CENTRE FOR ECONOMIC PERFORMANCE

DISCUSSION PAPER NO. 374

November 1997

A SIMPLE TEST OF THE SHIRKING MODEL

A. MANNING and J. THOMAS

ABSTRACT

Although popular in some circles, efficiency wage models of the labour market have proved surprisingly difficult to test and direct evidence for the central tenets of the theory is rare to non-existent. In this paper we propose a simple test of the Shapiro-Stiglitz shirking model which is based on the following idea. In the traditional search model the distribution of accepted wages should be truncated below by the reservation wage. But, if shirking is important then the employer will never want to employ a worker at their reservation wage and the distribution of accepted wages should be truncated below by the reservation wage plus something. That something is a measure of the importance of shirking. We test this prediction using data from the UK Survey of Incomes In and Out of Work. The results are not particularly supportive of the shirking model.

This paper was produced as part of the Centre's
Industrial Relations Programme

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A. MANNING and J. THOMAS

NOVEMBER 1997
Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London
WC2A 2AE

ISBN 0 85328 494 6

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The Centre for Economic Performance is financed by the Economic and Social Research Council.

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Alan Manning and Jonathan Thomas

INTRODUCTION

Efficiency wage models have been regarded in certain circles as very important for understanding why the labour market may not clear with the consequence of the existence of involuntary unemployment. Yet, there is incredibly little direct evidence for the existence let alone the importance of efficiency wages. Those studies which purport to offer evidence for efficiency wages are generally unpersuasive. Let us consider some examples.

The most persuasive paper in many ways is Cappelli and Chauvin (1991) who claim to test the main predictions of the shirking version of efficiency wage theory proposed by Shapiro and Stiglitz (1984). They use a data set of UAW plants which all have the same wage package and disciplinary procedure to test the hypothesis that there are fewer dismissals for disciplinary reasons in plants located in low wage areas (where the UAW job is more attractive relative to alternatives). As they summarise their findings “the wage premium appears to provide incentives to avoid dismissal” (p784) and argue (p769) that this is “a direct test of the main implications of the shirking efficiency wage model”. The problem is that this second claim does not follow from the first. Showing that incentives are important is not the same as validating the main claims of the shirking efficiency wage theory, namely that restrictions on the contracts that can be offered by firms force employers to offer workers a level of utility strictly above what they could get on the open labour market. It is this issue of whether employers have enough flexibility to design labour contracts which simultaneously motivate workers and give them a level of utility equal to what they could get on the open labour market that is really at the heart of the debate about the relevance of the shirking model (see

Lazear, 1981; Carmichael, 1985; Macleod and Malcomson, 1989, 1993; Akerlof and Katz, 1989 for different results with different assumptions about the set of feasible incentive contracts). Cappelli and Chauvin (1991) do not test this as the incentive contract chosen is not set unilaterally by employers but negotiated with the union so that it is unsurprising that it is more generous than outside opportunities. To sum up, Cappelli and Chauvin does provide valuable evidence that incentives are important but few would dispute that and it does not prove the relevance of efficiency wage ideas.

This problem pervades other proposed tests of efficiency wage models. For example there are a series of papers (Wadhwani and Wall, 1991; Levine, 1992; Konings and Walsh, 1994) arguing that the distinctive feature of these models is that worker productivity is higher when wages are high relative to alternatives and then look for evidence of this either by the direct estimation of production functions or more indirect means. The problem is that this prediction is **not** a distinctive feature of efficiency wage models: a competitive compensating wage differentials model would have the same prediction as a firm that wants to work its workers hard needs to pay a higher wage relative to alternatives. This point is made by Machin and Manning (1992) who try to distinguish between competing models on the basis of dynamics: this approach itself is very dependent on the theoretical model used. In this literature the proponents of efficiency wages implicitly claim that the idea that there is a disutility of effort proves the existence of involuntary unemployment: again, this is simply not true.

A third empirical literature that is often claimed as support for efficiency wage models is that on inter-industry wage differentials (Krueger and Summers, 1988) which finds evidence that wages are systematically related to industry affiliation even when all other (or, more accurately, all available) relevant factors are included in earnings equations. There is a considerable literature on whether these industry effects actually exist (see Murphy and Topel, 1987; Gibbons and Katz, 1992; Keane, 1993) but even if they do it is obvious that the connection between industry effects and efficiency wage models is tenuous at best.

At the end of all this perhaps the best evidence for efficiency wage models are anecdotes eg the study of Henry Ford's $5 day by Raff and Summers (1987) and Weiss' (1980) model built on the story of the Stanford Linear Accelerator Laboratory. But, it is obviously difficult to generalise from case studies to the importance of efficiency wages in the economy as a whole.

In this paper we propose a simple test of one prominent version of the efficiency wage model, the shirking model of Shapiro and Stiglitz (1984) which has the considerable merit, we believe, of focussing directly on the issue of whether involuntary unemployment exists or not. This test is based on the following idea. In traditional search models workers have a reservation wage at which the value of employment at that wage equals that of remaining unemployed. Consequently, the distribution of accepted wages will be truncated below by the reservation wage. Now, suppose there is imperfect monitoring which leads to a potential problem with workers shirking. A key insight of this literature is that workers will shirk unless they receive a wage which is sufficiently high to ensure that retaining the job is better than losing it. This means that an employer will not be prepared to knowingly employ a worker at their reservation wage or even slightly above it as they will then not have sufficient incentives not to shirk. The distribution of accepted wages will be truncated below by the reservation wage plus something. Establishing the existence and size of that something is the basis of our test.

The plan of the paper is as follows. In the next section, we present a simple model to formalise the idea expressed above. We then describe our data which is drawn from the 1987/88 UK Survey of Incomes In and Out of Work (SIIOW). The third section then modifies the theoretical model to be suitable for empirical investigation and the fourth presents the results. Our conclusions are that while there is some evidence supportive of the importance of shirking, the evidence is hardly over-whelming.

1. A THEORETICAL MODEL

In this section we present a simple theoretical model that combines features of traditional search ideas and the shirking model of Shapiro and Stiglitz (1984). Let the worker receive utility b when unemployed. A worker faces a distribution function of wage offers F(w) which, for convenience, we assume to be differentiable with density function f(w). We are deliberately vague about where this wage distribution comes from. It could be from models of equilibrium wage dispersion in which employers set wages or it could be the results of bargaining between workers and firms where there is job-specific variation in productivity. The bargaining case produces the same qualitative predictions as, in the absence of incentive problems, a match will occur whenever there is a surplus to be shared between workers and employer so that the lower bound on the surplus in matches is zero and the workers will receive their reservation wage in this case. So, it does not really matter where the wage distribution comes from for our purposes. It is also important to recognise that our model does not require there to be employers offering wages below the reservation wage as the distribution of accepted wages which we model will not depend on this.

Job offers are assumed to arrive at a rate $?_0$ for unemployed workers and $?_1$ for employed workers. Workers also leave employment for unemployment at an exogenously given job destruction rate q and have a discount rate equal to d. If a worker accepts a wage w and does not shirk then the instantaneous utility from the job is assumed to be (w-e), while if they do shirk this utility is simply assumed to be w. We assume there is imperfect monitoring of workers; in particular that the incidence of monitoring is a Poisson process with arrival rate ?. Like Shapiro and Stiglitz (1984) the punishment for shirking is to be fired.

Implicit in this set-up is that we also follow Shapiro and Stiglitz (1984) in assuming that the employment contract is simply a fixed wage. There is, of course a considerable literature on why more complicated contracts involving bonds or upward-sloping wage profiles may be optimal to deter shirking (see, for example, Carmichael, 1985; Macleod and Malcomson, 1989, 1993) and, as we have already mentioned, the issue of the flexibility of labour contracts is crucial for determining whether involuntary unemployment exists. However, it is hard for us to take full account of the undoubted complexities of real-world employment contracts in our empirical work as our data set only has information on a single starting wage and a single reservation wage. This is not necessarily disastrous. If all jobs have much the same incentive structure (in terms of wage growth and bonuses etc) then one can think of workers as having a reservation starting wage for jobs and the issue of whether involuntary unemployment exists can be thought of as whether the lowest acceptable starting wage for employers is or is not strictly above the reservation wage for workers. So, if we find that the lower bound for accepted wages is the reservation wage we would prefer to interpret that as implying that other ways of providing incentives work well rather than as evidence that there is no incentive problem at all (which is what, strictly speaking, our theoretical model implies).

Define V(w) to be the value to a worker of being employed in a wage paying w if they do not shirk, $V^s(w)$ to be the value of the job when they do shirk and V^u to be the value of being unemployed. Not surprisingly, the worker will want any job that exceeds some reservation wage r (to be derived below) and the firm will only want to employ workers when they know that the worker will not shirk which will require the wage to be above some critical level which we will denote by w^* (which is also derived below)[1]. w^* is the minimum wage at which a worker will not shirk. Then, the value functions must be given by:

$$\delta . V(w) = w - e - q.[V(w) - V^u] + \lambda_1 . \int_{\max(w,w^*)} [V(x) - V(w)] dF(x) \quad \textbf{(1)}$$

$$d\cdot V^{s}(w) = w-(?+q)\cdot[V^{s}(w)-V^{u}]+?_{1}\cdot\int_{\max(w,w^{*})}[V(x)-V(w)]dF(x) \qquad \textbf{(2)}$$

$$d\cdot V^{u} = b + ?_{0}\cdot\int_{\max(r,w^{*})}[V(x)-V^{u}]dF(x) \qquad \textbf{(3)}$$

In these equations we allow for the possibility that a worker is employed at a wage below w^* in order to derive the no-shirking condition although, in equilibrium, this will never happen. By differentiating (1) and (2) with respect to w we have that:

$$V'(w) = \frac{1}{d+q+?_{1}\cdot[1-F(\max(w,w^{*}))]} > \frac{1}{d+q+?+?_{1}\cdot[1-F(\max(w,w^{*}))]} = V^{s\prime}(w) \qquad \textbf{(4)}$$

so that $V(w)-V^s(w)$ is increasing in the wage so that the no-shirking condition will a be a cut-off rule of the form we have assumed ie that $w \geq w^*$ where $V(w^*)=V^s(w^*)$. Using (1) and (2) this condition can be written as:

$$V(w^{*}) = V^{u} + \frac{e}{?} \qquad \textbf{(5)}$$

(5) is a familiar type of no-shirking condition as it says that the utility the worker gets from the job must be strictly larger than the utility available when unemployed. As ?64 and monitoring becomes perfect the premium that needs to be paid to workers to prevent them from shirking goes to zero. (5) also implies that w^* must be above the reservation wage of workers as the reservation wage will be the wage at which the value of the job is equal to the value of being unemployed. So, in (3), $\max(r,w^*)=w^*$.

It is instructive to write the no-shirking condition in terms of the wage distribution rather than the value functions. Integrating the final term in (1)-(3) by parts, and using the first part of (4), we can derive:

$$\delta V(w) = w - e - q[V(w) - V^u] + \lambda_1 \int_{w^*} \frac{[1-F(x)]dx}{\delta + q + \lambda_1[1-F(x)]} \quad \textbf{(6)}$$

$$\delta V^s(w) = w - (q+\lambda)[V^s(w) - V^u] + \lambda_1 \int_{w^*} \frac{[1-F(x)]dx}{\delta + q + \lambda_1[1-F(x)]} \quad \textbf{(7)}$$

$$\delta V^u = b + \lambda_0 [V(w^*) - V^u][1-F(w^*)] + \lambda_0 \int_{w^*} \frac{[1-F(x)]dx}{\delta + q + \lambda_1[1-F(x)]} \quad \textbf{(8)}$$

Evaluating (6) at w^* and using (8) and (5) allows us to write the no-shirking condition as:

$$w^* = b + e + \frac{\delta + q + \lambda_0[1-F(w^*)]}{\lambda} e + (\lambda_0 - \lambda_1) \int_{w^*} \frac{[1-F(x)]dx}{\delta + q + \lambda_1[1-F(x)]} \quad \textbf{(9)}$$

It is simple to check that there must be a unique w^* that solves (9). (9) is easy to understand. Workers must be offered a wage that exceeds the utility they can receive when unemployed and the disutility of effort associated with working. If job offer arrival rates differ by employment status they must also receive compensation for the difference in the value of search when employed and unemployed: this is the last term in (9). Finally there must be a sufficient gap between the value of the job when employed and unemployed to ensure that the worker does not shirk; this is given by the penultimate term.

Let us now consider the reservation wage of the worker. There is an ambiguity here according to whether we compute the reservation wage assuming that the worker does or does not shirk. We know that the reservation wage will be below w^* and that such a worker will shirk. So, it seems natural to define the reservation wage assuming the worker will shirk ie r is given by the solution to $V^s(r)=V^u$. Using (7) and (8) we have that:

$$r = b + (?_0 - ?_1) \cdot \int_{w^*} \frac{[1-F(x)]dx}{d+q+?_1 \cdot [1-F(x)]} \quad \textbf{(10)}$$

Substituting this back into (9) gives us:

$$w^* = r + e + \frac{d+q+?_0 \cdot [1-F(w^*)]}{?} \cdot e \quad \textbf{(11)}$$

(11) shows that with shirking, the minimum wage at which employers will be prepared to employ workers is the reservation wage plus something positive. One problem with (11) is that this result seems to hold even when monitoring becomes perfect. The problem here is that there is a discontinuity in the model with perfect monitoring as then a worker will not shirk even at their reservation wage[2]. Denote by r_1 the reservation wage if workers do not shirk ie r_1 solves $V(r_1)=V^u$. From (6) and (8) it is straightforward to see that $r_1=r+e$. Using this reservation wage for the case of perfect monitoring we can see that the minimum wage acceptable to employers is then the same as the reservation wage.

The prediction we have derived so far is that if shirking is important, then the distribution of accepted wages should be truncated below by the reservation wage plus a little something extra. But, we can also derive stronger predictions.

First, note that $?_0(1-F(w^*))$ is the exit rate from unemployment. (11) says that the something will be larger, the higher is the exit rate from unemployment. This is not surprising, as the threat of being fired for shirking is less severe when it is relatively easy to find another job. So, in labour markets with high unemployment we might expect the 'something' to be smaller.

Secondly an increase in q, the rate at which workers leave employment for non-employment, tends to raise the ‘something’ as workers’ expected job duration is shorter when q is higher. As women leave employment for non-employment at a faster rate than men (because of domestic reasons) and because lay-off rates are higher for less educated workers this delivers the prediction that we would expect the ‘something’ to be higher for women and less educated workers.

In this section we have presented a traditional search model augmented with shirking problems to show how these will cause the distribution of accepted wages to be truncated below not by the reservation wage but by the reservation wage plus something. That something is a measure of the importance of shirking and is also predicted to be larger for workers with low exit rates from unemployment and high rates of job loss. We now consider whether there is any evidence for these predictions.

2. THE DATA AND A FIRST ANALYSIS

The data for this study comes from the SIIOW which is based upon a nationally representative sample of 3003 men and women who started a spell of unemployment (by signing-on) in March or April 1987. This period witnessed the onset of a very fast boom. The unemployment rate had peaked at about 12% in early 1986, had fallen to 11.3% by March 1987 and then, over the period of study, fell continuously to 9.6% by November 1987. Individuals were interviewed twice, once within around 6-8 weeks of signing-on and again approximately nine months later. Information from these surveys was supplemented by information from the administrative records of the Department of Health and Social Security (DHSS). The aim of the survey was to examine the relationship between incomes in and out of work, and their effects on job search and unemployment durations. To this end, the interviews asked a large number of questions about search behaviour and the process of the return to work.

For our purposes, we need information on the reservation wage and the wage in the return to work (RTW) job. The information on the reservation wage comes from the question "what is the lowest weekly take-home pay you might consider accepting" which was supplemented by a question on hours. This was converted to an hourly wage. Not all the sample provided useable information on the reservation wage: 211 said they had never looked for work and of those who had, 632 provided no reservation wage information, leaving a sample of 2,160 for whom we do have a measure of the reservation wage.

The wage in the RTW job was derived from a question on the usual take-home pay in the first job after signing-on. The answer to this question was converted to an hourly wage. 378 of the workers with a reservation wage never returned to work in the approximately nine months to the second interview so obviously no wage is available for them (we discuss potential problems caused by this sample selection later). Among the 1,782 workers who did return to work, we have information on the wage for 885 of them which is approximately 50% of the total population[3]. Our basic sample consists of these 885 workers. Some summary statistics about this sample are presented in Table 1 as well as a comparison of all those with reservation wage information who left unemployment for a job. The two samples are similar except that those providing information on the wage tend to have shorter durations. This is because they are more likely to have been in employment at the first interview (and hence provide information on the RTW wage at that time) whereas those with longer durations could only have provided information about the RTW wages at the second interview when there was considerable attrition. One noteworthy fact, which will be of importance later, is that the gap between average reservation wages and realised wages is very small. Figure 1 presents a simple plot of realised wages against reported reservation wages. If the model presented in the previous section was correct, one would have a very simple estimate of the lowest value of the something: it would be the smallest observed gap between realised wages and reservation wages[4]. This estimator would be superconsistent (by a straightforward application of Christensen and Kiefer, 1991). But, there is an obvious problem with this procedure, for realised wages are sometimes observed to lie below reservation wages. This is inconsistent with the standard search model without shirking in which the realised wages are truncated below by reservation wages. A usable empirical model must allow for this fact.

One concern might be that the problem of Figure 1 is caused by the fact that reported reservation wages are meaningless and do not play the role they are given in the theoretical model. According to the theory, other things equal, higher reservation wages should be associated with higher realised wages and longer durations of unemployment. So, we would like to know whether both of these propositions are true.

From Figure 1, there is a very noticeable positive correlation between realised and reservation wages. Table 2 investigates how robust this conclusion is to the inclusion of other control variables. In the first column we regress log wages on a variety of characteristics normally included in earnings equations. A familiar picture emerges: wages are positively related to education, being male, white and in good health and a concave function of age. The second column includes the reservation wage. What is striking is not just the fact that the reservation wage is very significant but that other variables are much less significant. In particular, age now has no effect suggesting that the higher wages realised by older workers are a consequence only of their higher reservation wage. The third column also includes the duration of unemployment which has a very small effect on wages consistent with the growth in nominal wages over the sample period.

One concern might be that the reservation wage picks up unobserved heterogeneity in worker quality so that high reservation wages are associated with high realised wages through the position of the wage offer distribution rather than the truncation that our theory suggests. But, by looking at how durations are related to reservation wages, we can see whether this is the dominant effect as we would expect a high quality worker to have both a higher reservation wage and a duration that is shorter than a low quality worker. The observed correlation between unemployment duration and reservation wages would be negative. On the other hand, if the variation in the reservation wage is associated with variation in the truncation point of a given wage offer distribution then we would expect a positive correlation. Table 3 presents the results of the estimation of various parametric and semi-parametric duration models: an exponential, a Weibull and a Cox. A positive coefficient on a variable indicates that it is positively correlated with duration. In addition to the variables included so far, we include the local unemployment rate and measures of the time and money spent on job search and whether the worker has access to private motorised transport. In all the specifications a high reservation wage is associated with higher durations suggesting that, on average, variation in the reservation wage is working in the way suggested by our model.

We now turn to the issue of how we can present an empirical model that can explain the problem posed in Figure 1.

3. AN EMPIRICAL MODEL

There are a number of ways in which we might modify the theoretical model of the first section to make it consistent with the data presented in Figure 1. The approach we adopt here is to assume that the utility derived from jobs is determined not just by the wage but also by some non-monetary characteristics eg convenient hours, congenial working conditions, distance from home etc. Evidence in support of this idea can be found in Blau (1991) and Altonji and Paxson (1992). When individuals are asked for their reservation wage they cannot qualify their answer by saying that it would be £3 per hour in one job, £3.50 per hour in another. The assumption we make here is that the answer they give is based on the average job. This is our identifying assumption and, because of this, it is not testable.

To make this idea more precise, assume that the utility to be derived from the job can be written as $u=w+v$ where w is the log of the wage and v is some non-monetary component to the utility from the job. v is assumed to be normally distributed with mean zero and variance σ^2_v, and w is assumed to be normally distributed with mean μ (which will be allowed to vary with personal characteristics) and variance σ^2_w. For the moment, assume that w and v are independently distributed. We assume that the individual wants the job if $u>r$ where r is the log of the reservation wage, but that the employer only wants to employ the worker if $u>(r+a)$ where $a>0$ and is a measure of the importance of shirking.

Consider what will be the observed distribution of wages conditional on reservation wages in this model which we will denote by $f(w|r)$. First, consider what is the probability of getting a job offer that is acceptable to both parties. This is the probability that $(w+v)>(r+a)$ as $(r+a)$ is the truncation point. Given our assumptions, $(w+v)$ is normally distributed with mean μ and variance $\sigma^2_1=(\sigma^2_w+\sigma^2_v)$. So the probability of getting an acceptable job offer is $[1-\Phi((r+a-\mu)/\sigma_1)]$. The probability of getting an offer w that is acceptable is the probability of getting w times the probability of getting a value of v such that $v>(r+a-w)$, which is given by $[1-\Phi((r+a-w)/\sigma_v)]$. So the density of observed wages conditional on reservation wages will be given by:

$$f(w|r) = \frac{\frac{1}{\sigma_w}.\phi\left(\frac{w-\mu}{\sigma_w}\right).\left[1-\Phi\left(\frac{r+a-w}{\sigma_v}\right)\right]}{\left[1-\Phi\left(\frac{r+a-\mu}{\sigma_1}\right)\right]} \qquad \textbf{(12)}$$

This is the individual contribution to the likelihood function.

The alternative approach to rationalising Figure 1 would be to assume that the observed wage contains some measurement error but that the true wage is always above the true reservation wage: this is the approach taken by Christensen and Kiefer (1994). To see the implications of this suppose that the true wage is u but the observed wage is w and w=u+v where v is mean zero and uncorrelated with u. Decisions to take on workers will be based on a comparison of u with (r+a). This model can be put in our framework by noting that we can write u=w-v which is the model presented above but with the generalisation that now w and v can be correlated. In fact, they must have a negative correlation. We tried to estimate this model but our estimates always went to edge of the parameter space in which v was uncorrelated with w (although it should be noted that the likelihood function does seem to be very flat). For this reason we stick to our first model.

A brief discussion of identification is in order here. The likelihood function in (12) is essentially the distribution of w conditional on utility being bigger than (r+a) so that we are interested in estimating the parameter a in a density function of the form f(w*u>r+a). Without further structure it should be obvious that one cannot estimate a in general (ie it is non-parametrically unidentified)[5]. Our assumption that the reservation wage is determined by workers thinking about the average job implies that E(u*w)=w. But, this type of assumption is still not enough to identify a in a non-parametric sense because the distribution we are estimating is a truncated one and there is going to be no information in our data about the part of the distribution that is not observed. Given this we see little alternative to using a specific functional form to achieve identification, in which case one should be aware of the possibility that results are driven by inappropriate assumptions about functional form. With this in mind, we present tests of the adequacy of the functional form chosen.

4. ESTIMATION AND RESULTS

Basic Results

Table 4 presents the results of estimation of the likelihood function in (12). In the first column we report the results for the whole sample including all the variables that we would expect in earnings functions. From our point of view, the important estimate is that of a which is estimated to be 16% with an asymptotic t-statistic of 1.88. In terms of the shirking model, it is obviously of the right sign but lies on the margin of conventional levels of significance. We would also like some idea of whether this estimate is large or small. One way of assessing the importance of this estimate is to compute its effect on the exit rate from unemployment. Ideally, one would like to compare the situation with and without problems caused by shirking. The problem is that there is reason to believe that the whole structure of the economy would be different if there was no shirking. For example, we might expect there to be more but lower wage jobs so that the wage offer distribution and the job arrival rate would be different. In turn, this would have an effect on the reservation wage. There is obviously no way that these general equilibrium effects can be estimated. Nevertheless, to give some general idea of the importance of shirking we assumed that the wage offer distribution, reservation wage and job offer arrival rates are the same with and without shirking problems. The proportional increase in unemployment duration caused by shirking is then given by:

$$d = \frac{1-\Phi\left(\frac{r-\mu}{\sigma_1}\right)}{1-\Phi\left(\frac{r+a-\mu}{\sigma_1}\right)} \qquad \textbf{(13)}$$

The average value of this measure is reported in the row marked d. For the first column of Table 1, the average value of d is 1.72 implying that unemployment durations are 72% higher in the presence of shirking (subject to the provisos made above). This effect seems large given that the estimate of a seems small, but comes about because the gap between the realised and reservation wages is not large so that small variation in a can have big effects. However, the standard error is also extremely large so that d is not significantly different from one. The problem is that we have very large point estimates of d but very large standard errors means that one can rarely reject the null hypothesis that unemployment durations are no different from what they would be in the absence of shirking.

As discussed above, one other concern might be that our results are very sensitive to functional form, the choice of which has been dictated primarily by analytical convenience. To allay some of these fears we present a series of specification tests. First, to see whether the model fits the data reasonably well we use the test proposed by Vuong (1989) to test our functional form against the linear regression model in which the log of the wage is regressed on all the explanatory variables in the model and the log of the reservation wage (essentially this is the model of the second column of Table 2). A positive test statistic indicates that our model does better than this crude alternative. As the test statistic has an asymptotic standard normal distribution one can see that the model in column 1 of Table 4 is nearly significantly better than the crude alternative.

As a further test of the adequacy of our functional form we also present a test statistic based on the approach proposed by Heckman (1984). Given our parameter estimates, we compute for each individual the probability of observing a log wage below the mean log wage given their characteristics. We then take the sample average of this probability and test whether it is significantly different from the actual sample proportion with a log wage below the mean (which is close to 0.5 in our sample). We report the difference between the actual and predicted proportions and also report the asymptotic standard error. While we reject the null hypothesis that the functional form is acceptable for the specifications with men and women together, we always accept the null hypothesis for separate male and female equations.

The second column deletes those variables from the wage offer distribution that are not significant. The estimate of a rises to about 17% and is now just statistically significant at the 5% level.

We now move on to try to test some of the more specific predictions of the shirking model. We suggested above that the estimates for a should be larger for women than men because women leave employment for non-employment at a faster rate. The third and fourth columns estimate separate equations for men and women. It is clear that there is no effect whatsoever for women and any effect that does exist is for men. For men alone a is estimated at 34% and the implied reduction in unemployment durations is of the order of 238% although, again, the estimate is not significantly different from one. These results are not in line with the predictions of the shirking model. The fifth column reports the results when the variables determining the mean of the wage offer distribution are restricted.

Table 5 extends this examination of the importance of shirking for men, testing the hypothesis that a should be larger for less skilled workers (because they have higher lay-off rates) by allowing a to depend on whether the individual has higher education. The results are reported in the first column. Although the point estimate is in line with the predictions of the shirking model it is insignificant.

The second column of Table 5 also investigates the possibility that the local unemployment rate affects a through its effect on the exit rate from unemployment. Given the evidence amassed by Blanchflower and Oswald (1995), it is probably unwise to control for the unemployment rate without also controlling for the mean of the wage offer distribution. This is the approach of the second column and there is no evidence that high unemployment rates are associated with less problems of shirking: if anything, the reverse seems to be the case although once again a zero effect cannot be rejected.

Given all this, the performance of the shirking model is rather weak. It certainly does not seem to be a phenomenon which is so important that one could not deny its existence with any credibility.

However, its performance is not completely disastrous and one could make a case that it does have a modest impact on the labour market.

Additional Tests

a. sample selection issues

The main potential for sample selection bias arises from the fact that we only observe realised wages for those with completed durations. There are a number of reasons for thinking that this may lead to a bias in the estimate of a but no definitive conclusion about the direction of the bias is possible. For example, suppose there is individual heterogeneity in the arrival rate of job offers when unemployed. Then, as (11) shows, we would expect a to be increasing in the exit rate from unemployment so that our sample which focuses on individuals with relatively short durations also focuses on those with high a. Then, our estimates will over-estimate the importance of shirking. But if the individual heterogeneity was in ? so that some individuals are better at shirking than others then the bias would be in the other direction as high ? individuals will tend to have high a and long unemployment durations (as it takes them longer to find a job with a wage above their w^*). One might also think that there are efficiency gains to be obtained by estimating a model of the joint density of durations and realised wages. This model would have to contain extra parameters related to the job offer arrival rate. As there is no particular reason to exclude any variables from the determinants of the job offer arrival rate, one can think of the parameters of the realised wage offer distribution as being essentially independent of those of the duration model. There is then no real efficiency loss from not modelling durations.

b. changing wage distributions and reservation wages

There is also a potential problem with the fact that the reservation wage information we have used only relates to a single point in time near the beginning of the spell and cannot pick up any changes over time. For example, if the wage offer distribution is constant but reservation wages fall over time then we will expect to see spuriously low realised wages which will tend to lead to a downward bias in the estimate of the importance of shirking. On the other hand, if the wage offer distribution is shifting up over time because of inflation or real wage growth but reservation wages were constant then there would be an upward bias in the estimate of the return to shirking.

We have a number of ways of looking for the importance of this effect. First, for those workers who were not in work at the second interview, we have a second observation on the reservation wage. The relationship between these two reservation wages is shown in Figure 2. On average the reservation wage at the second interview is about 2% higher than that at the first interview. This corresponds to reservation wages increasing in line with prices. The problem with this information is that it may be contaminated by severe sample selection bias: it may be precisely those workers who refuse to lower their reservation wage who do not manage to get into jobs.

A second way of investigating the effect of changing wage offer distributions and reservation wages is to assume that the mean of the wage offer distribution changes with duration and that the reservation wage also changes with duration. So, in the specification of (r+a) we include a term that is linear in the spell. The results of this are presented in the third column of Table 5. One could also think of this as being a test of the direction of the potential bias discussed in the previous section. The spot estimates imply that the mean of the wage offer distribution is increasing with duration presumably because inflation and real wage growth are more than off-setting any deterioration in the human capital of the long-term unemployed. The estimates of the effect of duration on the reservation wage imply that the reservation wage decreases with duration which is probably what we would expect. However, the spot estimates of these effects are much too large to be plausible as annual inflation was about 4% in this period and annual nominal average wage growth was about 7%, something which is reflected in the large standard errors. But the intercept in a, which is our measure of the importance of shirking, remains much the same. The final column of Table 5 restricts the effect of the spell on the mean of the wage offer distribution to be in line with what we would expect nominal wage growth to be for these workers ie about 4% per annum. This makes little difference to the estimate of a.

c. unobservable reservation wages

The model we have presented above assumed that employers could observe the reservation wage of workers when offering a job. If they are not able to do this they will sometimes employ workers who they think will not shirk but actually will and sometimes refuse employment to those who would not have shirked. One way of testing whether this is important is to look at the subsequent job history of those who are hired at wages that are low in relation to reservation wages. If this effect is important we would expect to see higher dismissal rates for workers whose wages are low relative to reservation wages. For the jobs in our sample, Table 6 summarises the fraction that we have information on having ended and the reasons given for the job ending. A considerable fraction (over 40%) of the RTW jobs had ended within the sample period. But, dismissal was the reason cited by only a very small minority (4%) of those leaving the RTW job. Taken at face value this implies either that employers are well able to identify at the hiring stage who will shirk and who will not or that dismissal is not a widely used threat for motivating workers. But there is a problem with this rather glib conclusion as there are good reasons for thinking that some of the job endings classified in other categories were really dismissals[6]. First, individuals may have an understandable reticence in admitting to the interviewer that they had been dismissed for being a ‘bad’ worker. Secondly, workers who are dismissed are potentially denied access to benefits (as are those who voluntarily quit) so that employers may be prepared to ‘sweeten the pill’ and give some other reason for the worker leaving the firm. Finally, the failure of the employer to renew a contract may be because the employer has not performed to a satisfactory standard and the ending of a short-term contract does not expose the employer to risks of being sued under unfair dismissal legislation. Given this, we propose to consider whether there is any link between wages, reservation wages, jobs ending and the reason given. We start by considering a simple logit model for whether the job has ended or not. The results are reported in Table 7. We include the usual set of personal characteristics as well as dummy variables for when the return to work job was found. For someone with a RTW job it may be the case that they had the job by the first interview. These people have obviously had longer to have left the first job (unfortunately we lack exact information on job tenure) and we will have had more opportunity to observe the worker leaving the job if there is a second interview. Accordingly we include in the regression a dummy variable for those workers who had returned to work by the first interview and another dummy variable for whether there was a second interview. The excluded category is those who had not had a job by the date of the first interview but who had had one by the second interview (which must have occurred for this group to have made it into the sample).

From the first column of Table 7 these variables are very important. In terms of the effect of the wage and reservation wage, we can see that the wage has the expected negative effect and the reservation wage the expected positive effect though the reservation is wage is not significantly different from zero and the wage is only significant at the 10% level. The second column then excluded the other variables that seem to be unimportant in explaining whether the worker leaves or not. The coefficient on the reservation wage is resolutely insignificant. The wage effect could conceivably be argued to be supportive of the shirking model but we would prefer not to give this interpretation as it is well-known that high wage workers have a lower risk of job loss and are less likely to quit (so perhaps the turnover version of efficiency wages is more relevant). We think that the coefficient on the reservation wage is the cleanest test of the shirking model and our results are not consistent with it.

We now turn to see whether there is any significant difference in the effect of wages and reservation wages on the probability of leaving for particular reasons. Table 8 presents the results from a multinomial logit model in which the default category is those who have not left their job. To improve the sample sizes in the different categories we group together the laid-off categories and the other and not stated. The significantly negative effect of the wage can be seen to be mostly the result of the negative effect on the chances of quitting. Similarly, the effect of the reservation wage (always insignificant) is not more important for the dismissals and contracts ending. We conclude that this job-ending data is not consistent with the view that employers have substantial difficulty in identifying potential shirkers as the chances of being dismissed seem very small and are not related to reservation wages in the way predicted by the theory.

5. CONCLUSIONS

Efficiency wage models have been surprisingly resistant to empirical testing in spite of their potential theoretical importance. In this paper we have presented a simple test for the empirical relevance of the shirking model of Shapiro and Stiglitz (1984) which, compared to other studies, has the virtue of focusing directly on seeing whether there is any evidence for involuntary unemployment ie workers being unable to get jobs at wages they would be prepared to accept. Our empirical findings have been mixed but overall do not suggest that the shirking model is of great importance in the labour market. This should not be interpreted as saying that there is no problem with motivating workers, rather that employers have other ways of dealing with these problems apart from paying wages above the reservation wage and dismissing workers caught shirking.

We have also only provided a test of the shirking version and there are other popular versions (see Akerlof and Yellen, 1990). We think this is a virtue: very different theories are lumped together under the title of efficiency wage models and this only hinders detailed empirical testing of them.

ENDNOTES

1. It is simple to prove that the equilibrium cut-off rule must be of this form (see (4) above) but allowing for a general hiring rule at this stage introduces tedious additional notation which only complicates the presentation.

2. This discontinuity arises because of the discrete nature of the effort choice in the present model and would disappear in a richer (but more complicated) model with continuous effort choices.

3. One reason this proportion is low is that the information on the unemployment spell comes from administrative records which were examined for a year whereas the latest information on employment comes from the second interview conducted at approximately nine months.

4. It should be noted that if there is any heterogeneity in the something then this estimator cannot be used to estimate the average value. However, this literature often assumes that the reservation wages are constant across subsets of individuals so the assumption of a constant something is also in that spirit.

5. For example, one obviously could not estimate a if w and u were independent. This is not something to concern us too much here as there is good reason to believe that utility and wages are positively correlated.

6. It is worth noting here that, if shirking is important, there is a meaningful economic distinction between quits and lay-offs as, in the latter case, the worker is forced out involuntarily this being the equivalent situation to the involuntary unemployment faced by an unemployed worker.

TABLE 1
Summary of the Data

	Sample with Observed Wages (885 observations)		Sample with Completed Durations (1736 observations)	
Variable	Mean	Std Deviation	Mean	Std Deviation
wage	2.55	1.26		
res wage	2.27	0.85	2.37	1.09
exp wage	2.66	1.03	2.77	1.26
age	36.3	11.1	36.6	11.4
male	0.60	0.49	0.61	0.49
white	0.93	0.25	0.92	0.27
health probs	0.34	0.47	0.37	0.48
higher ed	0.22	0.41	0.23	0.42
tech qual	0.43	0.49	0.40	0.49
school qual	0.45	0.50	0.46	0.50
spell	75.3	76.3	101.7	92.3
search time (hours/week)	9.0	7.5	8.5	7.3
search expenditure (£/week)	4.81	4.41	4.67	4.43
wheels	0.50	0.50	0.51	0.50
local u rate	13.8	4.5	13.6	4.4

TABLE 2
Wage Regressions
Dependent Variable: Log Hourly Wage in RTW Job

	1	2	3
constant	-0.27 (0.15)	0.16 (0.13)	0.15 (0.12)
male	0.21 (0.02)	0.070 (0.023)	0.069 (0.022)
age	0.043 (0.008)	0.005 (0.007)	0.005 (0.006)
age sq /100	-0.048 (0.010)	-0.005 (0.009)	-0.005 (0.008)
white	0.081 (0.041)	0.087 (0.035)	0.089 (0.043)
health probs	-0.051 (0.026)	-0.037 (0.023)	-0.037 (0.022)
higher ed	0.11 (0.035)	0.081 (0.030)	0.081 (0.027)
tech qual	0.078 (0.025)	0.018 (0.023)	0.018 (0.022)
sc qual	0.027 (0.030)	-0.023 (0.025)	-0.023 (0.025)
ln(res wage)		0.61 (0.05)	0.61 (0.04)
spell (yrs)			0.024 (0.050)
No. of obs	885	885	885
R-squared	0.35	0.37	0.37

Notes: Asymptotic standard errors in parentheses.

TABLE 3
Estimated Duration Models

	Exponential	Weibull	Cox
constant	6.27 (0.29)	6.32 (0.35)	
male	0.11 (0.06)	0.13 (0.07)	0.11 (0.06)
age	-0.046 (0.014)	-0.050 (0.018)	-0.039 (0.015)
age sq /100	0.062 (0.018)	0.067 (0.022)	0.053 (0.018)
white	-0.343 (0.095)	-0.371 (0.116)	-0.299 (0.095)
health probs	0.041 (0.052)	0.044 (0.063)	0.035 (0.052)
higher ed	-0.13 (0.06)	-0.13 (0.08)	-0.10 (0.06)
tech qual	-0.32 (0.05)	-0.34 (0.07)	-0.28 (0.05)
sc qual	-0.041 (0.059)	-0.053 (0.072)	-0.043 (0.059)
ln(res wage)	0.28 (0.09)	0.31 (0.10)	0.24 (0.09)
search time	-0.021 (0.004)	-0.023 (0.005)	-0.019 (0.004)
search expenditure	-0.028 (0.007)	-0.031 (0.009)	-0.025 (0.007)
wheels	-0.26 (0.05)	-0.29 (0.07)	-0.23 (0.05)
local u rate	0.017 (0.006)	0.019 (0.007)	0.015 (0.006)
sigma		1.22 (0.025)	
No. of obs	2036	2036	2036

Notes: Asymptotic standard errors in parentheses.

TABLE 4
Estimates of Basic Shirking Model

	all	all	women	men	men
µ: const	-0.61 (0.32)	-0.54 (0.23)	-0.23 (0.42)	-0.70 (0.46)	-0.79 (0.41)
µ; male	0.17 (0.06)	0.18 (0.06)			
µ: age	0.012 (0.016)		0.019 (0.024)	0.011 (0.021)	
µ: age sq/100	-0.012 (0.021)		-0.023 (0.033)	-0.010 (0.027)	
µ: white	0.24 (0.12)	0.29 (0.13)	-0.048 (0.17)	0.36 (0.16)	0.47 (0.17)
µ: health prob	-0.096 (0.060)	-0.078 (0.063)	-0.004 (0.082)	-0.15 (0.08)	-0.14 (0.09)
µ: higher ed	0.22 (0.07)	0.20 (0.07)	0.19 (0.10)	0.21 (0.10)	0.19 (0.10)
µ: tech qual	0.045 (0.059)		-0.065 (0.091)	0.077 (0.077)	
µ: sc qual	-0.076 (0.069)		0.072 (0.102)	-0.136 (0.09)	
s_w	0.49 (0.02)	0.51 (0.02)	0.44 (0.03)	0.57 (0.03)	0.55 (0.03)
s_v	0.29 (0.01)	0.29 (0.01)	0.20 (0.02)	0.34 (0.02)	0.34 (0.02)
a	0.16 (0.085)	0.18 (0.084)	-0.057 (0.058)	0.34 (0.184)	0.37 (0.18)
No. of obs	885	885	353	532	532
logl	-186.6	-188.7	-18.0	-148.5	-151.5
d	1.72 (0.64)	1.88 (0.68)	0.84 (0.18)	3.38 (3.19)	4.20 (4.05)
VUONG	1.68	1.68	2.22	0.87	0.85
HECKMAN	0.048 (0.015)	0.046 (0.015)	0.036 (0.023)	0.035 (0.019)	0.033 (0.020)

Notes: Asymptotic standard errors in parentheses.

TABLE 5
Further Estimates of Shirking Model for Men

	1	2	3	4
μ: const	-1.57 (1.15)	-2.21 (2.37)	-0.79 (0.42)	-0.74 (0.40)
μ: white	0.46 (0.17)	0.41 (0.17)	0.44 (0.17)	0.44 (0.17)
μ: health	-0.15 (0.10)	-0.13 (0.09)	-0.13 (0.09)	-0.13 (0.09)
μ: higher ed	1.51 (1.08)	0.19 (0.10)	0.18 (0.10)	0.18 (0.10)
μ: spell			0.40 (0.72)	0.04
μ: urate		-0.66 (0.98)		
s_w	0.55 (0.03)	0.55 (0.03)	0.54 (0.03)	0.54 (0.03)
s_v	0.34 (0.02)	0.34 (0.02)	0.33 (0.02)	0.33 (0.02
a: const	0.77 (0.59)	1.35 (1.26)	0.40 (0.19)	0.37 (0.17)
a: higher ed	-0.74 (0.55)			
a: spell			-0.35 (0.39)	-0.15 (0.10)
a: urate		0.44 (0.51)		
No. of obs	532	532	532	532
logl	-147.7	-150.1	-150.7	-150.8
d	22.9 (76.9)	5.15 (6.44)	3.43 (3.05)	3.69 (3.58)
VUONG	1.30	0.92	0.91	0.98
HECKMAN	0.034 (0.019)	0.034 (0.020)	0.033 (0.020)	0.033 (0.019)

Notes: Asymptotic standard errors in parentheses.

TABLE 6

The Ending of RTW Jobs

	number of jobs	% of jobs	% of ended jobs
not ended	506	57.2	
firm closure	7	0.8	2.0
laid-off	52	5.9	12.1
dismissed	14	1.6	4.1
quit	99	11.2	26.9
end of contract	172	19.4	42.9
ill health, pregnant	8	0.9	2.3
other reason	22	2.5	7.3
not stated	5	0.6	2.3

TABLE 7
Logit Model for the Probability of a Job Ending
Dependent Variable: RTW Job Ended Within the Sample Period

	1	2
constant	0.10 (0.82)	-0.55 (0.22)
male	-0.03 (0.16)	
age	-0.07 (0.04)	
age sq /100	0.086 (0.056)	
white	0.45 (0.31)	
health probs	0.44 (0.15)	0.41 (0.15)
higher ed	0.23 (0.19)	
tech qual	0.30 (0.15)	0.37 (0.15)
sc qual	0.09 (0.17)	
ln(res wage)	0.24 (0.29)	0.08 (0.26)
ln(wage)	-0.41 (0.24)	-0.37 (0.23)
in job by first interview and second interview	0.79 (0.15)	0.81 (0.15)
in job by first interview but no second interview	-0.91 (0.24)	-0.86 (0.24)
Log-Likelihood	-560.2	-563.8
No. of obs	885	885

Notes: Asymptotic standard errors in parentheses.

TABLE 8
Multinomial Logit Model for Ending of RTW Job
Default Category: RTW Job Has Not Ended in Sample Period

category	laid-off / firm closed	dis-missed	quit	contract ended	health / pregnancy	other / not stated
constant	-4.15 (1.79)	-18.64 (.)	-1.26 (1.31)	-1.13 (1.07)	-15.00 (.)	-1.61 (2.43)
male	0.43 (0.33)	0.52 (0.66)	0.031 (0.25)	-0.20 (0.20)	-0.78 (0.80)	-0.17 (0.46)
age	0.029 (0.090)	-0.30 (0.14)	-0.017 (0.073)	-0.060 (0.055)	-0.45 (0.20)	-0.021 (0.13)
age sq /100	-0.012 (0.11)	0.39 (0.17)	-0.008 (0.099)	0.090 (0.070)	0.51 (0.25)	-0.026 (0.18)
white	0.17 (0.64)	19.28 (2.59)	0.55 (0.51)	0.35 (0.40)	18.75 (3.23)	1.35 (0.44)
health probs	0.27 (0.30)	1.16 (0.59)	0.33 (0.25)	0.29 (0.20)	1.62 (0.81)	1.35 (0.44)
higher ed	-0.67 (0.43)	0.91 (0.72)	-0.07 (0.30)	0.48 (0.23)	0.79 (1.00)	0.88 (0.57)
tech qual	0.47 (0.30)	-0.68 (0.66)	0.49 (0.25)	0.30 (0.20)	-0.066 (0.85)	-0.28 (0.49)
sc qual	0.36 (0.34)	0.018 (0.72)	0.29 (0.28)	0.10 (0.23)	-1.13 (0.99)	-1.24 (0.57)
ln(res wage)	-0.27 (0.58)	0.53 (1.14)	0.34 (0.48)	0.036 (0.37)	3.04 (1.54)	1.41 (0.90)
ln(wage)	0.15 (0.47)	-0.44 (0.84)	-1.43 (0.41)	0.15 (0.30)	-2.24 (1.19)	-1.90 (0.72)
in job by first interview and second interview	1.15 (0.30)	0.46 (0.59)	0.88 (0.24)	0.67 (0.20)	0.95 (0.76)	0.36 (0.42)
in job by first interview but no second interview	-1.00 (0.63)	-1.20 (1.09)	-1.15 (0.46)	-0.62 (0.30)	-32.8 (.)	-1.91 (1.05)
Log-Likelihood	-1038.5					
No. of obs	885					

Notes: Asymptotic standard errors in parentheses. For some categories there are no values of some of the interview variables or they perfectly predict success. The failure to estimate the standard errors in these cases is denoted by a dot.

FIGURE 1

Realised and Reservation Wages

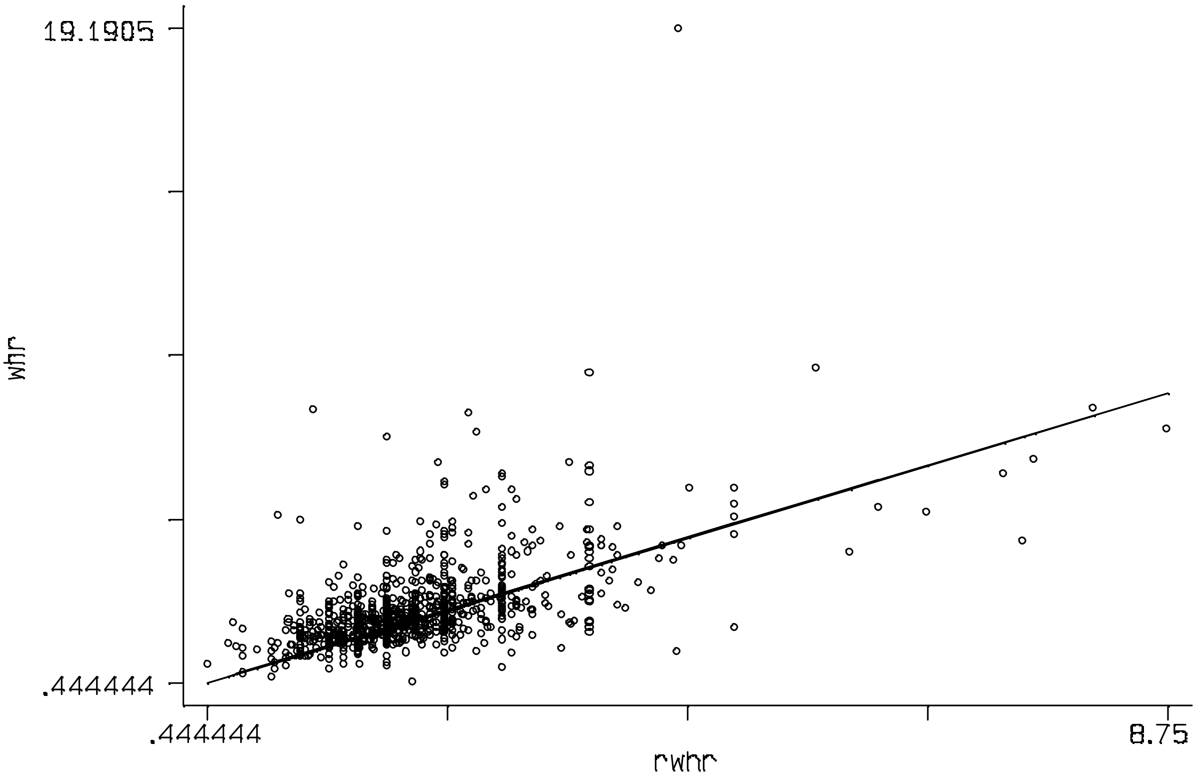
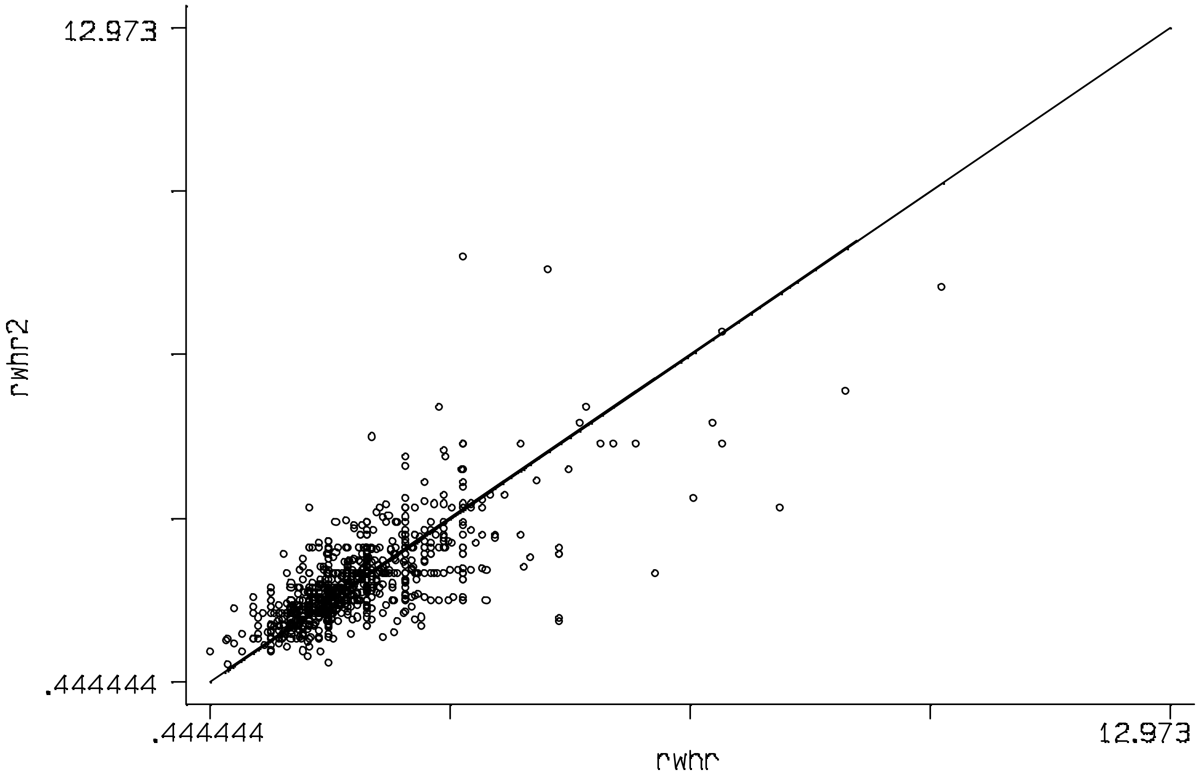


FIGURE 2

Changes in the Reservation Wage



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