

Minimum Wage Restrictions and Employee Effort in Labor Markets with Gift Exchange

Present*

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5/7/2009

Abstract

Minimum wage restrictions are studied in experimental labor markets with opportunities for gift exchange. The labor policy effects of the minimum wage are a reduction in effort in the neighborhood of the minimum wage but no systematic effects on effort levels for higher wages. The minimum wages results in a Pareto improvement in social welfare as employees have significantly higher incomes and employers experience the same or modest increases in income. Our results provide clear evidence of positive reciprocity at higher wage rates as there is systematically less effort provided in the neighborhood of the minimum wage than without it. The absence of consistent, or statistically significant, differences at higher wages suggests that the minimum wage requirement is less salient at these higher wages and/or that employees recognized that wages set a good deal higher than the minimum represent just as large a monetary gift as without it.

JEL classification: J38, J41, D01

Key words: minimum wage, effort response, gift exchange, experiment

* Research has been partially supported by grants from the National Science Foundation and the Jones College of Business at Middle Tennessee State University. We thank Hal Arkes, Patricia Reagan, Steven Cosslett, Howard Marvel, Bruce Weinberg, David Blau, Nels Christiansen, and seminar participants at the Ohio State University for helpful suggestions. We also thank Susan Rose, John Lightle and Adam Hogan for their help in conducting experiments. Any opinions, findings, and conclusions or recommendations in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

1 Introduction

Numerous experimental studies of gift exchange in experimental labor markets have supported Akerlof's (1982) hypothesis that employees consistently provide higher effort levels in response to higher wages independent of any repeated play considerations based on individual reputations.¹ The existence of a successful laboratory gift exchange paradigm makes possible controlled investigation of a number of interesting issues in labor economics; e.g., the possible benefits of incomplete versus complete contingent contracts (e.g., Brown, Falk and Fehr, 2004) and the reasons for sticky downward wages (Hannan, 2005). The present experiment focuses on the effects of minimum wage requirements on effort levels in labor markets with gift exchange present.

There are two motivations for the present study. First, few studies have investigated the effect of labor market policies on gift exchange, in particular the effect of a minimum wage requirement on worker effort. Introduction of a minimum wage into such a market might be expected to reduce worker effort as a result of employees discounting the gift component of the wage payment by the minimum wage requirement.² It is extremely difficult to measure effort in field settings, much less the effects of increases in the minimum wage on worker effort.³ The present paper does this, reporting results from a series of laboratory markets both with and without minimum wages.

The second motivation for the present study is to better understand the mechanism underlying greater worker effort in response to higher wages in gift exchange experiments. Charness (2004) looks at this issue, comparing the effects of exogenously

¹ The identification of gift exchange effects is not limited to experimental labor markets. For example, Campbell and Kamlani (1997) and Bewley (1998) find support for the presence of gift exchange in labor markets from employer surveys and Al-Ubaydli et al. (2008) and Kube et al. (2008) from field experiments.

² In the Akerlof (1982) model firms voluntarily offer a "gift" to workers in the form of a wage that is above the zero unemployment market clearing wage. In return workers voluntarily provide a "gift" to the firm by working in excess of the minimum standard.

³ Incentive effects of minimum wages are, of course, irrelevant within standard economic theory. The standard economic argument against the minimum wage is that in a perfectly competitive labor market imposing a minimum wage that exceeds the market determined equilibrium wage will lead to increased unemployment. Empirical studies regarding the employment effect of increases in the minimum wage have been subject to some controversy recently. Katz and Krueger (1992) and Card and Krueger (1994), do not find that unemployment increases with minimum wage increases. In contrast, Neumark, Schweitzer, and Wascher (2004) find that work hours are reduced.

determined wages versus an employer determined wages in order to tease apart reciprocity considerations from other forms of social preferences, in particular dislike of unequal payoffs. He finds that effort levels are significantly higher at lower wage rates when these are determined exogenously (either randomly or by the experimenter) as opposed to employer determined, but that at higher wages there are no significant differences between the two treatments. He attributes the lower effort with employer determined wage rates (employees provide close to minimum possible effort) to negative reciprocity. However, given the similarity of effort at higher wage rates between random and employer determined wages, and the payoff functions employed, it is not possible to distinguish between reciprocity guided gift exchange or other regarding preferences based on dislike for unequal payoffs at these higher wages.

We compare the effects of a minimum wage on effort supplied under three different conditions: introducing a minimum wage starting from an economy that has no minimum, starting from an economy that has a minimum wage and then drops it, and comparing between economies with and without a minimum wage. In all three cases there is a modest adverse effect of the minimum wage on effort supplied in the neighborhood of the minimum, with this difference statistically significant in sessions where a minimum wage requirement is introduced mid-way through the session. However, in none of the three cases are there any systematic and/or statistically significant differences in effort levels at higher wages with and without the minimum wage requirement.

Further, in all three cases the presence of a minimum wage yields a Pareto improving outcome in that employees have higher incomes and employers have the same, or slightly higher, earnings. And it is those employers who offered the lowest wages whose incomes experience the greatest increases with the minimum wage requirement. The latter indicates the fact that for, one reason or another, these employers failed to maximize income earning opportunities absent the minimum wage.

With respect to better understanding the mechanism underlying greater worker effort in response to higher wages in gift exchange experiments, our results provide clear evidence for positive reciprocity at higher wage rates. This follows from the fact that there was systematically less effort provided in the neighborhood of the minimum wage,

with the minimum than without it, since the same other regarding income considerations are at work in both cases. The fact that there are no consistent, or statistically significant, differences at higher wages suggests that the minimum wage requirement was less salient at these higher wages and/or that employees recognized that wages set a good deal higher than a minimum wage requirement represent just as large a monetary gift as without the requirement.

Our results regarding minimum wage effects on effort levels are quite different from the two existing studies reported in the literature. The experiment that is closest to ours, Brandts and Charness (2004), looks at minimum wage effects as part of a larger experimental investigation of labor supply issues. They report two findings contrary to ours: (i) wages were dramatically lower in their minimum wage sessions (we find that wages increase) and (ii) the minimum wage substantially reduced overall effort levels. Statistical support for this second result is based on an ordered probit that includes a minimum wage dummy but no wage variable or interaction term between wages and the minimum wage dummy. As such their conclusions regarding reduced effort levels with a minimum wage cannot be distinguished from the response to the dramatically lower wages offered in the minimum wage treatment. Falk, Fehr, and Zehnder (2006) look at the effects of a minimum wage in an economy where workers provide either zero effort by refusing to accept a wage offer, or automatically provide maximum effort when accepting a wage offer. Their minimum wage requirement is set higher than nearly all the pre-minimum wage rates offered, so that between the very high wage requirement and the differences in experimental design it is difficult to compare their results to ours. As such what comparisons there can be made are best done after reporting our results.

The paper is organized as follows. Section 2 outlines some theoretical considerations regarding the effects of a minimum wage on effort levels. Section 3 describes the design and procedures. Experimental results are reported in Section 4. Section 5 summarizes our results and compares them with the two earlier studies cited above.

2 Theoretical Considerations

Implementing a minimum wage within the gift exchange paradigm can help to clarify the true nature of gift exchange in labor markets. The positive relationship

between wages and effort levels reported in the typical gift exchange experiment is (potentially) related to two distinct factors: (i) true gift exchange in the sense of Akerlof (1982) and (ii) outcome based income inequality (e.g., Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). The latter relates to the fact that some proportion of the population has been shown to be willing to sacrifice own income in the presence of strong income inequality. These two factors are likely to work in opposition to each other following the introduction, or an increase, in the minimum wage.

At one extreme, if reciprocity considerations are the only factor underlying higher effort levels in response to higher wages, employees might completely recalibrate their effort levels so that they provide the same effort level as prior to the minimum wage at “comparable” wages. By recalibrating at “comparable” wages we mean the following: Let w_L represent the lowest possible wage that can be offered and in response to which employees provide the minimum possible effort level, e_L . Using this as a baseline, following the introduction of a mandatory minimum wage, $w_\mu > w_L$, one might expect effort level at the minimum wage, e_μ , to be equal to e_L as employees recalibrate their effort levels to account for the mandatory nature of w_μ . Further, employees continue to fully compensate for the mandatory nature of w_μ so that at wages $w^* > w_\mu$ they respond with the same effort level as they would under the voluntary wage equal to $(w^* - w_\mu)$. However, there are a number of factors working against these outcomes.

First, at a minimum wage $w_\mu > w_L$, under the typical payoff values employed in gift exchange studies, absent a positive response by employees to w_μ there is income inequality in favor of the employee that is strongly increasing in w_μ . As such to the extent that some portion of the population is responsive to such outcome based income inequality, effort levels would be expected to exceed the minimum requirement. Further, since the minimum wage is imposed exogenously by a third party, and it is costly to employers regardless of where it came from, a wage rate equal to the minimum will not necessarily be viewed as expressing zero, or negative reciprocity as the wage rate w_L would, as there is clear evidence from past experiments for treating exogenous actions differently than voluntary actions (Charness, 2004, Blount (1995)). In short, to the extent that outcome based income inequality drives some employees choices, one would not

expect that effort levels would be recalibrated according to the extreme scenario describe in the previous paragraph either at w_μ or at wages $w^* > w_\mu$.

A dislike for unequal payoffs is not the only possible factor working against full recalibration of effort levels at comparable wages following introduction of a minimum wage. For example, to the extent that the norm outside the lab (for whatever reason) is for employees to respond to higher wages with greater effort, one might expect to see that norm at work in the lab as well.⁴ In addition, to the extent that employers offer wages substantially higher than the minimum wage requirement, one might expect that employees not to go through the process of systematically subtracting out the minimum wage requirement and recalibrating their effort levels. Further, to the extent that employees are sensitive to the fact that in terms of cost to employers, any wage $w^* > w_\mu$ represents just as much of a gift with w_μ as without it, complete recalibration is implausible, particularly as one moves further away from the minimum wage itself where the mandatory nature of the minimum would be less salient.

All of these other factors (and others the reader might think of) would have the effect of muting any lower effort levels in response to a minimum wage requirement. Sorting out between these other factors and outcome based income preferences is, to say the least, extremely difficult and will not be attempted here. And we will simply refer to any offsetting factors to complete recalibration as resulting from dislike of unequal payoffs.

3 Experimental Design and Procedures

Subjects were divided into two groups with an equal number of subjects in each group. One group was randomly chosen to be “managers” with the other group serving as “employees” for the entire session.⁵ Each session lasted for 10 market periods in which each manager was paired anonymously with exactly one employee in a period. The pairings were reassigned randomly before each market period. Details regarding the random assignment of pairings were explained before the start of each session and were repeated before each of the first several market periods within each session and subjects were periodically reminded of the random nature of the matching process throughout a

⁴ This might result from a conditioned response to Akerlof type gift exchange considerations outside the lab or other efficiency wage considerations at play outside the lab.

⁵ The terms “manager,” “employer,” and “firm,” and “employee” and “worker” are used interchangeably.

session. In the sessions with fewer than ten pairs, each employee was matched with each manager no more than twice and never re-matched in two consecutive periods.⁶ These procedures create a series of one-shot games so that the only motivation for offering efficiency wages is the potential gain from higher effort.⁷ Each participant was given a written copy of the instructions, which were read aloud to all participants.⁸

In each period managers were asked to choose a wage for an employee. Each employee was then given the individual wage that was offered to him/her. Wage offers were written directly on employee record sheets so that only the manager and employee involved in the contract knew the wage offer. One advantage of this procedure is that by not posting wages, any session level effects will be minimized.⁹ After receiving the wage, each employee was asked to choose an effort level, which was transmitted back to the manager in question.¹⁰ Thus, both wage offers and effort levels were private information for the manager and worker in each pairing.

The firm's payoff function and employee's effort-cost relationship were provided to both managers and employees so that this information was common knowledge. Participants were provided with calculators and were required to correctly compute the payoffs for both managers and employees in several examples prior to the start of the experiment.

The payoff functions for managers (Π_M) and employees (Π_E) were

$$\Pi_M = 100 - w + 5e$$

$$\Pi_E = 100 - e + 5w$$

with both wages and effort being chosen from the interval $[0,100]$.¹¹ The Nash equilibrium in the absence of any gift exchange motives has employees providing the

⁶ There were twelve sessions, four of which has lower than expected show up rates than the 20 subjects desired: one had 18 subjects, two had 16, and one had 14.

⁷ Models of efficiency wages as a means to prevent shirking, or to establish a reputation, are not applicable here.

⁸ A copy of the instructions can be found at http://www.econ.ohio-state.edu/kagel/Owens_Kagel_minWage_Insts.pdf

⁹ There are, in fact, a variety of procedures for matching firms with workers reported in past gift exchange experiments, of which this is one. There have been no systematic studies of the effects of these different procedures that we are aware of.

¹⁰ The term "effort" is used throughout this paper but in the experiment "Amount of Work" was used in its place.

¹¹ These payoff functions were inspired by the Brandts and Charness (2004) study, as they represent a rescaled version of their payoffs. We had begun our study of minimum wage effects using quite different

minimum allowable effort and managers, anticipating this, offering the lowest possible wage. The fact that the profit functions are linear and symmetric in this design means that the marginal cost of an increase in wages is equal to that of an increase in benefits and holds the costs constant throughout, and that the marginal return to firms of an increase in effort is equal to that of workers for an increase in wages, and constant throughout.¹²

Twelve sessions were conducted each having 10 market periods. Six of the sessions started with no minimum wage, which was introduced in market period six, and remained in effect until the session ended. We refer to these as NOtoMW sessions. They provide the basis for our within group comparisons of minimum wage effects. The other six sessions began with a minimum wage for periods 1-5 which was then removed for periods 6-10. These are referred to as MWtoNO sessions. Comparing outcomes in periods 1-5 between the NOtoMW with the MWtoNO sessions provides the basis for our between group comparisons. Comparing behavior between periods 1-5 and 6-10 within the MWtoNO sessions allow us to look at the impact of eliminating a minimum wage in an ongoing labor market.

The minimum wage was set at 40 in all sessions. It was determined endogenously in the first experimental session so that the minimum wage would have impacted 25-30% of all wage offers in periods 1-5, thereby creating a significant minimum wage effect while still providing ample scope to examine the impact of the minimum wage on higher wage earners.¹³ Subjects were told the number of market periods in advance but were not informed of any of the planned changes in treatments or how long a given treatment would last.

Sessions were conducted at two locations: Ohio State University and Middle Tennessee State University, with three NOtoMW and three MWtoNO sessions in each

payoffs prior to becoming aware of the Brandts and Charness paper. Results from far fewer sessions with these different payoffs can be found in our working paper (Owens and Kagel, 2007). Results reported here involve substantially more sessions than in our working paper.

¹² A popular specification of manager profits in past experiments is $\Pi_M = (100 - w) \times e$ with effort from the interval 0.1 to 1 (in increments of 0.1) and wages from 0-100. In this case the marginal benefit for any given effort level depends on the wage offered, so that managers receive smaller marginal benefits under a minimum wage requirement unless effort increases more than proportionately to the wage increase. This would tend to inhibit managers from raising wages above the minimum requirement.

¹³ After collecting all of the data 82 out of the 290 (28.3%) wages offered in the first five no minimum wage periods were less than or equal to 40.

location. Tests for session level effects between the two locations showed no significant effects so the data are pooled across locations.

Subjects were paid privately and individually at the end of each session at a rate of 250 experimental dollars to 1 US dollar along with a \$6 participation fee. Average earnings were approximately \$22.00 for employees and \$15.00 for managers. Sessions lasted about one hour and fifteen minutes.

4 Experimental Results

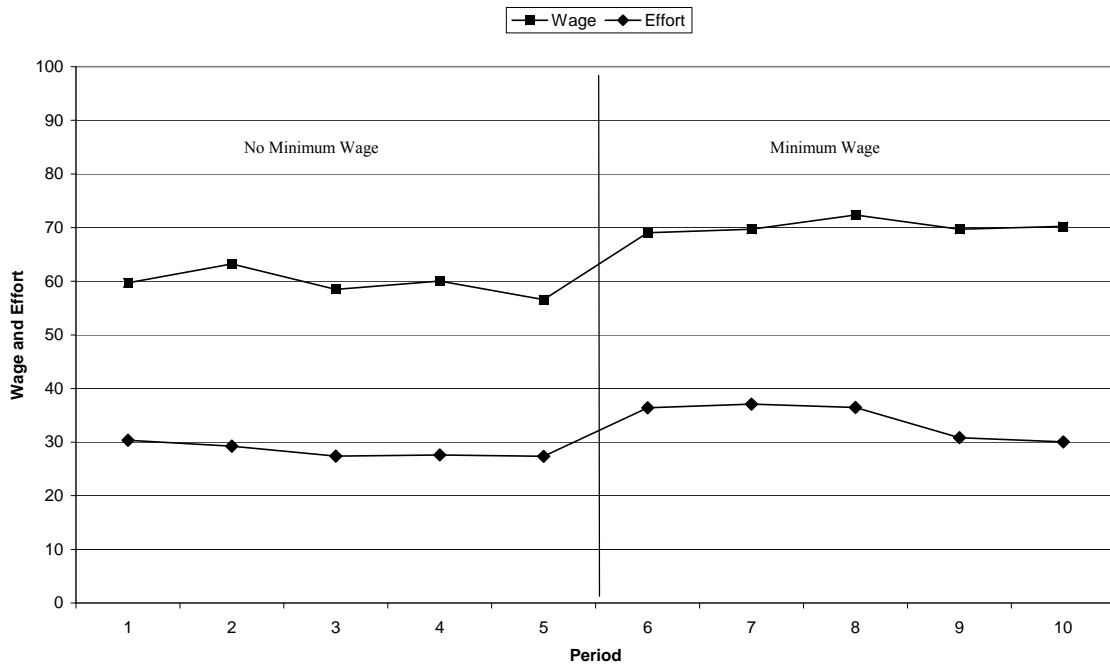
Results are presented in three parts. First, we report the effects of introducing the minimum wage within an ongoing market (NOtoMW sessions). Second, we compare the initial no minimum wage periods from NOtoMW sessions with the initial minimum wage periods of the MWtoNO sessions. Third, we examine the effects of dropping the minimum wage within in the market that began with a minimum wage (MWtoNO).

4.1. Effect of Introducing a Minimum Wage within an Ongoing Labor Market: Figure 1 shows average wages and effort over time before and with the minimum wage in the NOtoMW sessions. As in previous gift exchange experiments, wages and effort are significantly different from the minimum levels predicted by the Nash equilibrium (absent any gift exchange motives). The introduction of the minimum wage of 40 resulted in a marked increase in average wages from 59.6 before the minimum to 70.2 with the minimum, and was accompanied by an increase in the average effort level from 28.4 to 34.2.

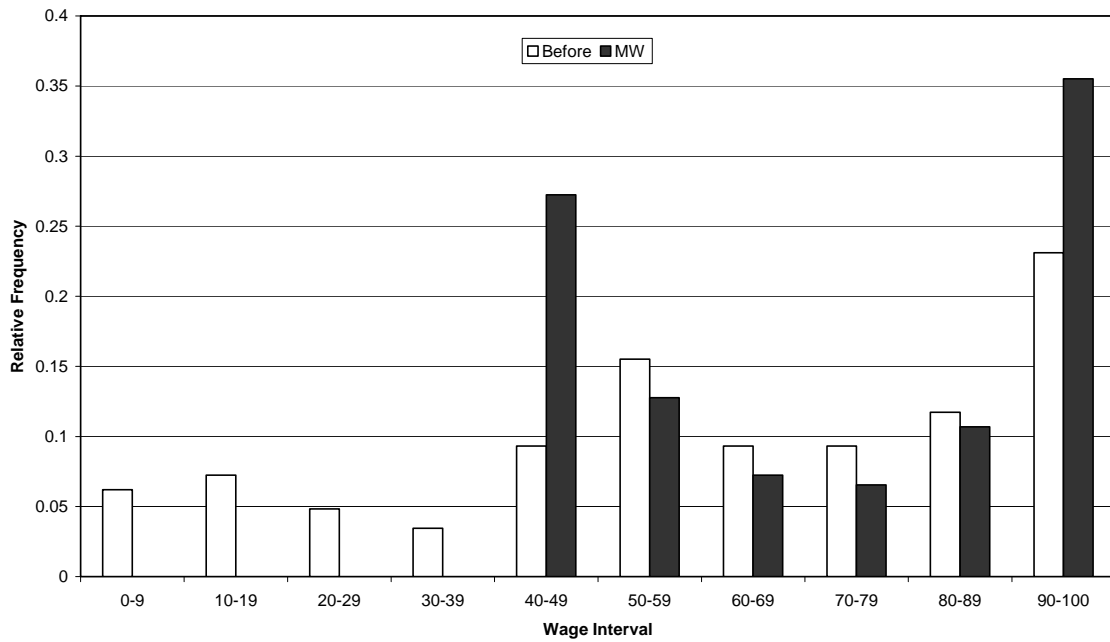
Figure 2 shows the relative frequency of wage offers before and with the minimum wage. The introduction of the minimum wage forced all employers who were paying below the minimum wage to increase their wages. However, it also influenced the

wages paid by employers who were already paying average wages of 40 or above. Of the

**Figure 1: Average Wage and Effort by Period:
(NO to MW sessions)**



**Figure 2: Histogram of Wage Offers:
(NO to MW sessions)**



47 employers who were paying above minimum wages (on average) to begin with, 36.2% (17 out of 47) increased wages, 51.1% (24 out of 47) offered the same average wages, and 12.8% (6 out of 47) reduced average wages.¹⁴ Thus, not only did the minimum wage requirement raise wages for those “covered” by it, it also raised average wages for a number of workers who were not “covered.”

Figure 3, Panel A, shows local polynomial regressions relating wages to effort before and after introducing the minimum wage in the NOtoMW sessions. These regressions essentially “smooth” the relationship between wages and effort without imposing a functional form on the relationship.¹⁵ Panel B displays the more standard bar graphs for mean effort in each wage range. The effect of the minimum wage differs depending on the wage rate: At lower wage rates effort is *lower* than it was *at these same wage rates* prior to the introduction of the minimum wage with this decrease, judging from the bar chart, concentrated at wages in the neighborhood of the minimum wage (40-49). In contrast, at higher wages effort is the same, or in some cases *greater* than it was, *at these same wages*, prior to introducing the minimum.

Of particular note is the fact that effort is significantly higher in the neighborhood of the minimum wage (40-49) than it was at the lowest wages rates (wages in the 20s or below) prior to introducing the minimum wage. This is shown more clearly in Figure 4, which compares effort levels before the minimum wage to effort levels with the minimum wage after subtracting out the minimum wage requirement of 40. Employees are providing greater effort in the neighborhood of the minimum wage than in the neighborhood of the zero wage point in the absence of the minimum wage, and the difference between effort levels increases as the wage increases.

Formal statistical tests of the effect of the minimum wage on effort levels are reported in Table 1 using random effect Tobits with a white noise error term and an employee specific random error term. The Tobits account for censoring at both the minimum effort level of 0 and the maximum effort level of 100. They employ session

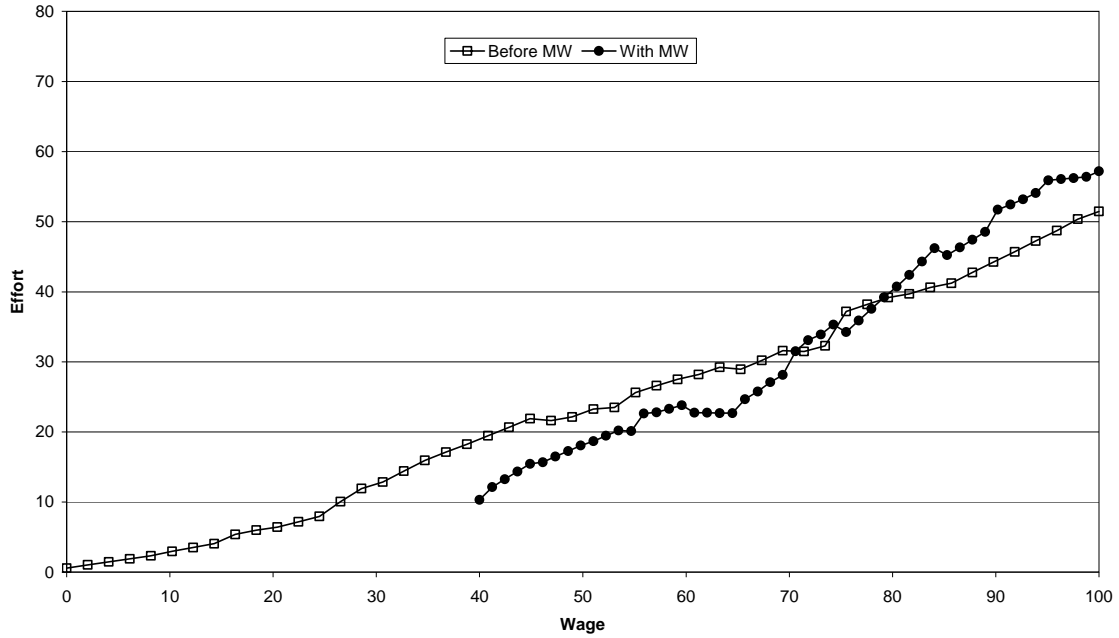
¹⁴ Average wages were calculated for each employer and placed in intervals as follows: less than 40, 40-60, 61-80, and 81-100 to get these percentages.

¹⁵ They smooth the data by essentially taking local weighted averages of both the independent and dependent variables when estimating the regression function. The regression estimates reported here and elsewhere are conducted using a polynomial of degree 1, the rectangle kernel and a band width of 15. Other polynomials, kernels and band widths were tried and produce qualitatively similar results with differing levels of smoothing.

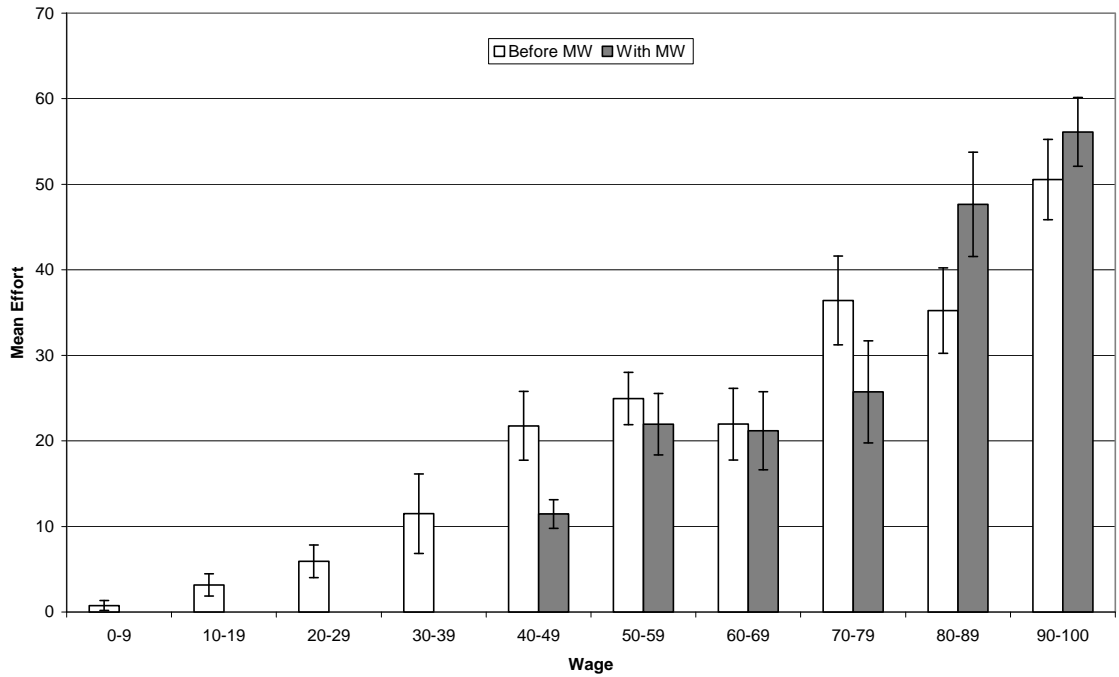
level fixed effects to account for potential interdependence of employees responses

**Figure 3: Comparison with and without a Minimum Wage within a Session
(NO to MW Sessions)**

Panel A: Local Polynomial Regression of Effort as a Function of Wages

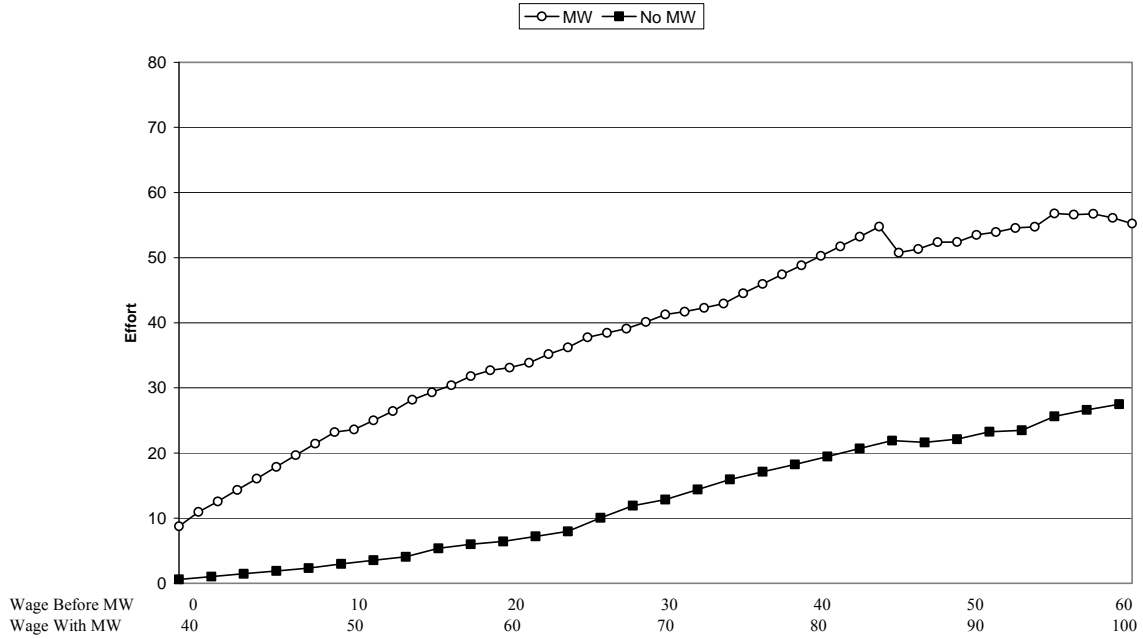


Panel B: Mean Effort for Given Wages

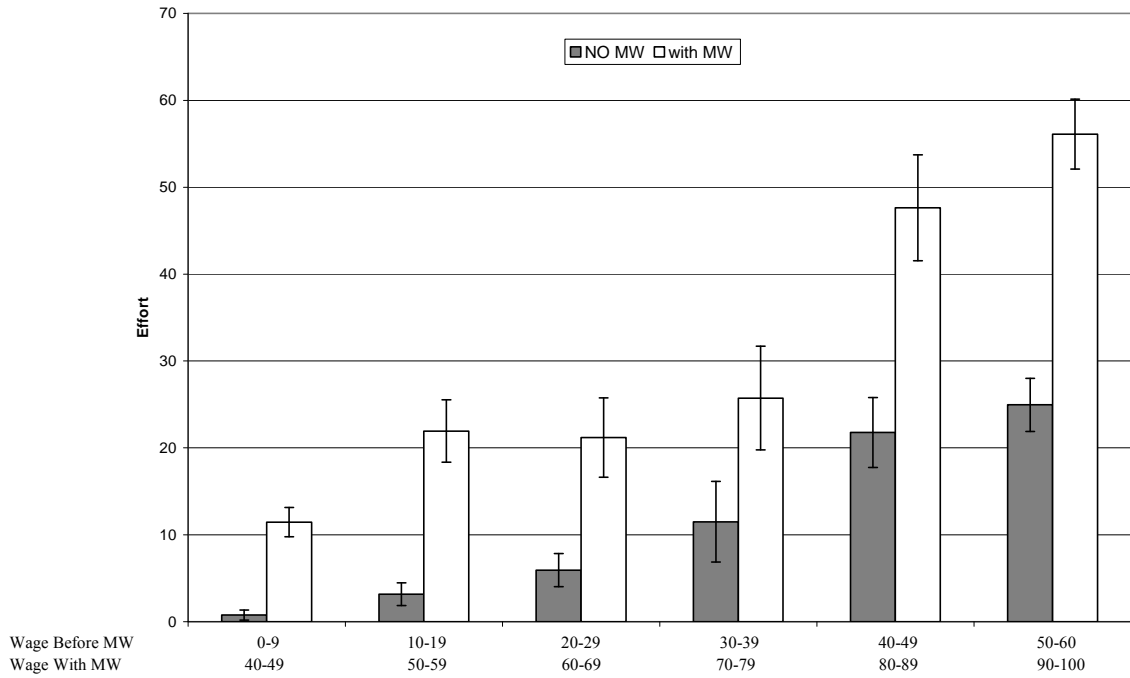


Note: Bars represent mean effort for the wage range and the error bands are the standard error of the mean.

Figure 4: Comparison After Setting the Zero Wage Reference Point at the Minimum Wage
Panel A: Local Polynomial Regressions of Effort as a Function of Wages



Panel B: Mean Effort by Wage Range



Note: Bars represent mean effort for the wage range and the error bands are the standard error of the mean.

Table 1: Random Effects Tobits for the Effects on Effort of the Minimum Wage within an Ongoing Labor Market: (NO to MW sessions)

| Dependent Variable is Effort ^a | (1) | (2) | (3) | Wage | Marginal Effect of Minimum Wage | Effort Difference at “Comparable” wage (MW – NO) |
|---|--------------------|--------------------|----------------------------|------|---------------------------------|--|
| Constant | -28.5*** (4.87) | -27.8*** (4.90) | -24.9*** (5.29) | 40 | -5.81* (2.97) | 26.26*** (4.21) |
| Wage | 0.84*** (0.04) | 0.85*** (0.04) | 0.80*** (0.05) | 60 | -3.46* (2.08) | 28.61*** (2.99) |
| MW | - | -2.63 (2.00) | -10.51* (5.80) | 80 | -1.11 (2.26) | 30.96*** (2.34) |
| Wage*MW | - | - | 0.12 (0.09) | 100 | 1.24 (3.34) | 33.31*** (2.69) |
| Log Likelihood | -2093.9 | -2093.0 | -2092.0 | | | |
| Joint test of MW and Wage*MW | - | - | $\chi^2(2)=3.82$ p=0.15 | | | |

MW = 1 if minimum wage is in effect; 0 otherwise. ^a Number of observations is 576 in all cases.

Session level dummy variables are suppressed as they are not statistically significant.

*Significantly different from 0 at the 10% level, two tailed test.

**Significantly different from 0 at the 5% level, two-tailed test.

***Significantly different from 0 at the 1% level, two-tailed test.

Standard errors are in parentheses.

within a session.¹⁶ Several specifications are reported. The session level fixed effects showed no significant effects at anything approaching conventional levels in any of the regressions, so they are suppressed.¹⁷

The most relevant specification is the last one with both a dummy variable for the minimum wage (MW = 1 with a minimum wage, 0 otherwise) and an interaction effect

¹⁶ These session specific fixed effects are used rather than clustering at the session level due to limitations of existing software. It is not possible to cluster at the session level and still correct for censoring of effort levels and subject random effects within Stata. Only two of these three can be done in a single regression.

¹⁷ Statistical tests using the local polynomial regressions are sensitive to the band width over which averaging is done and more importantly, cannot account for the autocorrelation in effort levels associated with repeated measures for the same worker at different wage rates. The tradeoff is that the Tobits restrict the functional form of the relationship between wages and effort. Qualitatively similar results have also been obtained using random effect ordered probits (see Owens, 2006). The Tobits are reported because they are somewhat easier to interpret with a large set of effort choices.

between wage and the minimum wage dummy (Wage*MW).¹⁸ The dummy for the minimum wage effect is negative and statistically significant at the 10% level, while the Wage*MW variable is positive but not significant at standard levels. We are unable to reject a null hypothesis that the coefficient values for the minimum wage dummy (MW) and the MW*Wage variable are jointly equal to zero ($\chi^2(2) = 3.82, p = 0.15$). However, as the next to last two columns of Table 1 show, effort is significantly lower ($p < 0.10$) at the minimum wage than at the same wage before it, and at wage 60 as well. In contrast, at wage rates 80 and 100 there are no significant differences in estimated effort levels, with mean effort levels higher at $w = 100$. The last column of Table 1 evaluates the difference in effort levels under the minimum wage versus “comparable” wages absent the minimum. In all cases effort is substantially, and significantly, higher under the minimum wage, than at comparable wages without it. As such we can definitely reject the complete recalibration of effort hypothesis offered at the beginning of section 2.

Other regarding income effects can plausibly account for this offsetting effect: Panel B in Figure 3 shows that workers respond with an average effort level of 1 for wages in the interval 0-9 prior to introducing the minimum wage. If workers responded with the same effort level with the minimum wage requirement of 40, earnings for employers would be 65 compared to 299 for employees. In contrast, at the average effort level reported for a wages in the interval 40-49 with the minimum wage requirement (11) earnings for employers averaged 115 versus 289 for employees, cutting the difference in earnings by almost a half at relatively little cost to employees.

Introduction of the minimum wage has a distinct *positive* welfare effect here as it creates a Pareto improving outcome: average employee earnings per period increase significantly from 369.2 before the minimum to 416.9 with it ($p < 0.01$) and employers’ earnings increase slightly, on average from 182.1 to 200.7 (although this difference is not statistically significant, $p > 0.10$).¹⁹ The key factor underlying this slight increase in employers’ earnings is the increase in average earnings for those employers whose

¹⁸ Eleven outlier observations with very high effort levels for the wage offered were dropped. An observation was dropped if both the effort provided was greater than 30 *and* was greater than twice the wage rate.

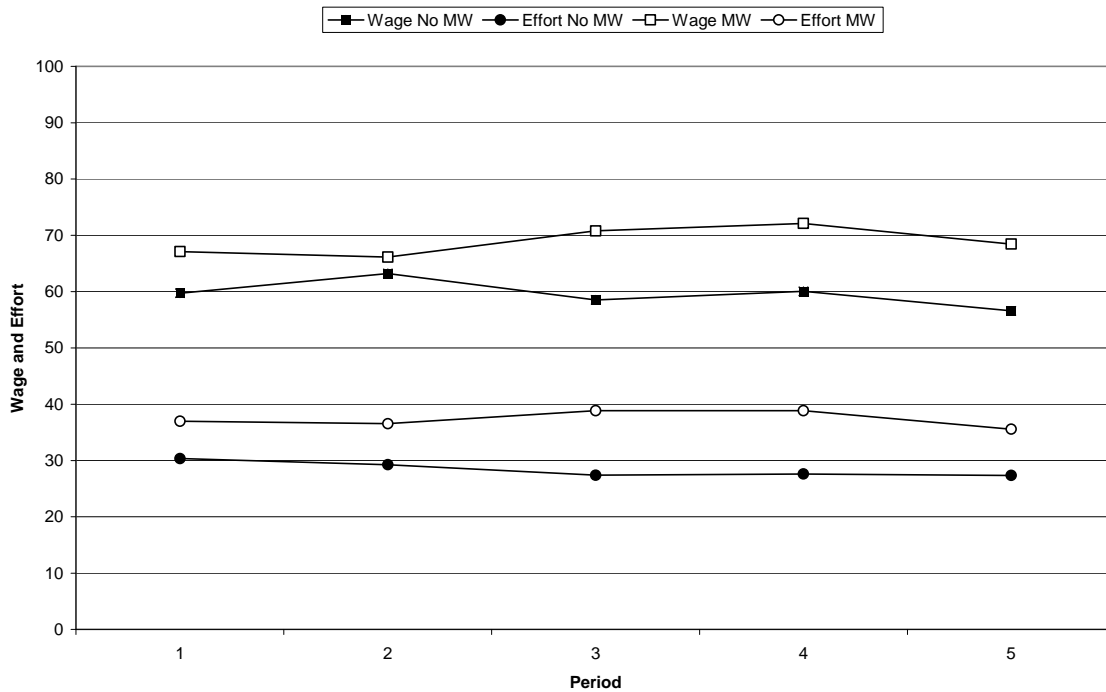
¹⁹ These calculations use individual employee and employer earnings as the unit of observation, using a two tailed t-test. Similar results hold when using session level averages as the unit of observation, but the increase in employees’ wages is now significant at $p = 0.05$ level using a two-tailed t-test.

average wages were below the minimum requirement to begin with.²⁰ Given the marginal response of employees to increased wages, and employers' profit function, these employers were clearly not maximizing earnings prior to the minimum wage mandate. Whether this was a result of risk aversion due to the variability in employee effort responses or a failure to fully explore the wage effort relationship or some other factor is, unfortunately, unknown.

4.2 Between Group Effects of a Minimum Wage: Figure 5 compares average wages and effort by period for the first five periods of NOtoMW sessions, periods without a minimum wage, with the first five periods of MWtoNO sessions that start with a minimum wage of 40. Both average wages and average effort are higher in every period for sessions that start with the minimum wage of 40.

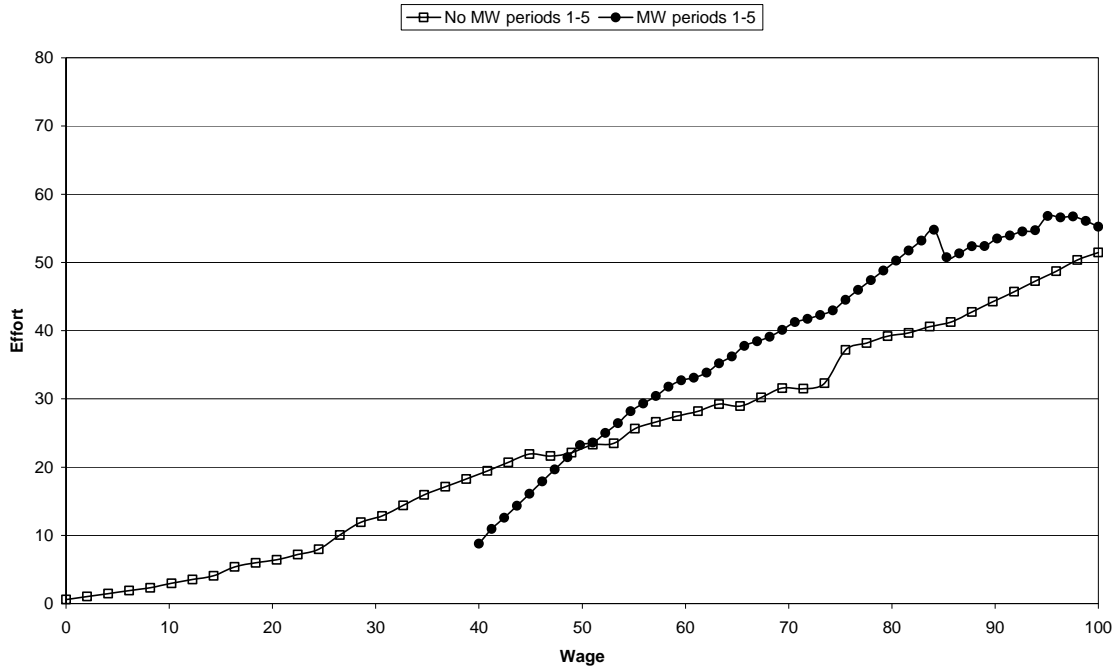
The local polynomial regressions reported in Figure 6, Panel A, show (i) lower effort at wages very near the minimum wage in sessions that start with the minimum

Figure 5: Wage and Effort with and without a Minimum Wage

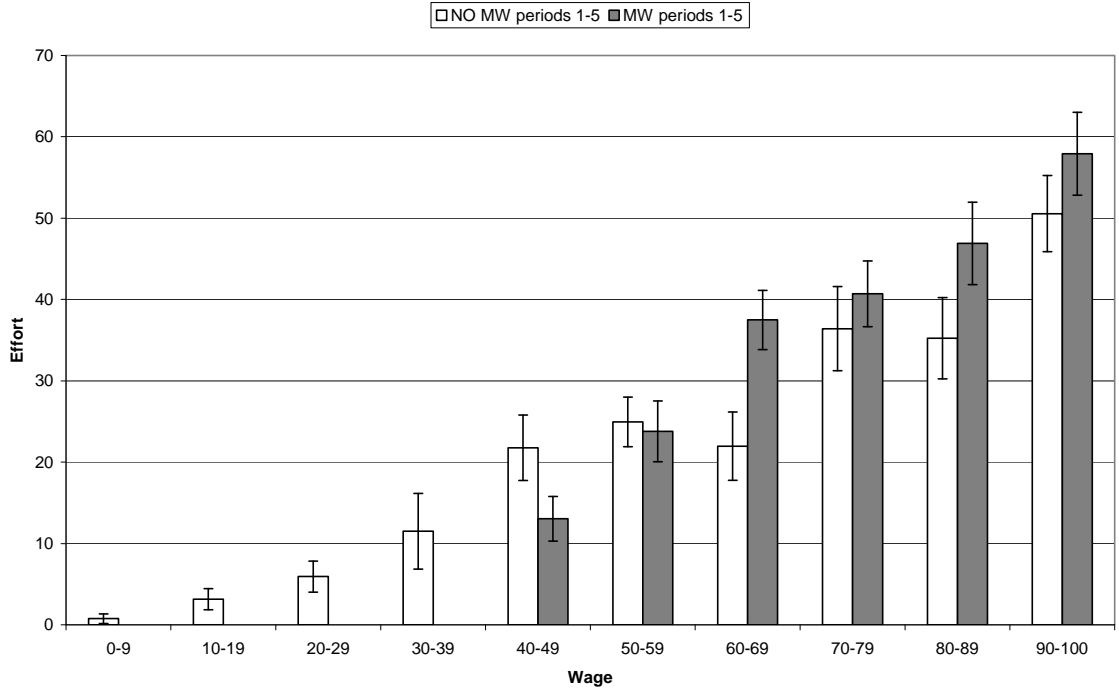


²⁰ This calculation is based on wage categories specified in footnote 15 above. There were 13 such employers, whose average earnings increased by close to 70% ($p < 0.01$). These increased earnings are largely offset by the relatively small number of employers who chose to reduce average wages following the minimum wage requirement which resulted in reducing their incomes.

Figure 6: Comparison of Periods 1-5: with versus without a minimum wage
Panel A: Local Polynomial Regression of Effort as a Function of Wages



Panel B: Effort for Given Wages



Note: Bars represent mean effort for the wage range and the error bands are the standard error of the mean.

wage of 40 and (ii) greater effort for wages that are at 50 and above. (The more standard bar graphs reporting effort levels are reported in panel B.) However, the data are exceedingly noisy so that the random effect Tobits reported in Table 2 show no significant differences in the intercept dummy for the minimum wage effect (MW) by itself in specification 2 or 3, with the MW*Wage interaction term not significant by itself in specification 3, with the two in combination not jointly significant in specification 3 ($p = 0.59$).²¹ Further, as the last column in Table 2 shows, there are no significant differences in effort levels at any of the wage rates in with the minimum wage compared to without it.

Table 2: Random Effects Tobits for the Between Group Effect of Minimum Wages on Effort (first five periods of all sessions)

| Dependent Variable is Effort ^a | (1) | (2) | (3) | Wage | Marginal Effect of Minimum Wage |
|---|--------------------|--------------------|------------------------------|------|---------------------------------|
| Constant | -18.7*** (3.84) | -20.3*** (4.55) | -18.9*** (4.83) | 40 | 1.50 (5.97) |
| Wage | 0.75*** (0.04) | 0.75*** (0.04) | 0.73*** (0.05) | 60 | 2.91 (5.48) |
| MW | - | 3.5 (5.44) | -1.3 (8.08) | 80 | 4.32 (5.53) |
| Wage*MW | - | - | 0.07 (0.09) | 100 | 5.73 (6.11) |
| Log Likelihood | -2122.1 | -2121.9 | -2121.6 | | |
| Joint test of MW and Wage*MW | - | - | $\chi^2(2)=1.06$ $p=0.59$ | | |

MW = 1 if minimum wage is in effect; 0 otherwise. ^a Number of observations is 556 in all cases.

Session level dummy variables are suppressed as they are not statistically significant.

*Significantly different from 0 at the 10% level, two-tailed test.

**Significantly different from 0 at the 5% level, two-tailed test.

***Significantly different from 0 at the 1% level, two-tailed test.

Standard errors are in parentheses.

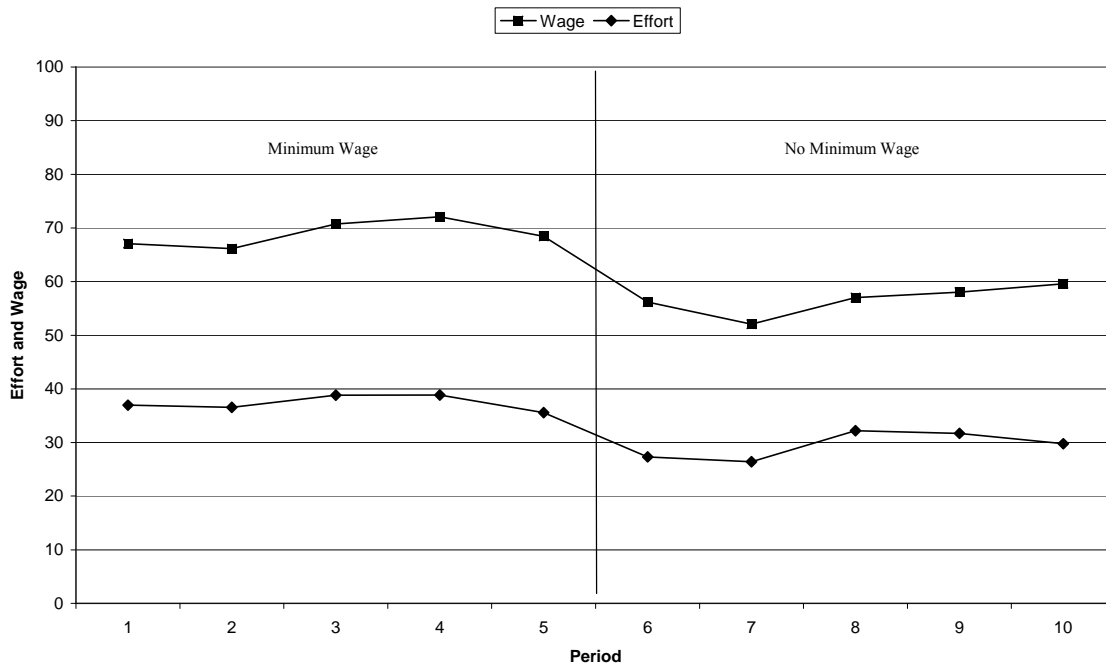
Given the absence of any between group effect of minimum wages on effort, there must be a Pareto improving outcome associated with the minimum wage in this case as

²¹ As with the regressions reported in Table 1, the Tobits included session level fixed effects which were not significant at anything approaching conventional levels and have been suppressed.

well: Employees earned an average of 407.2 per period with the minimum wage versus 369.2 without it ($p < 0.01$) and managers earned 217.9 with the minimum wage versus 182.1 without it ($p < 0.05$).²² The significant increase in manager earnings in this case can be accounted for by the fact that (i) effort levels are essentially the same at each wage rate with the minimum than without it and (ii) the minimum wage requirement serves to increase wages which, consistent with the gift exchange paradigm, increases effort levels.

4.3 Effects of Eliminating the Minimum Wage: Figure 7 shows average wages and effort by period for the sessions which start with a minimum wage of 40. There is a clear decrease in both average wages and average effort after eliminating the minimum wage. Much of the decrease can be accounted for by the 16 employers (out of 54; 29.6%) who reduced wages paid to below the old minimum wage requirement.²³

Figure 7: Mean Effort and Wage by Period After Dropping the Minimum Wage (MW to NO sessions)

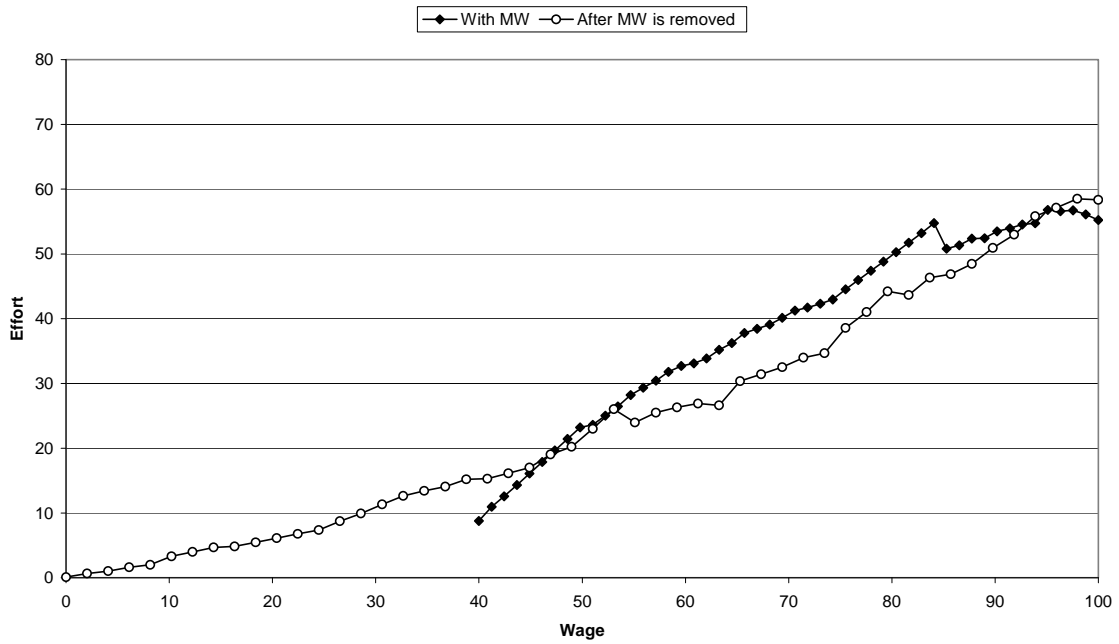


²² Using session level data as the unit of observation, the difference in employee earnings remains statistically significant at the 5% level, with managers' earnings significant at the 10% level.

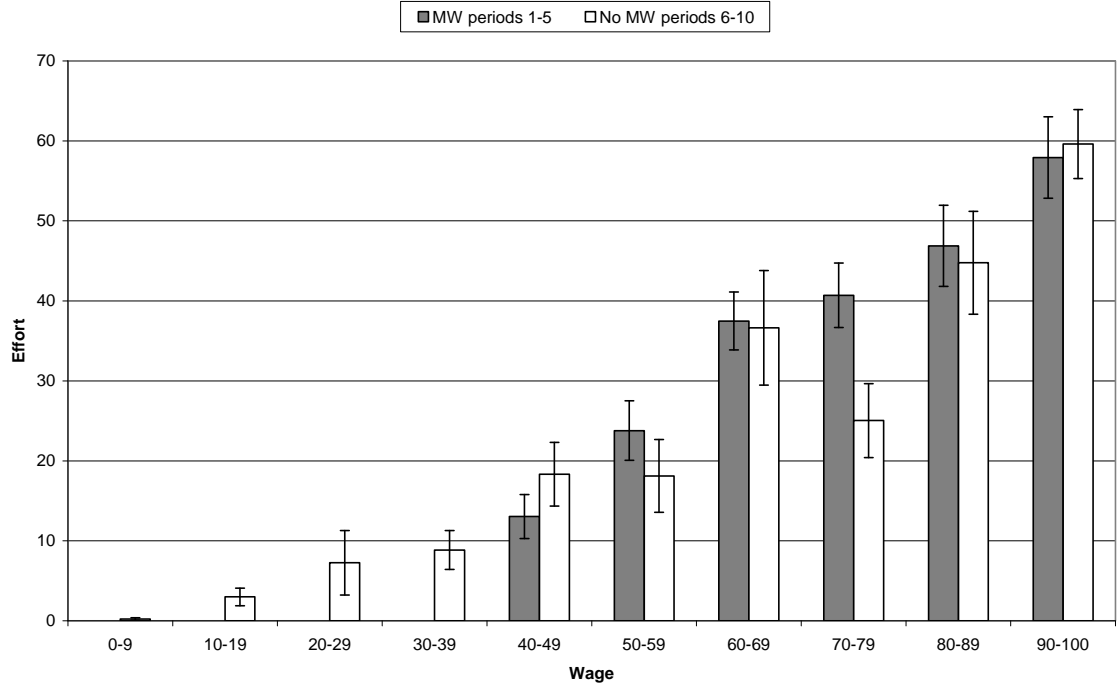
²³ The majority of these employers (10 out of 16) were offering relatively low average wages, in the interval 40-60, with the minimum wage requirement.

Figure 8: Comparison of with a Minimum Wage and after it is Removed within a Session (MW to NO Sessions)

Panel A: Local Polynomial Regressions of Effort as a Function of Wages



Panel B: Mean Effort for Given Wages



The local polynomial regressions reporting effort levels with and without the minimum wage are reported in Figure 8, top panel, along with the more standard bar graphs reporting effort. Similar to Figures 3 and 6, there is less effort in response to

wages in the neighborhood of the minimum wage (40-49), with the minimum than without it, with more mixed results after that. However, as with the between group comparison, this difference is not statistically significant at conventional levels, as the random effect Tobits reported in Table 4 show no significant effects on effort at any wage level from dropping the minimum wage requirement.²⁴

Table 4: Random Effects Tobits for the Impact of Removing the Minimum Wage on Effort (MW to NO sessions)

| Dependent Variable is Effort ^a | (1) | (2) | (3) | Wage | Marginal Effect of Minimum Wage |
|---|--------------------|--------------------|----------------------------|------|---------------------------------|
| Constant | -31.9*** (4.98) | -33.2*** (5.06) | -33.8*** (5.39) | 40 | 4.38 (3.37) |
| Wage | 0.92*** (0.05) | 0.92*** (0.05) | 0.93*** (0.05) | 60 | 3.68 (2.25) |
| MW | - | 3.4 (2.12) | 5.8 (6.69) | 80 | 2.99 (2.40) |
| Wage*MW | - | - | -0.03 (0.09) | 100 | 2.30 (3.66) |
| Log Likelihood | -1888.7 | -1887.4 | -1887.3 | | |
| Joint test of MW and Wage*MW | - | - | $\chi^2(2)=2.71$ p=0.26 | | |

MW = 1 if minimum wage is in effect; 0 otherwise. ^a Number of observations is 533 in all cases. Session level dummy variables are suppressed as they are not statistically significant.
 *Significantly different from 0 at the 10% level, two tailed test.
 **Significantly different from 0 at the 5% level, two-tailed test.
 ***Significantly different from 0 at the 1% level, two-tailed test.
 Standard errors are in parentheses.

Just as there was a Pareto improvement in outcomes from introducing a minimum wage in the NOtoMW sessions, dropping the minimum wage results in a Pareto *inferior* outcome with employees' incomes decreasing from 407.2 to 353.8 per period ($p < 0.01$) and employers' incomes decreasing from 217.8 to 189.5 ($p < 0.05$).²⁵ Managers who responded to removal of the minimum wage by reducing average wages to below the old

²⁴ As with the earlier regressions the Tobits included session level fixed effects which were not significant at anything approaching conventional levels and have been suppressed.

²⁵ Using session level averages $p < 0.05$ for the reduction in employees earnings and $p = 0.14$ for the reduction in employers earnings.

minimum had significantly lower earnings than with the minimum wage in effect, as did other managers who responded by reducing average wages (a 33% reduction in average earnings combined, $p < 0.01$). In contrast, pooling those managers who choose to increase average wages, or keep them the same, there was a modest (4%) increase in earnings ($p > 0.10$).

5 Summary and Conclusions

We study gift exchange in labor markets with and without minimum wage restrictions under three different conditions - starting from an economy that has no minimum wage, starting from one with a minimum wage, and between economies with and without a minimum wage. Qualitative results are the same in all three cases: the minimum wage has a modest adverse effect on effort in the neighborhood of the minimum wage and no systematic and/or statistically significant differences in effort levels at higher wages.

From a labor policy perspective the minimum wage has at worst a modest adverse effect concentrated in the neighborhood of the minimum wage. But taken overall, it results, somewhat surprisingly, in a Pareto improving social welfare effect as in all three cases employees' earnings increase significantly and employers' earnings increase modestly. Further, it is exactly those employers who offer low wages before the minimum wage is introduced who have the largest increase in average earnings. Correspondingly, following elimination of a minimum wage, it is those employers who reduce wages to below the old minimum that have the largest decrease in average earnings.

To get a closer look at what is actually going on at the lowest wage rates, we compared effort responses at exactly the minimum wage offer versus the pre-minimum zero wage offer. There were relatively few zero wage offers in sessions starting with no minimum wage, nine in total, all of which were met with a zero effort level. In contrast, there were fifty-eight wage offers exactly at the minimum (20% of all wage offers) in the periods following its introduction. Close to 38% of these wage offers were met with zero effort, a substantially smaller percentage than following a zero wage offer. Comparing effort with the minimum wage to pre-minimum effort in the neighborhood of the

minimum: 23% of pre-minimum offers in the interval 40-49 were met with zero effort, and average effort for those providing some effort was 28.3 for pre-minimum offers compared to 32.9% zero effort and average effort of 17.1 for those providing some effort with the minimum.²⁶ Thus, the lower effort provided in the neighborhood of the minimum results from an increased frequency of zero effort levels and lower effort levels conditional on providing some effort. And, as already noted, effort is substantially greater than at the pre-minimum zero wage level.

Regarding better understanding of the mechanism underlying gift exchange in experimental labor markets our results, combined with Charness (2004) make it clear that both positive and negative reciprocity is behind employees' effort levels. Charness (2004) experiment makes it clear that low, or zero, effort levels in response to low wages is reflective of negative reciprocity and, would probably result in some sabotage if employees had the opportunity to do so. Our experiment shows that for a moderately low, but far from zero wage, which is what our minimum was set at, positive reciprocity plays a significant role, although it is probably not the only factor at work. The question remains as to why we do not find systematic effects beyond the minimum wage? We have suggested several possible factors underlying this, clarification of which is beyond the scope of the present study.

Regarding the two other papers investigating minimum wage effects in experimental labor markets with gift exchange, our results are seemingly at odds with both studies. With respect to Brandts and Charness (2004) the key difference is that in their experiment wages were dramatically lower in their minimum wage sessions, which seems odd, and is contrary to all three of our treatments. Their conclusion that the minimum wage substantially reduced effort levels is based on this, as they find reduced effort levels in their ordered probits that include a minimum wage dummy but no wage variable or wage variable interacted with the minimum wage dummy. In contrast, in their ordered probits that include a wage variable as well as a wage variable interacted with the minimum wage dummy, neither the minimum wage dummy nor the wage by minimum

²⁶ There were 26 wage offers (9% of all wage offers) in the interval 40-49 prior to introducing the minimum wage.

wage dummy are statistically significant by themselves.²⁷ Further, in these ordered probits the signs of the minimum wage dummy and the wage by dummy interaction terms are the *same* as ours.

Falk, Fehr, and Zehnder (2006) look at the effects of a minimum wage in an economy where workers provide either zero effort by refusing to accept a wage offer, or automatically provide maximum effort when accepting a wage offer. They find that the introduction of a minimum wage into an ongoing labor market results in substantially higher reservation wages. They go on to argue that the minimum wage affects subjects' fairness perceptions, so that wages that were previously considered to be fair may no longer be perceived as such. We find results consistent with this interpretation at lower wages in that effort levels are significantly less in the neighborhood of the minimum wage in our sessions that start with no minimum wage. However, this does not hold in our experiment for higher wages where there are no significant differences, or even higher effort levels, with the minimum wage than without it. Given the very high minimum wage requirement set in Falk et al., a wage requirement that was higher than nearly all the pre-minimum wage rates offered, they do not have any observations for the effect of their minimum wage requirement on wage rates that were substantially higher than the minimum requirement to begin with.

Whether or not our findings with respect to minimum wage effects will generalize to field settings, or even other laboratory studies with other subject populations and other payoff functions, remains an open empirical question. What we can say is that our study demonstrates that the introduction of a reasonable minimum wage into an ongoing labor market has its main adverse effect on effort in the neighborhood of the minimum wage. And has an unanticipated positive effect on social welfare.

²⁷ A joint test of the two is not reported.

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