}^{1} \ell_i g(\ell_i)d\ell_i}{\left[1-G(\bar{\ell})\right]^2}\dfrac{\partial \gamma}{\partial u}$, which

we want to sign. We have already established that $\dfrac{\partial \bar{\ell}}{\partial f} > 0$, so $\dfrac{\partial f}{\partial u} < 0$ implies that the first term is

positive. We have also established above that $\dfrac{\partial \gamma}{\partial u} = \dfrac{\partial \gamma}{\partial f}\dfrac{\partial f}{\partial u} < 0,$ so the second term is also positive. $\blacksquare$

Proposition 4: *Conditional mean loafing, wages and unemployment income.* **Holding the outflow rate constant, the conditional mean of non-work on the job for those with positive non-work is increasing in the wage and decreasing in income in unemployment:** $\dfrac{\partial \phi}{\partial w} > 0$ **and** $\dfrac{\partial \phi}{\partial b} < 0$**.**

Proof. As with the proof of Proposition 3, differentiate $E\left[\ell_i | \ell_i > 0\right]$ with respect to *w* or *b*:

$$\frac{d}{dw}E\left[\ell_i | \ell_i > 0\right] = \frac{-g(\bar{\ell})\dfrac{d\bar{\ell}}{dw}}{1-G(\bar{\ell})} - \frac{\int_{\bar{\ell}}^{1}\ell_i g(\ell_i)d\ell_i}{\left[1-G(\bar{\ell})\right]^2}\frac{d\gamma}{dw} > 0$$

$$\frac{d}{db}E\left[\ell_i | \ell_i > 0\right] = \frac{-g(\bar{\ell})\dfrac{d\bar{\ell}}{db}}{1-G(\bar{\ell})} - \frac{\int_{\bar{\ell}}^{1}\ell_i g(\ell_i)d\ell_i}{\left[1-G(\bar{\ell})\right]^2}\frac{d\gamma}{db} < 0$$

The signs of these derivatives follow from the fact that $\dfrac{d\bar{\ell}}{dw} < 0$, $\dfrac{d\gamma}{dw} < 0$, $\dfrac{d\bar{\ell}}{db} > 0$ and $\dfrac{d\gamma}{db} > 0.$ $\blacksquare$

APPENDIX B. Closing the Model: Efficiency Wages versus Competitive Labor Markets

The model was set up in partial-equilibrium terms, focusing on the worker's decision to supply effort, taking the wage and unemployment as given. Closing the model requires specifying the wage determination process. One possibility is that firms set or post wages as in the efficiency wage or search literature.[30] In that class of models, firms choose a wage offer and a level of employment to maximize profits subject to the perceived dependence of effort on pay. Let the representative firm's production function be given by $Y = \Theta F(e(w)L)$, where F is a concave, continuous function of labor input $e(w)L$, with $F'>0$ and $F''<0$ and $\Theta>0$ is an exogenous productivity shift term. Note that $e'(w) = \dfrac{\theta g(\bar{\ell})}{r+\delta} > 0$.[31]

The price of output is set to one. First-order conditions for profit maximization are: $e\Theta F' = w$, and $\Theta e' F'(e(w)L) = 1$. Combining the two yields the familiar "Solow condition" (Solow, 1979), $we'/e = 1$:

$$w = \frac{(r+\delta)e(w)}{\theta g(\bar{\ell})} = \frac{(r+\delta)\left(1 - \int_{\bar{\ell}}^{1} \ell_i g(\ell_i)d\ell_i\right)}{\theta g(\bar{\ell})}.$$

where $\bar{\ell} = \dfrac{\theta(w-b) - fE\ell_i}{r+\delta}$. From the firm's perspective, the wage set is independent of the marginal product of labor, equating it rather to the ratio of average effort and marginal effort in response to the wage. The model is closed by the optimality condition for employment L after substituting for e and $\bar{\ell}$

$$\Theta\left[1 - \int_{\bar{\ell}}^{1} \ell_i g(\ell_i)d\ell_i\right]F\left(\left(1 - \int_{\bar{\ell}}^{1} \ell_i g(\ell_i)d\ell_i\right)L\right) = w,$$

and the flow equilibrium condition for f (8), which yields, after substituting for $\bar{\ell}$, a system of three equations in w, L and f.

Alternatively, a competitive wage equates the marginal product of labor, given effort, with the monetary disutility of work at some level of employment. The representative firm's profit is as before, but firms choose employment only. For simplicity, we specify an iso-elastic production function $Y = \Theta L^{1-1/\eta}$ with $\eta>0$. Profit maximization implies a single first-order condition $e\Theta F'(eL) = w$. At the same time, the competitive wage also equals the marginal disutility of work, $w=L^{1/\varepsilon}$. η and ε are thus the elasticities of labor supply and demand, respectively. The equilibrium level of employment L solves:

---

[30]The notion that firms post or set wages has a diverse literature: Bewley (1999) adduces strong evidence that firms set wages and are reluctant to reduce them; Burdett and Mortensen (1998) model wage-posting and turnover as sources of labor market frictions which gives rise to an equilibrium distribution of wages. Manning (2003) provides a summary of these arguments as deriving from both monopsony power and search frictions.

[31]To ensure uniqueness of the efficiency wage, we would need to require $e(w)=0$ for some $w>0$ and for $e(w)$ to be concave: $e''<0$. In the present model, the first condition is always met; the second is met if the density of preferred loafing times is declining at the optimum and $\bar{\ell}$ is decreasing in the wage in general equilibrium.

$$\left[1 - \int_{\bar{\ell}}^{1} \ell_i g(\ell_i) d\ell_i\right] \frac{\eta - 1}{\eta} \Theta L^{-1/\eta} = L^{1/\varepsilon},$$

yielding one equation in L, after substituting for out $\gamma, f, \bar{\ell}$ and using $w = e(L^{1/\varepsilon})\Theta F'(L)$.

Table 1. Descriptive Statistics, ATUS Employees' Workdays, 2003-12, N=35,548, Means and their Standard Errors (and Ranges for Several Variables)

	Unconditional Mean/ Incidence	Conditional Mean
Daily hours at work	8.35	
	(0.014)	
	[0.02, 24]	
Proportion of time at work Not Working:		
	0.0688	
	(0.00062)	
	0.663	0.1003
Of which:		(0.00084)
Eating	0.0372	
	(0.00028)	
	0.518	0.0682
		(0.00041)
Non-work not eating	0.0316	
	(0.00057)	
	0.0355	0.0869
Of which:		(0.00145)
Leisure and exercise	0.0221	
	(0.00038)	
Cleaning	0.0046	
	(0.00031)	
Other	0.005	
	(0.00028)	
Usual weekly work hours	41.38	
	(0.063)	
	[1, 160]	
State unemployment rate	6.65	
(three-month average)	(0.012)	
	[2.1,14.4]	

Table 2. Basic Estimates of the Fraction of Time at Work Not Working, ATUS 2003-12, N=35,548

(Parameter Estimates and Their Standard Errors)*

Ind. Var. Other		Non-Work			Eating at Work		_
State unemployment rate (3-month average)	0.00104 (0.00037)	0.00089 (0.00036)	0.00057 (0.00041)	0.00028 (0.00022)	0.00001 (0.00022)	0.00061 (0.00030)	0.00056 (0.00035)
Usual weekly hours		0.0029 (0.0004)	0.0027 (0.0004)	0.0007 (0.0002)	x	0.0022 (0.0003)	x
(Usual weekly hours)^2/100		-0.0034 (0.0004)	-0.0031 (0.0004)	-0.0010 (0.0002)	x	-0.0024 (0.0003)	x
Hours at work		-0.0368 (0.0028)	-0.0374 (0.0028)	0.0046 (0.0012)	x	-0.0414 (0.0026)	x
(Hours at work)^2/100		0.0032 (0.0002)	0.0032 (0.0002)	-0.0002 (0.00009)	x	-0.0034 (0.0003)	x
African-American		0.0109 (0.0022)	0.0101 (0.0024)	0.0028 (0.0010)	x	0.0081 (0.0020)	x
Hispanic		0.0134 (0.0022)	0.0107 (0.0025)	0.0097 (0.0010)	x	0.0037 (0.0020)	x
Schooling=12		-0.0049 (0.0029)	-0.0040 (0.0029)	-0.0001 (0.0012)	x	-0.0049 (0.0027)	x
Schooling=13-15		-0.0093 (0.0033)	-0.0064 (0.0034)	-0.0016 (0.0015)	x	-0.0077 (0.0030)	x
Schooling = 16		-0.0176 (0.0031)	-0.0128 (0.0033)	-0.0032 (0.0012)	x	-0.0144 (0.0028)	x
Schooling >16		-0.0194 (0.0031)	-0.0164 (0.0035)	-0.0029 (0.0013)	x	-0.0166 (0.0028)	x
Married		-0.0015 (0.0021)	-0.0023 (0.0021)	0.0019 (0.0011)	x	-0.0034 (0.0018)	x
Male		0.0020 (0.0025)	-0.0019 (0.0026)	0.0004 (0.0013)	x	0.0016 (0.0022)	x

Table 2, cont.

Married x Male		0.0014	0.0030	0.0001	x	0.0014	x
		(0.0031)	(0.0031)	(0.0016)		(0.0027)	
Occupation fixed effects (22)			x		x		x
Industry fixed effects (51)			x		x		x
State fixed effects (51)			x		x		x
Month fixed effects			x		x		x
Adjusted R^2	0.0004	0.074	0.086	0.028	0.047	0.112	0.118

*x denotes the variable or vector is also included. Each equation also includes a quadratic in potential experience, and an indicator of metropolitan status.

Table 3. Probit Derivatives and Conditional Regression Estimates of the Fraction of Time at Work Not Working, ATUS 2003-12 (Parameter Estimates and Their Standard Errors)*

Ind. Var.	Probit Derivatives		Conditional Regressions	
State unemployment rate	-0.00312	-0.00493	0.00161	0.00164
(3-month average)	(0.00152)	(0.00172)	(0.00042)	(0.00048)
African-American	0.0765	x	0.0045	x
	(0.0089)		(0.0024)	
Hispanic	0.0713	x	0.0104	x
	(0.0091)		(0.0025)	
Schooling=12	-0.0279	x	0.0009	x
	(0.0124)		(0.0032)	
Schooling=13-15	-0.0642	x	0.0003	x
	(0.0131)		(0.0035)	
Schooling = 16	-0.1080	x	-0.0046	x
	(0.01436)		(0.0034)	
Schooling >16	-0.1136	x	-0.0047	x
	(0.0144)		(0.0034)	
Occupation fixed effects (22)		x		x
Industry fixed effects (51)		x		x
State fixed effects (51)		x		x
Month fixed effects		x		x
Pseudo- or Adjusted R^2	0.094	0.127	0.365	0.374
N =	35,548	35,548	23,578	23,578

*x denotes the variable or vector is also included. Each equation also includes quadratics in usual weekly hours, time at the workplace, and potential experience; indicators of gender, marital status and their interaction, and metropolitan residence.

Table 4. Probit Derivatives and Conditional Regression Estimates of the Fraction of Time Eating at Work and Other Non-Work, ATUS 2003-12 (Parameter Estimates and Their Standard Errors)*

Ind. Var.	Eating at Work		Other Non-Work	
	Probit Derivatives	Conditional Regressions	Probit Derivatives	Conditional Regressions
State unemployment rate	-0.00557	0.00081	-0.00523	0.00231
(3-month average)	(0.00196)	(0.00031)	(0.00180)	(0.00072)
African-American	0.0446	0.0013	0.1003	-0.0022
	(0.0115)	(0.0014)	(0.0111)	(0.0038)
Hispanic	0.0898	0.0038	0.0005	0.0116
	(0.0120)	(0.0018)	(0.0111)	(0.0043)
Schooling=12	-0.0183	0.0031	-0.0056	-0.0035
	(0.0140)	(0.0016)	(0.0123)	(0.0044)
Schooling=13-15	-0.0303	0.0029	-0.0352	-0.0028
	(0.0151)	(0.0025)	(0.0130)	(0.0050)
Schooling = 16	-0.0367	0.0028	-0.0909	-0.0086
	(0.0165)	(0.0021)	(0.0140)	(0.0056)
Schooling >16	-0.0343	0.0013	-0.1242	-0.0057
	(0.0175)	(0.0023)	(0.0144)	(0.0061)
Occupation fixed effects (22)	x	x	x	x
Industry fixed effects (51)	x	x	x	x
State fixed effects (51)	x	x	x	x
Month fixed effects	x	x	x	x
Pseudo- or Adjusted R^2	0.153	0.150	0.058	0.503
N =	35,548	18,401	35,548	12,612

*x denotes the variable or vector is also included. Each equation also includes quadratics in usual weekly hours. Time at the workplace, and potential experience; indicators of gender, marital status and their interaction, and metropolitan residence.

Table 5. Estimates of the Earnings and Unemployment Benefits on the Incidence and Intensity of Non-work, ATUS 2003-12 (Parameter Estimates and Their Standard Errors)*

	Maximum Benefit			Average Weekly Benefit		
	Unconditional Mean	Incidence	Intensity	Unconditional Mean	Incidence	Intensity
State unemployment rate (3-month average)	0.00050 (0.00045)	-0.00630 (0.00187)	0.00173 (0.00052)	0.00059 (0.00048)	-0.00626 (0.00197)	0.00179 (0.00056)
Weekly earnings ($000)	-0.0036 (0.0011)	-0.0266 (0.0054)	-0.0020 (0.0014)	-0.0035 (0.0011)	-0.0264 (0.0054)	-0.0020 (0.0014)
UI benefits ($000)	0.0189 (0.0231)	0.2688 (0.1035)	-0.0105 (0.0259)	0.0061 (0.0405)	0.3732 (0.1860)	-0.0253 (0.0464)
Pseudo- or Adjusted R^2	0.088	0.128	0.374	0.088	0.128	0.374
N =	35,548	35,548	23,578	35,548	35,548	23,578

*Each equation also includes all the variables included in the estimates shown in Table 2, as well as all four vectors of fixed effects.

Table 6. Changes in Productivity, 2006:IV – 2010:I (2003:I = 100)

Row	Productivity Measure	Peak Quarter 2006:IV	Trough Quarter 2010:I	Percentage Change Peak to Trough
1	Business Productivity	108.05	116.81	8.11
2	Cociuba *et al* Adjustment	106.27	111.79	5.20
3	Burda *et al* Adjustment of (2)	105.20	111.79	6.26
4a	(3) Adjusted for Maximum Non-work	103.57	114.44	10.49
	Of Which: Intensive Margin	103.27	117.66	13.93
4b	(3) Adjusted for Minimum Non-work	104.30	113.22	8.55
	Of Which: Intensive Margin	103.10	113.50	10.08
	Unemployment Rate	4.21	10.23	
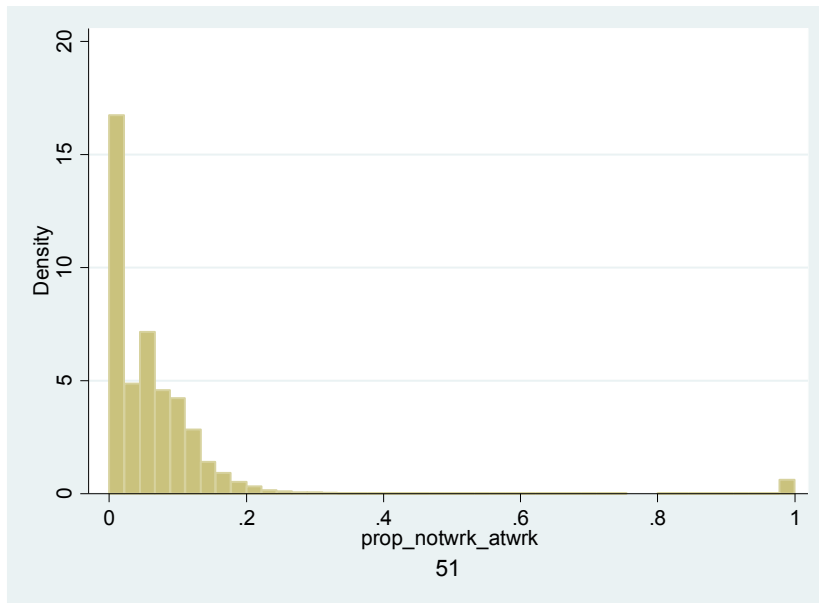
Figure 1. Distribution of the Fraction of Non-work Time, ATUS 2003-2012
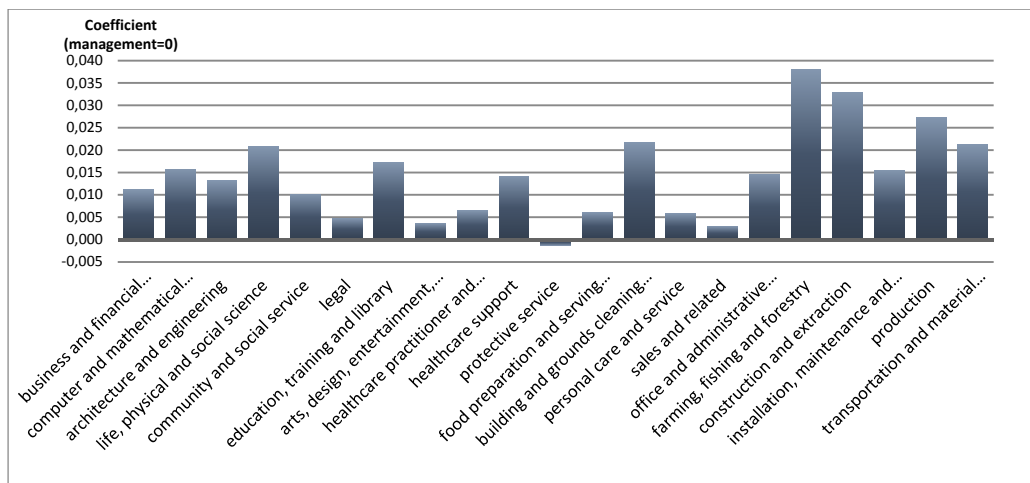
Figure 4a. Coefficients on Occupational Indicators, Column (3), Table 2 (Net Effect).
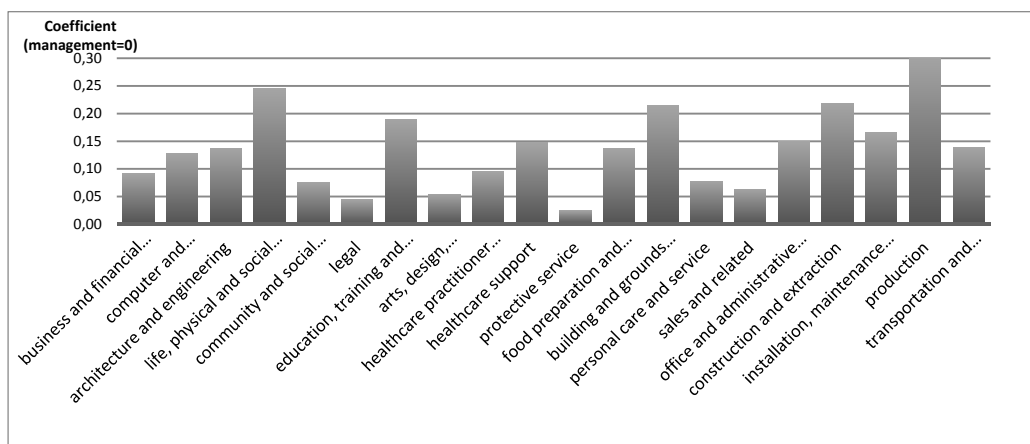
Figure 4b. Coefficients on Occupational Indicators, Column (2), Table 3 (Extensive Margin)

41
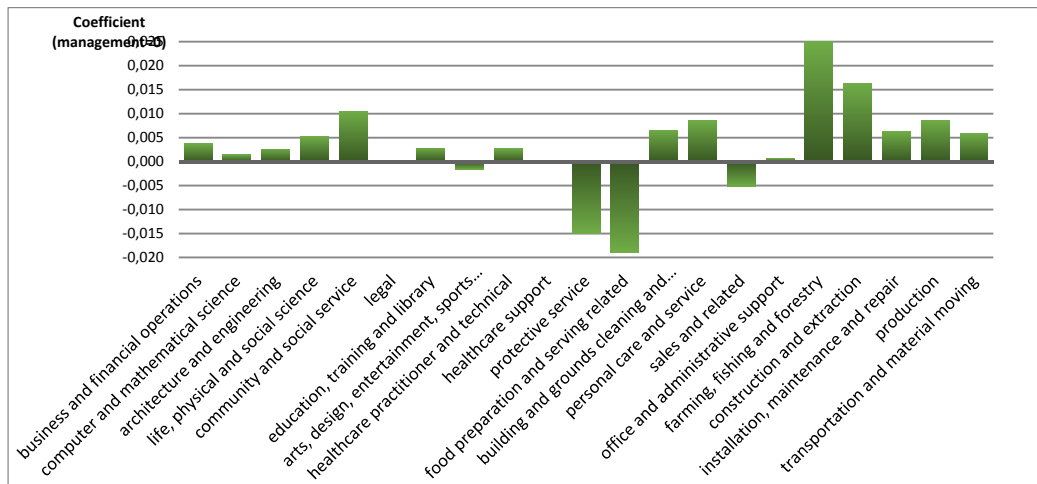
Figure 4c. Coefficients on Occupational Indicators, Column (4), Table 3 (Intensive Margin)

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