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CONSTRAINTS ON THE
CHOICE OF WORK HOURS:
AGENCY VS. SPECIFIC-CAPITAL

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ABSTRACT

Most models of implicit lifetime contracts imply that at any particular point in time, workers' wages and value of marginal product (VMP) will diverge. As a result, the contract will have to specify hours as well as wages, since firms will desire to prevent workers from working more when the wage is greater than VMP and from working less when the wage is less than VMP. This divergence, combined with the fact that in efficient contracts, the hours are set so that VMP equals the marginal value of leisure, implies that workers will face binding hours constraints. We show that the two major models of lifetime contracts, the agency model and the firm-specific capital model, make opposite predictions regarding the relation between work hours constraints and job tenure. We test these predictions. Our results indicate that neither model of efficient long-term contracts explains the observed pattern of hours constraints. Therefore, we briefly consider other explanations.

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Most models of implicit lifetime contracts imply that at any particular point in time, workers' wages and value of marginal product (VMP) will diverge. As a result, the contract will have to specify hours as well as wages, since firms will desire to prevent workers from working more when the wage is greater than VMP and from working less when the wage is less than VMP. As discussed below, this divergence, combined with the fact that in efficient contracts, the hours are set so that VMP equals the marginal value of leisure, implies that workers will face binding hours constraints. We show here that the two major models of lifetime contracts, the agency model and the firm-specific capital model, make opposite predictions regarding the relation between work hours constraints and job tenure. We test these predictions. Our results indicate that neither model of efficient long-term contracts explains the observed pattern of hours constraints. Therefore, we briefly consider other explanations.

I. Hours constraints under lifetime contracting

There are two major models of lifetime contracting in the labor market, an agency model and a firm specific capital model. These models differ primarily in their assumptions about which parties are assumed to fulfill the lifetime contract automatically. Kuhn (1986) offers a useful framework for considering these assumptions. Either firm or worker can renege on the contract, and there are two qualitatively different ways of renegeing: withdrawing, i.e. worker quitting or firms laying off (in Kuhn's terminology, malfeasance by unilateral withdrawal), and not fulfilling the specifics of the contract (in Kuhn's terminology, malfeasance by altering

the terms of the contract), e.g. worker shirking or firms paying lower wages than agreed.

The agency model developed in Becker and Stigler (1974) and Lazear (1979, 1981) is oriented toward worker malfeasance by altering the terms of the contract (i.e. workers cheating, for instance stealing). To minimize inefficient cheating, firms and workers develop lifetime contracts in which a disproportionate amount (relative to productivity) of worker compensation is received toward the end of the contract. While firm malfeasance may occur, for much of this literature, the probability of firm malfeasance is assumed to be independent of the contract. In the simplest model, there is no firm malfeasance whatsoever.

The agency model leads to a specific relationship between the hours constraints that workers face and their tenure. Although the nature of hours rigidity can be demonstrated in a much more general agency model (Lazear, 1981), the essence of this theory can be developed in a simple two period model in which workers' sole opportunity for cheating occurs in between periods. To isolate the effect of worker cheating, we assume no specific human capital. (There may or may not be general human capital.) Let w_i , VMP_i and h_i represent the wage, value of marginal product and hours of the worker at the firm in the i 'th period ($i=1,2$) and w_a , VMP_a , and h_a represent wage, VMP, and hours at the alternative job if the worker works there in the second period. Workers will not cheat provided that

$$(1) \quad U_2(w_2, h_2) > U_2(w_a, h_a) + B$$

where U_2 is utility in the second period and B is the immediate benefit of cheating to the worker, defined in utility terms.

A worker who cheats goes to the alternative firm for the second period and receives his VMP there. (Note that there is no additional opportunity for cheating in the alternative firm.) Since this model assumes no specific capital, VMP in the second period is the same in both the original and the alternative firm. Thus,

$$(2) \quad \text{VMP}_2 = \text{VMP}_a = w_a$$

Following Lazear, for simplicity, hourly VMP is assumed to be independent of hours worked.

Both the two-period contract at this firm and the one-period contract at the alternative job will be efficient. Efficient contracts require that hours be set so that the value of a marginal hour of leisure equal VMP. This, together with (2), means that second period hours will be the same whether the worker remains at the original firm or cheats and moves to the alternative firm. Given $h_2 = h_a$, (1) and (2) imply that

$$(3) \quad U_2(w_2, h_2) > U_2(\text{VMP}_2, h_2)$$

or,

$$(4) \quad w_2 > \text{VMP}_2.$$

Profit maximization requires that discounted lifetime VMP equal lifetime wages, or

$$(5) \quad h_1 * (\text{VMP}_1 - w_1) + h_2 * (\text{VMP}_2 - w_2)/(1 + r) = 0.$$

where r is the discount rate. Since $w_2 > \text{VMP}_2$, (5) implies that

$$(6) \quad w_1 < \text{VMP}_1$$

Because of (4) and (6), firms will restrict low tenure workers from working fewer hours, while leaving them free to work more hours; the opposite is true for high tenure workers.¹

Furthermore, these constraints will be binding: since, in efficient contracts, hours are set to equate VMP to the value of leisure, the value of leisure exceeds the wage for low tenure workers who therefore will want to work less than contracted, while the wage exceeds the marginal value of leisure for high tenure workers who therefore will want to work more than contracted. These predictions are tested here.

Extending this result to a multiperiod model could either result in a generally upward sloping wage-tenure profile, below VMP in earlier periods and greater than the VMP in later periods, or it could result in a discontinuous pattern with a bond posted by the worker in the first period and wage equal to VMP otherwise, except for a large final period premium. Which pattern arises depends on assumptions made about other aspects of the model: whether firm malfeasance is endogenous, relative rates of time preference, etc.² The predictions about hours constraints would not hold for the completely discontinuous pattern where bonds are posted before the worker begins work and repaid after the worker completes his worklife. However, it is clear that wage profiles do not have this pattern, since we generally do not observe large bonds posted at the commencement of the work relation. (See Lang and Kahn, 1987, for a survey of the literature on bonding.)

The implications of the agency model regarding hours constraints contrast sharply with the specific human capital model of Mincer (1974), Becker (1971) and later authors, which assumes that both workers and firms may break the implicit contract by withdrawing (quits or layoffs). Firm-specific human capital makes it desirable for workers and firms to maintain long term employment relationships, and withdrawal of either party is

discouraged by sharing in the investment in human capital. The investment is shared by setting wages in early years above the VMP but below alternative wages. The implications of this model for hours restrictions can once again be shown in the context of a two-period model. Our model is similar to that developed in Parsons (1972) but incorporates hours restrictions.

Firm-specific capital is modeled by assuming that VMP is higher in the second period if the worker remains with the same firm.³ Thus

$$(7) \quad VMP_1 < VMP_2.$$

The employment relationship can only be terminated, either by worker or firm, at the beginning of the second period.

The wage profile of a lifetime contract ensures that the firm has no incentive to fire the worker in the second period, i.e. that

$$(8) \quad VMP_2 > w_2.$$

Given (8), ex post the firm would like the worker to supply more hours. It will restrict high tenure workers from working fewer hours, but leave them free to work more.

The relationship between VMP and wages in the first period can be derived from the profit maximization condition (5). Equations (5) and (8) together require that

$$(9) \quad VMP_1 < w_1.$$

Thus, the firm will restrict low tenure workers from working more hours, but leave them free to work fewer.

Will these constraints be binding on workers? Efficient contracts will ensure that the value of a marginal hour of leisure is equal to the hourly VMP. Therefore, condition (9) implies that in the first period, the

marginal value of leisure is less than the hourly wage and workers will, ex post, want to work more hours than originally contracted. Likewise, condition (8) implies that second period workers will want to work fewer hours.

Mandatory retirement can be seen as an extreme hours constraint, where hours are constrained to equal zero. Carmichael (1986) and Lazear (1979, p. 1264) suggest that the existence of mandatory retirement demonstrates that wages must exceed VMP at the end of the contract. However, it is possible to have mandatory retirement even in models where wage is less than VMP at the end of the contract.⁴

The empirical work below tests the alternative theories of long term work relations by looking at the relation between hours constraints and job tenure. Of course, since long-term relations are not the only factor which can account for such constraints, our discussion of the empirical work also considers other explanations.

II. An empirical model

In order to assess the relationship between tenure and hours constraints, we translate the theoretical model into an empirical model in the following way. Let:

$$(10) \quad \ln w_i = X_i B_1 + b_1 \text{tenure}_i + e_{1i}$$

$$(11) \quad \ln \text{VMP}_i = X_i B_2 + b_2 \text{tenure}_i + e_{2i}$$

where w is the wage, X is a vector of worker characteristics, the B 's

represent vectors of coefficients, and the e 's are random error terms. Equation (10) is a standard wage equation and is consistent with both the agency and human capital interpretations of the return to tenure. VMP is modeled analogously to the wage.

The probability that desired hours exceed contract hours is the probability that w exceeds VMP or

$$(12) \quad \text{Pr}[\text{desired hours} > \text{hours}] = \text{Pr}[X_i(B_1 - B_2) + (b_1 - b_2)\text{tenure}_i + (e_{1i} - e_{2i}) > 0]$$

The test of the agency model versus the specific capital model is a test of whether b_1 is greater than or less than b_2 , that is whether wages rise more rapidly or less rapidly than VMP. Note that we are concerned with the total effect of tenure on VMP including both general and specific training. Consequently, the experience variable included in the X vector must be experience prior to taking the job.

The zero profit condition requires that lifetime discounted wages equal lifetime discounted VMP. It can be shown that imposing this condition implies that B_1 equals B_2 except for the constant term.⁵ Thus, if tastes are forecast perfectly, the only variables which should enter equation (12) are tenure and the constant. However, more reasonably we may assume imperfect foresight, in which case variables such as number of children or health which may not be known to the firm and worker prior to the contract may also enter the equation.⁶

The models of lifetime contracts described in the previous sections assume that all workers are constrained to work more or fewer hours than they wish. As discussed below, in practice some workers are apparently

content with the number of hours that they work. We consider two modifications of the model which are consistent with this fact. First, workers may not be concerned with small deviations from their desired number of hours so that workers only desire more hours if VMP exceeds the wage by some finite amount d . In this case, it is appropriate to estimate equation (12) as an ordered probit.

A second possibility is that not all workers are employed in jobs covered by long-term (implicit) contracts and that workers who respond that they are not hours-constrained are in fact in spot markets. In this case, it is appropriate to estimate (12) as a standard probit using only those workers who desire more or fewer hours than they actually work.⁷ We use both approaches in this paper.

IV. Data

We use data from the Panel Study of Income Dynamics (PSID). Our data are drawn from the 1981 and 1982 waves of the PSID and refer to 1981 jobs. We have not excluded individuals from the SEO sample since experience with the PSID indicates that sample selection bias from inclusion of the low wage sample is not significant for later years (see e.g. Dickens and Lang, 1985).

The PSID poses the following questions. It asks workers if there was more work available on any of their jobs last year. If more work was not available, the respondent is asked whether he would have liked to work more. Respondents who report that they did not want to work more (or who had more work available) are then asked if they could have worked less had they wanted to. Those who could not have worked less are asked if they would have liked to work less even if that would have meant earning less money.

These questions allow us to create variables for "more work available," "wants to work more," and "wants to work less;" however, we cannot create a variable for "able to work less", since this was not asked of workers who wanted to work more.⁸ Note that the wording of the question does not specify whether it refers to more/less hours of work per day, hours per week or weeks per year.

There are a number of difficulties with these questions. The initial question asks whether more work was available on any of the respondent's jobs. A worker with a second job with flexible hours who would have preferred additional work on his primary job would respond that more work was available even though his primary job was constrained. We experimented with treating workers who were paid less in a second job than in their primary job as constrained. The results were similar to those based on the question responses.

A second problem is that it is not clear that any of the questions as phrased, especially the "more work available" question, is meaningful for most salaried jobs, including many professional and managerial jobs. A significant number of individuals for whom "more work was available" also responded that their hourly rate of pay for additional work was zero. As a result we limit our sample to workers who are paid for additional hours of work.

A final issue is what rate of pay individuals are considering when they say they would like to work more. One possibility is that firms are reluctant to pay a premium for overtime which many workers would like to obtain. In fact, wanting to work more is less common among workers who would get an overtime premium if they worked additional hours than among

those who would receive only their straight time wage. In addition, the May 1985 Current Population Survey asked workers whether they would like to earn more, fewer or the same number of hours at the same rate of pay.⁹ When the sample is restricted in a fashion analogous to our sample, the responses are almost identical; 35% desire more work, while 8% desire less work. Although the responses to the CPS and PSID questions are significantly different in the statistical sense, when one takes into account the different sample years, the responses appear quite similar, and it does not seem that the high proportion of workers who want more hours is solely an artifact of the question wording although, of course, we cannot discount the possibility that there is some difficulty of this sort.

Despite these difficulties there is evidence from other studies that these questions are meaningful. Ham (1982) finds that the labor supply behavior of constrained and unconstrained workers differs. Altonji and Paxson (1987) find that workers who are constrained to work fewer hours than they wish tend, when they change jobs, to move to jobs with more hours and to get less of a compensating differential for doing so.

One concern is that workers who respond that they desire to work less are actually referring to self-imposed constraints, as opposed to employer-imposed ones. They would like to work less even if that would mean earning less money now, but are not prepared to work less because of the deleterious impact that would have on the development of their careers or their prospects for promotion. This might be expected to be especially true of people in management types of positions or at formative stages of their careers. To investigate this possibility, we examined the occupation, experience, and tenure of the 32 members of our sample who say they would

have liked to work less. Only two were managers. The rest were mostly operatives (15), clerical workers (3), or skilled mechanics and craftspeople (9). These were not people in formative years of their careers: Their average level of prior experience was 10.6 years and average amount of tenure 9.2 years, compared to averages in the total sample of 9.5 and 8.0 respectively.

As a further check on whether workers who respond that they want to work less are referring to self-imposed constraints, we looked at the responses of self-employed workers (whom we excluded from our sample.) Presumably, self-employed workers are generally free to reduce their hours, and the responses to the PSID questions would reflect this. Of 164 prime age male workers who reported that they were self-employed, 3 responded that they would have liked to work less even if that would have meant earning less money. This proportion is only slightly less than for our sample of wage earners (32/759). However, of these three, two appear to represent coding errors or misinterpretation of the category "self-employed": one of the workers was paid a salary and worked thirty-five hours per week as a retail manager. A second, a composer or musician, worked fewer weekly hours on his self-employed "main" job than on his "second" job where he received an hourly rate of pay; furthermore, the amount that he said he would be paid for additional work was equal to his second job's hourly wage. It therefore appears that he wanted to work less at his work for others, i.e. his second job.

The third self-employed person worked sixty-five hours per week and appears to own a tire or battery retail outlet. We surmise that he felt that long hours were necessary to keep his business going; thus his

constraints were self-imposed, in the sense that we have been using that term. Thus, one self-employed person interpreted the question too broadly, for our purposes. Note, that this is only one of the 62 managers/administrators in the self-employed sample, and only one of the 79 self-employed men who worked 50 hours/week or more.

In sum, we conclude that a very small number of respondents may interpret the question "would you have preferred to work less even if you had earned less money?" as including self-imposed constraints. However, the likelihood of this being true among the non-self-employed is even less than of it being true among the self-employed, both because of the occupational distribution of the 32 people in our (non-self-employed) sample who desired to work less and because it seems more likely for a self-employed worker to interpret the question as including self-imposed constraints than it is for an employee.

Empirical tests of models of lifetime contracts should be limited to those workers who are likely to be in potentially long-term employment relations. Therefore, we restrict our analysis to working male heads of households, age 25 to 54 who are not self-employed and receive a wage or a salary. We exclude agricultural, government and private household workers, and limit ourselves to workers for whom all data were available on all items used in the analysis. The final sample consists of 759 workers.

In our initial work, we distinguished between workers who were covered by a collective bargaining agreement and those who were not since the relation between hours constraints and job tenure in union firms is likely to partially reflect intraunion decision-making. (For instance, union work rules are likely to give greater choice of work hours to more senior

workers.) However, in no case could we reject the hypothesis that the coefficients for the two samples were identical. We therefore restrict our analysis to the combined union and nonunion samples.

Our explanatory variables are drawn from a list of likely candidates for wage and hours equations for adult males -- whether or not the individual lives in an SMSA (SMSA), white versus nonwhite (WHITE), married versus other (MARRIED), the highest grade completed (EDUCATION), whether health limits his work (BAD HEALTH), years of potential experience prior to this job (PRIOR EXP.) measured by age at start of job minus education minus 6, and its square (PRIOR EXP.**2), number of children in the household (CHILDREN), whether or not the worker's job is covered by a collective bargaining agreement (UNION), and years of tenure (TENURE).

A difficulty arises because hours constraints may exist for reasons other than the divergence of the wage and VMP. Our major concern in this respect is underemployment or work sharing. In a market where wage rigidities or other factors prevent instantaneous market clearing, employers may respond to periods of low demand by cutting back workers' hours instead of by layoffs, especially if there are significant rehire costs. In a Baily (1974)/Azariadis (1975) implicit contracts framework, constancy of the wage and variation of hours over the business cycle imply that in low demand periods, workers' wages will exceed their reservation wage or value of leisure, and they will desire to work more. If such work shortages are correlated with tenure, our estimates will be biased. In order to control for the effect of underemployment, we included the local unemployment rate and, in some specifications, weeks unemployed during the year.

We did little experimentation with the choice of the remaining variables with the exception of the tenure variable. We experimented with adding either tenure squared or tenure multiplied by the age at which the individual started his job. The first allows for a nonlinear tenure effect while the second takes into account the possibility that expected tenure may vary with the age at which the individual started the job. In none of the specifications which we tried did either of these variables approach significance. We also tried imposing the functional form for tenure implied by profit maximization.¹⁰ The results were almost identical to those reported below, which is not surprising given the .9 correlation between tenure and the modified tenure variable.

V. Results

While our primary focus is on the relationship between hours constraints and tenure, if hours constraints were not widespread, that alone would cast doubt on the relevance of models of lifetime contracts. In fact, we find considerable evidence of the importance of hours constraints. Only about¹¹ 15% of our sample are free to vary their hours in both directions. 43% can work neither more nor less, 15% can work more but not less, and 27% can work less but not more. Adjusting these figures for workers in second jobs which pay less than their primary job and for salaried workers who are not paid for overtime would further increase the extent to which workers are unable to work extra hours.

In addition, these constraints are binding for a large proportion of workers. Fully 41% of the workers in our sample would prefer to work more if more work were available. On the other hand, only 4% would prefer to

work less. Thus, while hours constraints are widespread, they are overwhelmingly in the direction of making workers' hours less than, not more than, they desire. The difference between the proportion of workers constrained to work fewer hours than they desire and the proportion constrained to work more hours than they desire is striking. Dickens and Lundberg (1985) also find that most workers work fewer hours than they wish. Since their study used markedly differing methods and different data, the similarity of the findings provides strong confirmation for the result.

To cast light on the relationship between tenure and hours constraints, we begin by looking at the mean level of tenure for workers who wish to work more, fewer, or the same number of hours that they presently work. The results provide weak support for the specific capital model. Mean tenure is 8.0 years for workers who are satisfied with their hours, 7.8 years for those who desire more hours and 9.2 years among those who wish to work fewer hours. However, these differences are not significant at conventional levels.

To examine the relationship between tenure and hours constraints while controlling for the effects of other variables, we turn to the probit estimates in Table 1. The first column gives the results of an ordered probit in which the highest category is "wants more work", the middle category is "wants neither more nor less work", and the lowest category is "wants less work". A positive coefficient therefore indicates that the variable tends to increase the probability that the individual desires more work. The ordered probit provides strong evidence against the Lazear agency model. Using a one-tail test, we can reject the predicted positive sign on tenure at the .05 level.

In the second column, we restrict the sample to those workers who feel constrained in one direction or the other. The estimates are therefore of a standard probit with two categories, wants more and wants less. The estimated effect of tenure in this model is somewhat less strong but remains significant at the .05 level using a one-tail test.

While the remaining variables are not the primary focus of the paper, we note in passing that there is strong evidence that whites are less likely to be constrained to work fewer hours than they desire. It also appears that married workers, more educated workers, and workers with few children are less likely to be constrained to work fewer hours than they wish. The effect of the local unemployment rate appears to operate in the direction predicted by the underemployment model. The coefficient is significant at the .05 level using a one-tail test in the ordered probit but falls far short of conventional significance levels when unconstrained workers are dropped from the sample.

Because the result for unemployment suggests that our results may be affected by the presence of workers experiencing underemployment in the sample, the third and fourth columns replicate the estimates but with weeks of unemployment experienced by the individual included as an explanatory variable. While the estimates are virtually unchanged for the standard probit (column 4), the effect of tenure is substantially reduced in the ordered probit and is significant at only the .1 level for a test of the hypothesis that the coefficient is zero against the hypothesis that it is negative. It therefore appears that the negative relationship between tenure and wanting more work is due in part to the greater underemployment experienced by relatively junior workers.

The Lazear model is strongly rejected when we treat all constraints as being derived from lifetime contracts. While it is true that when we attempt to eliminate the effect of underemployment, the evidence against the agency model is less compelling, the effect of tenure continues to be in the opposite direction from that predicted by the model. Moreover, testing whether the tenure coefficient is negative rather than zero provides a very weak test of the agency model since that model implies that the coefficient should be greater than zero. A "correct" test of the model would require specification of the prior distribution of the tenure coefficient under the agency model. Implicitly, our test puts all of the weight of the prior distribution at zero, when it should put weight on a range of points greater than zero. Thus rejecting the "null" hypothesis even at the .1 level represents strong rejection of the agency model.

While the negative tenure coefficients might be taken as weak support for the specific-capital model, our overall findings also appear to be inconsistent with that model. The overwhelming majority of workers who face binding constraints want to work more, not less. Since the firm-specific capital model implies that senior workers are constrained to work less than they wish, this is hard to reconcile with that model. Workers would have to be paid more than their VMP for an extended period at the beginning of the relationship and less than their VMP for a very short period at the end of the relationship. However, given equality of lifetime discounted wages and lifetime discounted VMP, this implies that wages must be far below VMP towards the end of the relationship. This is only possible if either VMP increases sharply towards the end of the relationship, which seems unlikely, or if wages drop sharply, which simply does not occur.

A second way of making the same point is to note that the results imply that an "average" worker would be constrained to work more hours than desired only after tenure reaches about 100 years. We suspect that few of the workers in our sample expect to remain with the same firm for this length of time.

Moreover, the result is not robust to the choice of prior experience rather than experience as an explanatory variable. While the long-term relations model suggests that the proper parameterization uses prior experience, this choice is by no means as clear for other models of hours constraints. If experience rather than prior experience is used for the first set of estimates, the effect of tenure is essentially zero (.002 with a t-statistic of 0.3 for the ordered probit and .006 with a t statistic of .4 for the two category probit in the first set of specifications). Since we cannot rule out this choice of parameterization, our results provide only weak support for the firm-specific capital model of long-term relations where the wage is less than VMP at the end of the relationship.

VI. Other Explanations for Hours Constraints

While the primary objective of this paper was to test two models of lifetime contracts, the failure of both models to explain hours constraints moves us to at least consider some other explanations.

One obvious alternative explanation has been discussed somewhat already -- hours constraints as a form of underemployment. While underemployment cannot account for workers who are constrained to work more hours than they wish, it is an attractive theory since most constraints take the form of workers being employed for fewer hours than they wish. As a partial control

for this form of underemployment, we included the local unemployment rate in our specifications. We would expect to find a positive effect of the local unemployment rate on wanting to work more, even though it is unlikely to be a perfect control. As noted above, the relationship between hours constraints and the unemployment rate, however, provides only very weak support for this hypothesis. While the effect of unemployment is significant at the 5% level in the full sample ordered probit, it does not approach significance in the two category probit.

Similarly, there is no strong relationship between the unemployment rate for the years 1968 to 1983 and the proportion of workers in each year who are constrained for all working heads of households interviewed by the PSID, (see Table 2). The unemployment rate has insignificant relationships with both the proportion of workers who say they could work more ($t=.4$) and the number who want to work less ($t=.6$), and in the latter case the relationship is positive, opposite to what the unemployment hypothesis would predict. There is a significant, positive relationship between unemployment and wanting to work more, but this reflects the upward trend in both unemployment and wanting to work more. If we include a time trend, the relationship turns insignificant ($t=1.3$). (Including a time trend in "could work more" and "want less work" regressions reverses the sign for the latter, but still leaves them both insignificant.)

On the other hand, there does appear to be a relationship between personal unemployment experience and individuals' responses to the questions. Weeks unemployed has a significant and positive effect in the ordered probit, although an insignificant effect in the "more vs. less" probit. 30% of the workers who want more work had experienced unemployment

in the course of the year. A worker who experienced unemployment during the year is much more likely to have wanted to work more: fully 60% of those members of our sample who had experienced unemployment said they would have liked to work more compared with only 26% of those not experiencing unemployment. Thus it appears that a substantial fraction of hours constraints are associated with unemployment, but that the majority is not.

A second obvious source of hours constraints is technological. Often the production technology requires that a number of workers be present simultaneously. In an assembly line, for instance, there are likely to be significant problems of coordination unless workers work the same shift. Similarly, a receptionist or switchboard operator may be required for exactly the period during which the firm is open for customers. If many or most jobs are for a set number of hours per day or per week, there will be a hedonic relation between wages and hours which matches workers who desire long hours with firms which require long hours (see Moffitt (1984) for a model in which the wage depends on the number of hours worked). In a model with perfect mobility, each worker would be constrained to work a fixed number of hours, but each worker would be employed in the job which, given the wage/hours trade-off, required his preferred number of hours. Therefore, while hours in any given job would not be flexible, no worker would be constrained to work more or fewer hours than he desired. We find some evidence of such job matching in our sample. The 41% of workers who would like to work more hours are only slightly more than half of those who could not have worked more.

However, if hours constraints were determined by the need for technical coordination of schedules, hours would generally be rigid in both

directions, so that workers would be constrained both from working more and from working less. Of the workers in our sample constrained by employers (i.e. either having no more work available and/or not being able to work less), approximately¹² 51% are constrained in both directions while the remaining 49% are constrained in one direction only.

If workers acquire firm-specific human capital or have mobility costs, they will tend to remain with the same firm even if their tastes for hours of work change slightly, so that matching will not be perfect. Of course, potential workers will weigh their tastes for hours of work over the period they remain with the firm, discounting for their probability of remaining with the firm and for time preference. Nevertheless, at any point of time, a worker will be constrained to work a different number of hours than he currently desires. This will be more true for senior workers since their tastes are more highly discounted. In fact, Kahn (1987) shows that, in the case of safety, workers appear to take into account their tastes over a very short horizon of about three years. This may reflect the fact that the probability of staying in a new job for more than three years is quite low (Hall, 1982).

Thus, if technological coordination is the explanation for hours constraints, we would expect to see few junior workers and many senior workers facing binding hours constraints, and junior and senior workers would be constrained in opposite directions. This could account for the one-sidedness of hours constraints, as long as desired hours increased with age. However, if desired hours increased with age, we would expect labor supply also to increase with age. The labor supply literature shows no

strong and consistent relationship of this sort (at least for prime age males). Moreover, we do not observe senior workers being significantly more constrained than junior workers.

In sum, it seems that technological coordination of schedules is likely to be a significant determinant of hours constraints, but still only part of the story.

A related explanation for hours constraints is the inter-firm coordination problem and the historical development of workweek length. The need for inter-firm coordination makes the standard workweek a public good, from which it is difficult for firms to depart. It is possible that our particular standard workweek, forty hours, is simply an accident of history, reflecting past conditions, and that it is difficult to alter the standard workweek. One problem with this explanation (aside from its deus ex machina quality) is that minor deviations from the standard workweek (especially if the deviations are increases) should not be particularly costly for most firms so that if most workers are underemployed, there should be continual upward pressure on the length of the standard week. Moreover, the fact that historically there have been changes in the standard workweek suggests that this theory cannot explain the observed persistent constraints on hours.

In sum, while lifetime contracts, underemployment and technological coordination explain some aspects of observed hours constraints, none seems to account for the large number of workers who must work fewer hours than they wish. We suggest here two further possible explanations for hours constraints. One explanation is that VMP declines as the length of the work week increases (at least in the relevant range). If for some reason (perhaps because of the overtime provisions of the FLSA), it is impossible

to have the marginal hourly wage decline as VMP declines, an optimal contract will specify wages and weekly hours. Since the marginal wage exceeds marginal VMP and the optimal contract sets the marginal value of leisure equal to marginal VMP, the marginal wage will exceed the marginal value of leisure, and workers will want to work more hours than originally contracted. One difficulty with this explanation is that it suggests that firms should simply pay workers salaries rather than hourly wages. However, it is possible that, when combined with an assumption of fluctuating demand, this model could yield an explanation of both the observed hours constraints and payment in the form of hourly wages. A second problem is that we would expect such hours constraints to be most prevalent among those directly affected by the FLSA overtime provisions. However, as noted above, workers who would receive an overtime premium for additional work are less likely, not more likely, to want to work more.

Finally, we note that inefficient hours constraints may arise in a shirking model. Although Lazear in his agency model assumes that hours are set at the first-best efficient level, this assumption is justified only if bonding is costless. Bonding may be costly because of differences in discount rates between workers and firms, costs of preventing firm malfeasance, etc. Assuming that bonding is costly is natural for two reasons. First, the wage profile is determinate only if bonding is costly (Lazear 1979, 1981; Akerlof and Katz, 1986). Secondly, we would only observe monitoring if bonding were costly (Dickens, Katz and Lang, 1986).

When bonding is costly, hours will be set below their efficient level and therefore workers will tend to be constrained to work fewer hours than they desire. To demonstrate this, we present a simple model here with no

bonding. A more general model can be found in Lang (1987). An employer hires a single worker who must choose between shirking and not shirking. Workers are paid in advance and are infinitely long-lived. If the worker is caught shirking, he is dismissed, and for simplicity, it is assumed that the worker is not rehired anywhere and has a shadow value of leisure equal to zero. (A positive probability of rehire elsewhere or a positive value of leisure would not change the results.) The probability that the worker is caught shirking each period, q , increases with hours worked per period, h . The marginal probability of being caught is a decreasing function of hours ($q' < 0$). If the worker does not shirk, he suffers disutility of effort, e , that is increasing with h . The marginal disutility of effort on the job is a nondecreasing function of hours worked each period ($e' \geq 0$).¹³ The marginal product, v , is assumed constant, again for expositional simplicity.

Under these assumptions, the efficient number of hours each period would set v equal to e' . Denote the wage by w and the discount rate by r . If the worker shirks, his expected payment is the sum from zero to infinity of $wh(1-q)^t / (1+r)^t$, while if he doesn't shirk, his payment is the sum from zero to infinity of $(wh-e) / (1+r)^t$. Therefore, the condition that the worker not shirk is,

$$(13) \quad wh \geq e(h)[1 + r/q(h)].$$

The firm chooses hours to maximize profits equal to

$$(14) \quad vh - wh = vh - e(h)*[1 + r/q(h)]$$

where v is the hourly value of marginal product. Maximizing (14) with respect to hours gives

$$(15) \quad v = e'[1 + r/q] - q'er/q^2$$

or

$$(16) \quad v/e' = 1 + (r/q) [1 - (e/e')(q'/q)].$$

Since $e'' \geq 0$, e/e' is less than or equal to h . Similarly since $q'' < 0$, q'/q is less than $1/h$. Consequently, the term in (16) in square brackets is positive, and

$$(17) \quad v/e' > 1$$

or

$$(18) \quad v > e'$$

which means that hours are set below their efficient level.

Moreover, competition ensures that the wage equals the value of marginal product. Therefore the wage exceeds the marginal disutility of employment, and workers are constrained to work fewer hours than they desire.

VII. Conclusion

This paper provides strong evidence that most wage earners face hours constraints. Close to half of workers would like either to work more or fewer hours than they are, in fact, able to work. Most frequently, the constraint takes the form of workers not being able to work as much as they wish; in fact, about ten times as many workers want to work more than want to work less.

Theories of long-term employment relationships predict hours constraints. However, neither of the principal models of long-term contracting, firm-specific capital and Lazear's agency model, suggests hours constraints which are compatible with our findings.

Without doubt, some constraints arise from the need to coordinate the work schedules of different employees. However, the fact that many workers' hours are only restricted in one direction and that being constrained to work less than desired is so much more common than being constrained to work more suggests to us a role for other determinants of hours constraints. At the very least, if firms set hours to coordinate workers' schedules, we need an explanation of why the schedules should be biased toward fewer hours than workers desire.

Similarly, underemployment may be responsible for some of the workers observed to want more work. The variety of empirical evidence we present on unemployment, including the effect of the local unemployment rate and of weeks unemployed in the cross section analysis and a time series analysis, all indicate only very weak support for this explanation, except among people who had themselves experienced unemployment during the year. Since this is a limited sector, unemployment can account for some but not the majority of hours constraints.

Additional explanations for the observed widespread hours constraints must be found. We suggest two kinds of directions that could offer solutions. One of these has been further developed in Lang (1987). Both deserve additional theoretical development and empirical testing.

TABLE 1

Probit Estimates of Wanting More vs. Less Work (Union/Nonunion)

	Ordered	More vs. Less	Ordered	More vs. Less
SMSA	0.014 (0.1)	0.248 (1.1)	0.021 (0.2)	0.248 (1.1)
Married	-0.203 (1.4)	-0.132 (0.4)	-0.176 (1.2)	-0.145 (0.4)
Unemp. Rate	0.031 (1.7)	0.022 (0.5)	0.024 (1.3)	0.020 (0.5)
Education	-0.079 (3.5)	-0.087 (1.7)	-0.078 (3.4)	-0.084 (1.6)
Children	0.106 (2.8)	0.130 (1.4)	0.114 (3.0)	0.151 (1.6)
Bad Health	0.236 (1.2)	0.512 (0.9)	0.225 (1.1)	0.498 (0.9)
White	-0.397 (4.1)	-0.773 (3.0)	-0.357 (3.7)	-0.723 (2.8)
Prior Experience	-0.036 (2.1)	-0.034 (1.0)	-0.032 (1.9)	-0.029 (0.8)
Prior Experience **2/100	0.071 (1.3)	0.010 (0.1)	0.046 (0.8)	-0.017 (0.2)
Tenure	-0.013 (1.9)	-0.023 (1.6)	-0.009 (1.3)	-0.019 (1.2)
Union	-0.067 (0.7)	-0.207 (1.0)	-0.075 (0.8)	-0.225 (1.0)
Weeks Unemployed	-	-	0.047 (4.3)	0.043 (1.4)
Log likelihood	-600.3	-93.4	-590.4	-92.1

T statistics are in parentheses.

TABLE 2

Relationship Between Unemployment Rates and Hours Constraints
(hours constraints as a percent of all working heads of households)

Year	Unemployment Rate	Could Work More	Wants More Work	Wants Less Work
1967	3.8	46.3	14.2	3.1
1968	3.6	37.1	18.9	5.8
1969	3.5	39.3	20.3	4.9
1970	4.9	39.0	21.5	5.7
1971	5.9	40.4	19.6	6.1
1972	5.6	40.9	18.4	6.0
1973	4.9	41.9	18.2	5.6
1974	5.6	41.1	22.0	5.1
1975	8.5	36.8	23.9	3.7
1976	7.7	41.8	21.3	6.2
1977	7.1	45.3	19.8	6.2
1978	6.1	45.5	19.6	7.5
1979	5.8	41.1	22.3	6.1
1980	7.1	43.4	23.5	5.4
1981	7.6	41.0	25.5	5.5
1982	9.7	37.6	27.8	5.5
1983	9.6	41.9	23.6	6.1

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FOOTNOTES

1. Lazear shows that these results hold even in a more general model with some firm malfeasance, particularly where there is imperfect information about some firms' default histories. Because not all firms default despite a wage higher than the VMP in later periods, there is still an upward sloping wage profile with all the implications developed above.
2. See Akerlof and Katz (1986) and Lazear (1981). Also, if there are job ladders where shirking or cheating is not possible in early years, low wages during this entire period can take the place of a bond.
3. The assumption that the increase in VMP is exogenous greatly simplifies the analysis. If the increase is treated as endogenous, the theoretical prediction is sensitive to modelling assumptions and to the choice of parameter values in some models. For senior workers, all endogenous VMP models lead to the same prediction as the exogenous model, i.e. that senior workers will be constrained to work more than they want. However, endogenous VMP in some models may reverse our conclusions about junior workers, so that junior workers will be constrained to work more than they want. The predictions that we develop here for exogenous VMP, therefore, are true for many models of endogenous VMP. Moreover, the other endogenous VMP models give predictions that are immediately rejected by the data since the empirical evidence discussed below strongly rejects a model which implies that most workers are constrained to work more than they want.
4. For example, mandatory retirement might arise in an adverse selection model such as Weiss (1980) or in an efficiency wage model similar to the one described towards the end of the paper.
5. The zero profit condition can also be shown to imply that the coefficient on tenure depends on the expected probability of remaining at the firm until each tenure level, which in a steady state can be calculated from the distribution of tenure in the firm.
6. This can be derived formally by including actual and expected marginal value of leisure equations and solving for the ex ante optimal hours and the ex post desired hours.
7. Whether this process leads to sample selection bias is a more complex question than it might at first appear. In essence the existence of sample selection bias depends on whether we are interested in the effect of tenure conditional on being in a long-term contract with hours constraints or simply on the effect of tenure. Since we are interested in the former, there is no problem of sample selection bias. This point was the subject of a heated debate between Poirier and Ruud (1981) and Maddala (1983).
8. The exact questions are:
 - A. Now thinking about your job(s) over the past year, was there more work available on (your job/any of your jobs) so that you could have worked more had you wanted to?

- B. (asked only if answer to A is yes) How much would you have earned per hour?
- C. (asked only if answer to A is no or don't know) Would you have liked to work more if you could have found more work?
- D. (asked only if answer to A is yes or answer to C is no or don't know) Could you have worked less if you had wanted to?
- E. (asked only if answer to D is no or don't know) Would you have preferred to work less even if you had earned less money?

9. The exact question was, "If you had a choice, would you prefer to work, the same number of hours and earn the same money, fewer hours at the same rate of pay and earn less money or more hours at the same rate of pay and earn more money?"

10. See footnote 6. We used cross-section data from the May 1979 CPS to calculate the probability that a worker who started a job at a given age would attain each level of tenure.

11. We cannot calculate some of these figures exactly because the question "could you have worked less?" was not asked of workers who wanted to work more but couldn't. Estimates were arrived at by assuming that the same proportion of these workers have less work available as in the population of workers who couldn't work more and didn't want to.

12. Footnote 11 also applies here.

13. That $q'' < 0$ arises naturally if, for example, being caught is a Poisson process with constant arrival probability. That $e'' \geq 0$ is just the standard assumption of diminishing marginal utility.