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

Mark F. Owens and John H. Kagel*
Department of Economics
Ohio State University

1/20/2006

Abstract

Minimum wage restrictions are introduced into an experimental labor market characterized by gift exchange between employers and employees. Experiment 1 shows that introducing a minimum wage into an ongoing labor market has an overall positive effect on employee effort as there is a small, statistically insignificant, negative effect on effort at low wages, and a larger, statistically significant, positive effect at higher wages. However, in comparing a labor market that starts with a minimum wage versus one that does not, the minimum wage results in sharply reduced effort. We argue that (i) these differences in results are entirely consistent with the decision theoretic research on reference point effects and (ii) the response to the minimum wage within an ongoing labor market has greater "ecological validity" for evaluating the likely impact outside the lab. Experiment 2, using payoff functions that make gift exchange more costly to both employers and employees, confirms that the effects of a minimum wage on effort within an ongoing labor market are unlikely to have a major adverse effect on employee effort.

JEL classification: J38, J41, D01
Key words: minimum wage, effort response, gift exchange, reference point effects, experiment

* Research has been partially supported by grants from the National Science Foundation. We thank Hal Arkes, Patricia Reagan, Steven Cosslett, Howard Marvel, Bruce Weinberg and seminar participants at the Ohio State University for helpful suggestions. We also thank Susan Rose for her 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

Issues surrounding the minimum wage have a long history both in economic theory and in practice. Every few years there are calls for increasing the minimum wage and there is debate about the merits and the problems associated with minimum wages. 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.[1]

In contrast there has been very little analysis of the potential incentive effects of minimum wages on workers. Incentive effects of minimum wages are, of course, irrelevant within standard economic theory. However, in markets characterized by efficiency wages, in particular efficiency wages guided by gift exchange considerations (Akerlof, 1982), the introduction of a minimum wage might reduce worker effort as a result of workers discounting the gift component of the wage payment by the amount of the minimum wage requirement.[2] If workers' effort levels are in fact reduced in response to a minimum wage, then this change in behavior is another potential source of inefficiency resulting from minimum wages. However, as we will see, it is also possible for a minimum wage requirement to increase worker effort.

It is extremely difficult to measure effort in field settings; much less the effects that increases in the minimum wage have on worker effort. However, with the successful development of a paradigm for studying gift exchange in experimental labor markets (see, for example, Fehr, Kirchsteiger, and Riedl, 1993), one can gain insight into the possible incentive effects of minimum wages through laboratory experiments.[3] The present paper does this, reporting results from a series of laboratory markets both with and without minimum wages.

To date only Brandts and Charness (2004) have looked at the relationship between minimum wages and effort in a gift exchange experiment.[4] Their experiment compares one group

[1] 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.

[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] The identification of gift exchange effects is not limited to experimental labor markets. For example, Campbell and Kamlani (1997) and Bewley (1999) find support for the presence of gift exchange in labor markets from employer surveys.

[4] Aside from Brandts and Charness (2004), no previous experimental studies of gift exchange have looked at the effect of minimum wages on employee effort (which is just one of several treatments in the Brandts and Charness experiment). Other experimental studies relating to minimum wages such as Falk, Fehr, and

of subjects facing a minimum wage to begin with versus another group that does not (a "between group" design). They find that effort is reduced significantly when a minimum wage is present.

The present paper studies the effects of introducing a minimum wage within an ongoing labor market (a "within group" design). We do so because (i) from the decision theoretic research it is clear that reference points matter, so that the reaction to a minimum wage within a given labor market is likely to be quite different than between two different labor markets and (ii) we believe that a within group design is of greater ecological validity as minimum wages, or increases in minimum wages, are commonly introduced into ongoing labor markets. That is, comparing a market that has always had a minimum wage to one that does not cannot, by definition, capture changes in employees' perceptions resulting from changes in wage offers that the introduction of a minimum wage might produce. Introducing a minimum wage into an ongoing labor market directly captures the impact of any changes in employees' perceptions on effort responses.

In the first experiment we find that the introduction of a minimum wage into an ongoing labor market has an overall positive effect on employee effort. There is a small, statistically insignificant, negative effect on effort at low wages, and a larger, statistically significant, positive effect on effort at higher wages, as well as a sharp increase in the frequency of high end wages. Further, even after eliminating the minimum wage these higher average wages and effort levels are sustained, generating a Pareto improving outcome relative to the initial no minimum wage treatment. However, using the same payoff functions and the same subject pool, comparing a labor market that starts with a minimum wage versus one that does not, shows that effort is sharply reduced with the minimum wage. In fact, by and large the minimum wage group acts as if the minimum serves as the zero wage reference point, providing strikingly similar effort levels to the no minimum group for all wage levels *after* adjusting for the minimum to be the zero wage point. We relate these different results to the decision theoretic research showing similar reference point effects.

We also report results from a second experiment, which introduces a minimum wage into an ongoing labor market employing payoff functions similar to those employed in Brandts and Charness (2004). These payoff functions serve to raise the cost of gift exchange considerably for both employers and employees relative to Experiment 1. Under these payoff functions the minimum wage produces a substantially smaller increase in average wages compared to Experiment 1. Further, the pattern of employee effort is similar to Experiment 1, only the

---

Zehnder (2005) have focused on labor supply effects and wage demands, but have not considered changes in effort levels.

reduction in effort at lower wages is larger and the increase in effort at higher wages is smaller. Nevertheless we are unable to reject a null hypothesis that in this case the minimum wage has no effect on worker effort.

This paper is organized as follows. Section 2 describes some testable hypotheses. Section 3 describes the design and results for Experiment 1. Section 4 presents the design and results for Experiment 2. Section 5 summarizes our results and adds some concluding remarks concerning the limitations of our results for behavior outside the lab. Appendix A contains our statistical results.

2 Hypotheses

Minimum wages could have a positive or negative impact on employee effort in a gift exchange paradigm for a number of reasons. The key factor potentially producing a negative effect is that behavior is sensitive to causal attributions regarding the basis for an action as shown in past experiments. For example, Blount (1995) reports that subjects playing an ultimatum game accepted significantly smaller offers when a roulette wheel randomly chose how to split the money rather than another person whose payoff depended on acceptance of the offer. In a gift exchange experiment Charness (2004) found that employees responded with lower effort to low wages when they originated from a self-interested party whose payoff depended on their choice compared to when a low wage originated from a random source. Thus, to the extent that employees view higher wages as less of a gift in the presence of a minimum wage requirement that is clearly outside the employers' control, they might be expected to provide lower effort for any given wage rate. Further, if employers fail to increase wages except as required under the minimum wage (i.e., they only increase wages for those workers that had received below minimum wages in the past), this might tend to exacerbate any potential causal attribution effects.

On the other hand, there are reasons to think that the introduction of a minimum wage might have no effect on worker effort, or possibly increase effort. If employees only care about the absolute amount of money that they are given – "money is money" - the minimum wage will have no effect on effort. Similarly, if workers recognize that any wage above the minimum represents as much of a gift on the part of the firm as before the minimum, the minimum wage should have no impact on worker effort.[5] Further, to the extent that workers tend, in general, to respond to higher wages with greater effort (which is the basis for gift exchange in the first

[5] In this respect it is worthwhile noting that in Charness (2004) higher wage offers were met with similar effort regardless of whether they originated from a self-interested party whose payoff depended on the workers' choices or from a random source.

place), and they use wages received prior to the minimum wage requirement as their reference point, increases in wages resulting from the minimum wage might well result in increased effort.[6]

3 Experiment 1

3.1 Experimental Design:[7] In each session, subjects were divided into two groups with ten subjects in each group. (The one exception is session 3, which was conducted with two groups of eight participants due to low participant turnout.) One group was randomly chosen to be "managers" and the other group was chosen to be "employees" for the entire session.[8] In all periods each manager was paired anonymously with exactly one employee. The pairings were reassigned randomly before each market period. In sessions with more than ten market periods, and in the one session with fewer than ten pairs, each employee was matched with each manager no more than twice and never re-matched in two consecutive periods.[9] 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. Each participant was given a written copy of the instructions, which were read aloud to all participants.

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. 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 compute, correctly, the payoffs for both managers and employees in several examples prior to the start of the experiment.

---

[6] Another possibility is that if the increase in the minimum wage results in increased unemployment, those still holding jobs may provide more effort in response to the increased excess supply of labor. Our experimental design severely limits the scope for such an effect.

[7] The experimental procedures employed are an extension of those developed by Ernst Fehr and his colleagues to study gift exchange in labor markets (see, for example, Fehr, Kirchsteiger, and Riedl, 1993 and 1998). The experiment was conducted with pencil and paper. Instructions are posted at http://www.econ.ohio-state.edu/kagel/MinWage_Inst.pdf.

[8] The terms "manager," "employer," and "firm," and "employee" and "worker" are used interchangeably.

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

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

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

$$\Pi_M = (100 - w) \times 0.2 + 8e$$

$$\Pi_E = w - c(e)$$

where w is the wage rate, e is the employee effort level and c(e) is taken from the following table:

Effort	1	2	3	4	5	6	7	8	9	10
c(e)	0	1	2	4	6	8	10	13	16	20

The payoff function for employees, along with the effort cost schedule, is taken directly from prior gift exchange experiments (see, for example, Fehr, Kirchsteiger and Riedl, 1998). The payoff function for managers is modified relative to previous work. One popular specification of manager profits in past experiments is $\Pi_M = (100 - w) \times e$. In this case the marginal benefit for any given effort level depends on the wage offered. Using this function, a manager receives smaller marginal benefits under a minimum wage requirement unless effort increases proportionately. This would tend to inhibit managers from raising wages above the minimum requirement. The fact that the manager's profit function is linear holds the marginal costs and benefits constant for any given effort level. The 0.2 multiplier used in the manager's payoff function, in effect, reduces the cost of raising wages. In this way we hoped to see how employees would respond at higher wages following the introduction of the minimum wage. The Nash equilibrium in the absence of any gift exchange motives has employees providing the minimum allowable effort and managers, anticipating this, offering the lowest possible wage. Managers were given 100 "offer notes" in each market period to pay wages, so that the maximum possible wage is 100.

Experiment 1 employed four sessions to look at the effects of introducing (and eliminating) minimum wages both within an ongoing labor market and between labor markets. Sessions 1 and 2 look at the effect of introducing and eliminating minimum wages within an ongoing labor market. Both sessions had fifteen market periods and used an ABA design: no minimum wage in periods 1-5, a minimum wage in periods 6-10, and no minimum wage in periods 11-15. Sessions 3 and 4 served primarily to compare the effects of a market that starts with a minimum wage to one that has no minimum as periods 1-5 began with the same minimum wage as used in sessions 1 and 2. Thus, comparing wages and effort levels between periods 1-5 in sessions 1 and 2 with sessions 3 and 4 allows us to look at the "between groups" effect of a minimum wage. Periods 6-10 in sessions 3 and 4 dropped the minimum wage giving us another look at the impact of eliminating the minimum wage in an ongoing labor market; albeit one with

a different prior history. The minimum wage was set at 40 in all sessions. It was determined endogenously in session 1 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.

Subjects were paid privately and individually at the end of each session at a rate of 25 experimental dollars to 1 US dollar along with a $5 participation fee. Average earnings for sessions 1 and 2 were approximately $42.00 for employees and $34.50 for managers, and $25.10 and $18.30, respectively, in sessions 3 and 4. Sessions 1 and 2 lasted about one hour and forty-five minutes with sessions 3 and 4 lasting about one hour and fifteen minutes.

3.2 Experimental Results: Results from Experiment 1 are presented in three parts. First, we report the effects of introducing the minimum wage within sessions 1 and 2. Second, we examine the between group effects of the minimum wage comparing the initial no minimum wage periods from sessions 1 and 2 with the initial minimum wage periods of sessions 3 and 4. Third, we briefly report the effects of dropping the minimum wage, as this treatment is secondary to our main interest.

3.2.1. 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 sessions 1 and 2. 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 resulted in a marked increase in average wages from 59.1 before the minimum to 75.7 with the minimum. Note that the minimum wage served to raise wages for workers who were not "covered" by it, and/or raised wages for those covered by more than the minimum requirement as average wages in periods 1-5 would only have increased to 64.4 if all workers with below minimum wages had instead received the minimum. This increase in average wages was accompanied by an increase in the average effort level from 4.43 to 5.94.

Figure 2 presents the results of kernel regressions relating wages to effort before and after introducing the minimum wage in sessions 1 and 2. The kernel regressions provide a pictorial representation of the impact of wages on effort before and after the minimum wage at all wage levels. Essentially they "smooth" the relationship between wages and effort without imposing a functional form on the relationship.[11]

[11] They smooth the data by essentially taking local weighted averages of both the independent and dependent variables when estimating the regression function. The kernel estimates reported here and elsewhere are conducted using the triangle kernel and a band width of 20. Other kernels and band widths are found to produce qualitatively similar results.

The kernel regressions show that in the neighborhood of the minimum wage, effort is *greater* than what it was at the lowest wage rates prior to introducing the minimum, but somewhat *below* what it was at the same wage rates without the minimum. That is, the minimum wage serves to reduce effort a bit at low wages compared to before the minimum, but effort does not fall completely to the effort levels associated with the very lowest wages prior to the minimum wage. This reduction in effort gets smaller and smaller at higher wages so that effort at around wage 55 is the same as it was prior to the minimum wage, and remains there, or is slightly higher than before the minimum, up to wage rate 80. At that point effort with the minimum wage starts to exceed what it was prior to the minimum, with this difference getting larger and larger at higher wage rates. Tobit regressions reported in the Appendix indicate that the modest negative effect of the minimum wage on effort below wage 55 is not statistically significant at conventional levels, while the larger positive effect on effort at higher wages is statistically significant.[12] In short, the introduction of the minimum wage has a modest negative effect on effort compared to before the minimum for wages near the minimum, and a stronger positive effect on effort at higher wage rates. As such it is clear that workers do not simply treat wages at or near the minimum as a zero wage gift, nor do they subtract out the minimum wage requirement in calibrating their response to higher wages. We return to what we believe drives these results momentarily.

What accounts for the increase in effort under the minimum wage relative to before, at the high end of the wage scale? First, note that there is a large increase in the frequency of high end wages with the minimum compared to before it - 40% of all wage offers prior to the minimum were at 71 or above versus 60% with the minimum, with much of this difference driven by wage offers of 91-100 (16% before versus 30% with the minimum). Further, as the regression results in Table 1 show, employees respond to wages that are higher than any past wage they have seen with greater effort, so that the increase in the high end wages that goes along with the minimum wage produces greater effort. That is, employees act as if past wages serve as a reference point against which to judge the generosity of the gift provided, responding with greater effort to the increase in wages that the minimum wage triggered. This use of past wages as a reference point against which to judge the value of the gift inherent in higher wages, as opposed to the absolute value of the wage relative to the lowest level it could be, is fully consistent with results from the decision theoretic literature (see, for example, Kahneman and Tversky, 1979;

[12] These results are provided in Table 1A. Statistical tests using the kernel regressions are sensitive to the band width over which averaging is done and 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.

Shafir, Diamond, Tversky, 1997; Helson, 1964). But this is only part of the story as there are opposing forces at work near the minimum wage. We return to this part of the story after reporting the between group effects of a minimum wage in the next section.

3.2.2 Between Group Effects of a Minimum Wage: Evaluating the effects of a minimum wage through comparing an ongoing labor market that has no minimum wage versus an otherwise identical market that has always had a minimum wage yields results that are quite different from those reported in the previous section. Figure 3 compares average wages and effort in the first five periods of sessions 1 and 2, periods without a minimum wage, with the first five periods of sessions 3 and 4 that start with a minimum wage of 40. Average wages are roughly the same between the two markets (59.1 with no minimum versus 63.1 with it), but average effort is substantially lower in the market that starts with the minimum wage of 40 (2.92 versus 4.43). The kernel regression estimates reported in Figure 4 show that evaluating the impact of the minimum wage on effort levels through this kind of between group comparison yields (i) lower effort at all wages in the market that starts with the minimum wage of 40 and (ii) these reductions in effort are quite substantial and are the same or larger at all wages rates compared to the reductions in effort found for the minimum wage reported in Figure 2 in the previous section. Further, as the random effects Tobit estimates reported in Table 2A of the Appendix show, there is significantly less effort provided under the minimum wage treatment at all but the very highest wage rates in this case, contrary to the results reported in the previous section.

Figure 5 provides an even more revealing look at the impact of the minimum wage in this case. There we compare kernel estimates of the impact of wages on effort after having transposed wages in sessions 3 and 4 by subtracting 40 (the minimum wage) from all wage offers. Under this transformation, the minimum wage in sessions 3 and 4 matches the zero wage in sessions 1 and 2. At the very lowest wage rates there are minimal differences in effort levels between sessions 1 and 2 versus 3 and 4 under the transformed wages. Although effort levels are clearly higher under the minimum wage treatment around wage 20 (transformed wage 60), these differences appear to be idiosyncratic as they are completely eliminated by wage 40 (transformed wage 80). Differences reemerge at the highest wage rates with the maximum difference reported at wage rate 60 (transformed wage 100). Thus, at all but the highest wage rates, there are no consistent differences in effort levels for comparable (adjusted) wage rates. That is, the effort levels of employees in sessions 3 and 4 are quite similar to what they were in sessions 1 and 2 for comparable wages once the zero wage (zero gift) reference point is set equal to the minimum wage in 3 and 4. As a result the random effects Tobit estimates reported in Table 3A of the

appendix find no significant differences between effort levels under the two treatments when regressing on the transformed wage rates in sessions 3 and 4.

Clearly, these results differ rather dramatically from the impact of introducing a minimum wage within an ongoing labor market as reported in the previous section. So, although the results of this section replicate, at least qualitatively, the results of the between group comparison of minimum wages on effort reported in Brandts and Charness (2004), the impact of introducing a minimum wage within an ongoing labor market yields quite different results.[13] Further, we would argue that it is the latter that has greater ecological validity for extrapolating to labor markets outside the laboratory as minimum wages are introduced, or increased, within ongoing labor markets.

The difference in results between this section and the previous section clearly illustrates the importance of accounting for reference point effects in evaluating the impact of introducing a minimum wage, and is entirely consistent with results reported from the decision theoretic literature. The notion that within broad limits humans focus less on the absolute value of a stimulus than to deviations from established norms has been well documented in the psychological literature for some time (see, for example, Helson, 1964). The work of Kahneman and Tversky (1979) established the relevance of this insight to decision theory and economics. As applied here, from a strictly rational point of view any wage greater than 40 represents just as much of a gift from the firm's point of view regardless of whether or not there is a minimum wage of 40 in place. However, for employees whose initial/only reference point is 40, a wage of say 50 or 55 does not appear to be much of a gift at all.

In contrast, in sessions 1 and 2 workers form their initial beliefs about the gift associated with a given wage based on a reference wage of zero. The response to the change in wages resulting from the introduction of the minimum wage of 40 is evaluated relative to these established norms and expectations. And relative to these norms and expectations the increase in wages following the introduction of the minimum wage represents a larger gift on the part of the firm.[14] As a result, in sessions 1 and 2 the introduction of the minimum wage generates two

[13] There are some quantitative differences between our results and those of Brandts and Charness (2004). A figure corresponding to our Figure 5 would show significantly higher effort under the minimum wage for comparable wage rates beginning at the origin in Brandts and Charness (2004); e.g., the average effort at 0 wage is 0 versus 1.03 with the minimum wage. Further, Brandts and Charness find a sharp drop in the frequency with which the highest possible wage is offered with the minimum wage than without it, whereas these frequencies are essentially the same here (16% of all wage offers in the 91-100 wage interval in sessions 1 and 2 versus 13.3% in sessions 3 and 4).

[14] Any "irrationality" of such an effect is no different than the well documented irrationality of workers responding to lower wages in a recession with less effort. In addition to documentation of such an effect (or fear of such an effect) in field settings (Campbell and Kamlani, 1997; Bewley, 1999) there is well

competing forces: The reference point for zero gift has been shifted from 0 to 40, but for many wages have increased (sometimes substantially) relative to the past. For wage offers near the minimum wage the reference point effect tends to win out as there is somewhat less effort provided. However, at higher wages the wage change effect dominates and there is an increase in effort.

These results are quite similar to those found in the study of money illusion reported in Shafir, Diamond and Tversky (1997). There, they report (for example) that a majority of respondents indicate that they would be happier with a 2% rise in salary in times of 4% inflation than a 2% cut in salary in times of no inflation.[15] Shafir et al. note that these results are entirely consistent with research in cognitive psychology showing that the reliance on a particular frame is typically guided by what is more salient, simpler, or more natural, not by strategic consideration. They go on to note that it is not unusual for people to employ multiple representations contemporaneously. In these cases the response is often a mixture of the assessments induced by the different representations, each weighted by its relative salience, much like what appears to be going on at lower wages after the minimum wage is introduced in sessions 1 and 2.

3.2.3 Effects of Eliminating the Minimum Wage: Figure 6 shows average wages and effort for the five periods *after* eliminating the minimum wage in sessions 1 and 2 (top panel) and in sessions 3 and 4 (bottom panel) compared to the previous five periods with the minimum wage. In sessions 1 and 2 there is essentially no impact on wages, and no impact on effort, after eliminating the minimum wage.[16] Both managers and employees are better off in the last five periods after the minimum wage is dropped compared to before it was introduced: Manager profits averaged 43.6 per period prior to the minimum compared to 51.5 in the five periods after the minimum was eliminated; employee profits averaged 53.1 per period prior to the minimum compared to 65.5 in the five periods after the minimum was eliminated. That is, the minimum wage treatment served to induce a lasting, Pareto improving outcome after it was dropped.

The results are different in sessions 3 and 4. Eliminating the minimum wage in that case reduced average wages. But there is no significant impact on effort holding wages constant.[17] That is, employees effectively adjusted the reference point for a zero wage gift back to a wage of zero following elimination of the minimum wage.

---

documented laboratory evidence of this effect in an experimental labor market similar to the one employed here (Hannan, in press).

[15] Shafir et al. primarily employ data from questionnaires.

[16] The latter is confirmed by the random effects Tobit reported in the first data column in Table 4A in the Appendix.

[17] See the second data column in Table 4A in the Appendix.

4 Experiment 2: Introducing a Minimum Wage When Effort is More Costly

The payoff functions for managers and employees used in Experiment 1 differ substantially from those employed in the between group study of the impact of minimum wages employed in Brandts and Charness (2004).[18] Experiment 2 is designed to use payoff functions similar to those used by Brandts and Charness (2004) to determine the robustness of the effects of introducing a minimum wage within an ongoing labor market to the payoff functions employed.

4.1 *Design of Experiment 2:* Experiment 2 employed exactly the same procedures as Experiment 1 with the exception of the profit functions for managers and employees. These were

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

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

with both wages and effort being chosen from the interval [0,100]. This is a rescaled version of the profit functions in Brandts and Charness (2004).[19] As in Experiment 1 the Nash equilibrium in the absence of gift exchange motives is for managers to offer the lowest possible wage and for employees to provide the minimum allowable effort. Holding the anticipated effort level constant, it is now more costly for firms to pay workers at all wage rates compared to the payoff functions employed in Experiment 1. In addition, both the marginal and absolute cost to workers of providing any given effort level is more costly (after rescaling) compared to Experiment 1.

Two sessions were conducted with ten periods each. The first five periods were conducted without a minimum wage; the last five with a minimum wage of 40. Participants were paid privately and individually at the rate of 250 experimental dollars to 1 US dollar, with average earnings for Experiment 2 approximately $20.00 for employees and $12.00 for managers. Sessions lasted about one hour and fifteen minutes.

4.2 Results for Experiment 2: Figure 7 displays mean wages and effort by period for Experiment 2. Average wages increased modestly following the introduction of the minimum wage as did

[18] We were not aware of the Brandts and Charness (2004) experiment until after completing sessions 1 and 2 in Experiment 1.

[19] We conducted one session with exactly the same profit functions as Brandts and Charness (2004): $\Pi_E = 10 - e + 5w$ and $\Pi_M = 10 - w + 5e$, with wages and effort chosen from the interval from [0, 10] and the minimum wage set at 5 (as they did). Mean wages were 6.82 before the minimum wage and 7.34 with the minimum wage with mean effort levels of 4.10 and 4.26 with and without the minimum, respectively. Mean wages were comparable to those reported in Brandts and Charness (mean wage of 7.45 in the relevant no minimum treatment and 7.82 in the minimum wage treatment). These high initial (no minimum) wage levels inhibited any chance for a significant wage and effort increase as a result of the minimum wage given the upper bound on wages of 10, and were substantially higher (accounting for the scale difference) than in Experiment 1. Our guess was that this resulted from the scale [0, 10] employed since, for example, a wage of 2 appears to be much smaller than a wage of 20. (As disturbing as such scale effects might be for economists, comparable scale effects have been documented in the decision theory literature; see, for example, Yamagishi, (1994a,b)). We rescaled the profit functions and the conversion rate by a factor of ten in an effort to establish comparable initial conditions to Experiment 1.

average effort. Figure 8 shows the kernel regressions relating wages and effort for Experiment 2. The pattern is similar to the one reported following the introduction of a minimum wage within an ongoing labor market in Experiment 1: Effort provided at the minimum wage is (i) well above the effort provided at the zero wage point before introducing the minimum, (ii) lower under the minimum wage than without it for low wages, and (iii) higher under the minimum than without it for high wages. The primary difference from Experiment 1 is that the reduction in effort at low wages is more pronounced here, the greater effort at higher wages is less pronounced, and the crossover point from lower to higher effort occurs later (at a higher wage) here. However, based on the random effect Tobits reported in the appendix we are unable to reject a null hypothesis that the minimum wage treatment had any significant effect on effort here.[20]

Comparing outcomes between experiments 1 and 2 before the minimum wage is put into effect, wages are quite similar averaging 55.0 in Experiment 2 versus 59.1 in Experiment 1. However effort levels are considerably lower in Experiment 2 (25.0) compared to Experiment 1 (44.3 after rescaling). No doubt one reason for these lower effort levels is that both the marginal (and absolute) cost of increased effort is greater in Experiment 2. Thus, Experiment 2 demonstrates two effects. First, the uniformly negative and statistically significant impact of minimum wages on effort reported in Brandts and Charness (2004) for a between groups design does not extend to our introducing a minimum wage into an ongoing labor market with a comparable underlying economic structure. To be sure, subject population differences or other differences in experimental design may account for this. However, given the results from Experiment 1, we strongly suspect that the primary factor underlying these differences has to do with our introducing the minimum wage into an ongoing labor market, which results in workers employing a different reference point than would be employed in a between group comparison. Second, the underlying economic structure (as represented by manager and employee profit functions) plays an important role in determining the likely effect of introducing a minimum wage, or increasing a minimum wage, on worker effort levels. We do not get the relatively large increase in effort levels at higher wages here that we got in Experiment 1, with its lower marginal and absolute cost of providing increased effort.

5 Summary and Conclusions

This paper examines the impact of minimum wages on employee effort in a labor market characterized by gift exchange between employers and employees (Akerlof, 1982). The introduction of a minimum wage in a labor market of this sort might have an adverse effect on employee effort if employees discount the size of the gift represented in the wage offer by the

[20] See Table 5A.

amount of the minimum wage requirement. If this happened, it would indicate an additional cost to minimum wage laws above and beyond their potential employment effects on low wage workers.

Our experiments yield a number of key results. First, evaluating the impact of introducing a minimum wage within an ongoing labor market, as opposed to evaluating its impact by comparing outcomes between markets with and without a minimum wage, is critical to the results reported. In comparing between labor markets in Experiment 1, workers who start out with a minimum wage act as if the minimum wage is effectively the zero wage (zero gift) reference point, responding with comparable effort levels to those reported in the no minimum wage market *after subtracting out the minimum wage requirement* at all but the highest wages. That is, in the labor market that starts with a minimum wage workers act as if the minimum wage is the zero wage (zero gift) reference point, while workers in the labor market with no minimum wage treat the zero wage as the zero gift reference point. As such the conclusion from this exercise is that minimum wages reduce effort substantially, adding to whatever inefficiencies result from reduced employment of workers. In contrast, introducing the same minimum wage into an ongoing labor market has a relatively small, statistically insignificant, negative impact on effort close to the minimum wage, but a positive, statistically significant impact on effort at higher wage rates. The mechanism behind this result is that employees respond with greater effort to wages that are higher than they have experienced in the past, and the minimum wage requirement leads to substantial increases in the frequency of high end wage offers. That is, workers act as if past wages serve as the reference point against which to evaluate the level of gift provided in spite of the fact that the primary motivation for the increased wages is the minimum wage requirement. These quite different results clearly illustrate the importance of accounting for reference point effects in evaluating a change in economic policy of this sort, and are entirely consistent with results reported in the decision theoretic literature (Helson, 1964; Kahneman and Tversky, 1979; also see Shafir, Diamond, and Tversky, 1997).

Withdrawal of the minimum wage following its introduction in Experiment 1 maintains the new higher wage and effort levels associated with the minimum wage requirement. Thus, the minimum wage resulted in a new, Pareto improving, outcome for both firms and workers even after the minimum wage was dropped. Of course, these outcomes cannot be expected to occur universally as a consequence of introducing a minimum wage requirement into an ongoing labor market as witness the results from Experiment 2. However, even in Experiment 2, with more costly requirements for providing increased effort and increased wages compared to Experiment

1, the introduction of minimum wages into an ongoing labor market had no statistically significant, averse effect on employee effort.

The different treatments employed in Experiment 1 – evaluating the effects of a minimum wage between groups as opposed to the effect of introducing it into an existing labor market – corresponds to what experimenters refer to as a between group versus a within group experimental design. Typically choosing between these two methods for evaluating outcomes has relatively benign effects on the conclusions reached. Further, typically for the general reader comparing outcomes from between versus within group designs involve the kind of esoteric issues that experimenters should hash out among themselves. However, they are important to evaluating the potential external validity of the experiment's results in this case with, we would argue, the within group results having greater "ecological" validity. Further, the underlying basis for the different outcomes in this case rests on well established principles of reference point effects from the decision theoretic literature that economists need to be more sensitive to.

There is, however, one issue regarding external validity that has yet to be addressed. New workers entering a labor market with a long standing minimum wage requirement might be expected to treat the minimum wage in the same way that our between group subjects did since it is the lowest wage they are familiar with. One can imagine, however, two countervailing forces to such an effect. First, to the extent that effort norms have been established in the workplace, they should be impacted by the introduction of, or increase, in the minimum wage in a manner similar to the results reported here, and these norms would tend to guide new worker behavior (see, Akerlof (1982), for example). Second, to the extent that minimum wages increase from time to time we might expect to have the same effect on effort as the introduction of the minimum wage into ongoing labor markets reported here. If this is true, this would provide a strong case for consistent increases in minimum wages, at least to the point of keeping up with inflation. At any rate, the longer run effect of minimum wages on effort, and the impact on new workers, is an open research question that deserves attention.

References

Akerlof, G. (1982) "Labor Contracts as Partial Gift-Exchange," *Quarterly Journal of Economics*, **97**, 543-569.

Bewley, T. (1999) "Why Wages Don't Fall During a Recession," Cambridge, MA: Harvard University Press.

Blount, S. (1995) "When Social Outcomes Aren't Fair: The Effect of Casual Attributions on Preferences," *Organizational Behavior and Human Decision Processes*, **63**, 131-44.

Brandts, J., and Charness, G. (2004) "Do Labour Market Conditions Affect Gift Exchange? Some Experimental Evidence," *The Economic Journa*l, **114**, 684-708.

Campbell, C. and Kamlani, K. (1997) "The Reasons for Wage Rigidity: Evidence from a Survey of Firms," *Quarterly Journal of Economics*, **112**, 253-261.

Card, D., and Krueger, A. (1994) "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania," *The American Economic Review*, **84**, 772-793.

Charness, G. (2004) "Attribution and Reciprocity in an Experimental Labor Market," *Journal of Labor Economics*, **22**, 665-88.

Falk, A., Fehr, E., and Zehnder, C. (2005) "The Behavioral Effects of Minimum Wages," Working Paper No. 247, Institute for Empirical Research in Economics, University of Zurich.

Fehr, E., Kirchsteiger, G., and Riedl, A. (1993) "Does Fairness Prevent Market Clearing? An Experimental Investigation," *The Quarterly Journal of Economics*, **108**, 437-459.

Fehr, E., Kirchsteiger, G., and Riedl, A. (1998) "Gift Exchange and Reciprocity in Competitive Experimental Markets," *European Economic Review,* **42**, 1-34.

Hannan, R. L.,(in press) "The Combined Effect of Wages and Firm Profit on Employee Effort," *The Accounting Review*

Helson, H. (1964) "Adaptation-Level Theory," New York: Harper and Row.

Kahneman, D, and Tversky, A. (1979) "Prospect Theory: An Analysis of Decision under Risk," *Econometrica*, **47**, 263-92.

Katz, L. F., and Krueger, A. B. (1992) "The Effect of the Minimum Wage on the Fast Food Industry," *Industrial and Labor Relations Review*, **46**, 6-21.

Neumark, D., Schweitzer, M., and Wascher, W. (2004) "Minimum Wage Effects throughout the Wage Distribution," *Journal of Human Resources*, **39**, 425-50.

Owens, M. (2006) "The Impacts of Wage and Employment Policies with Gift Exchange Present," Ohio State University Dissertation.

Shafir, E., Diamond, P., and Tversky, A. (1997) "Money Illusion," *The Quarterly Journal of Economics*, **112**, 341-374.

Yamagishi, K. (1994a) "Consistencies and Biases in Risk Perception. I. Anchoring Process and Response-Range Effect," *Perceptual and Motor Skills*, **79**, 651-656.

Yamagishi, K. (1994b) "Consistencies and Biases in Risk Perception. II. Individual Subjects' Performance," *Perceptual and Motor Skills*, **79**, 659-663.

Figure 1: Average Wage and Effort by Period: Experiment 1 (sessions 1 and 2)

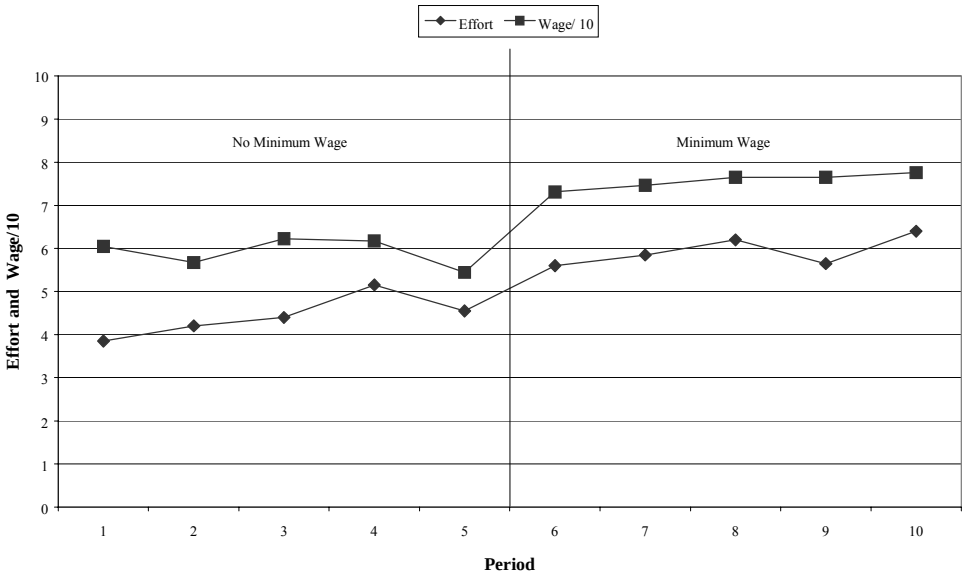


Figure 2: Kernel Regressions of Effort as a Function of Wages in Experiment 1 (Comparison with and without a Minimum Wage within Sessions 1 and 2)

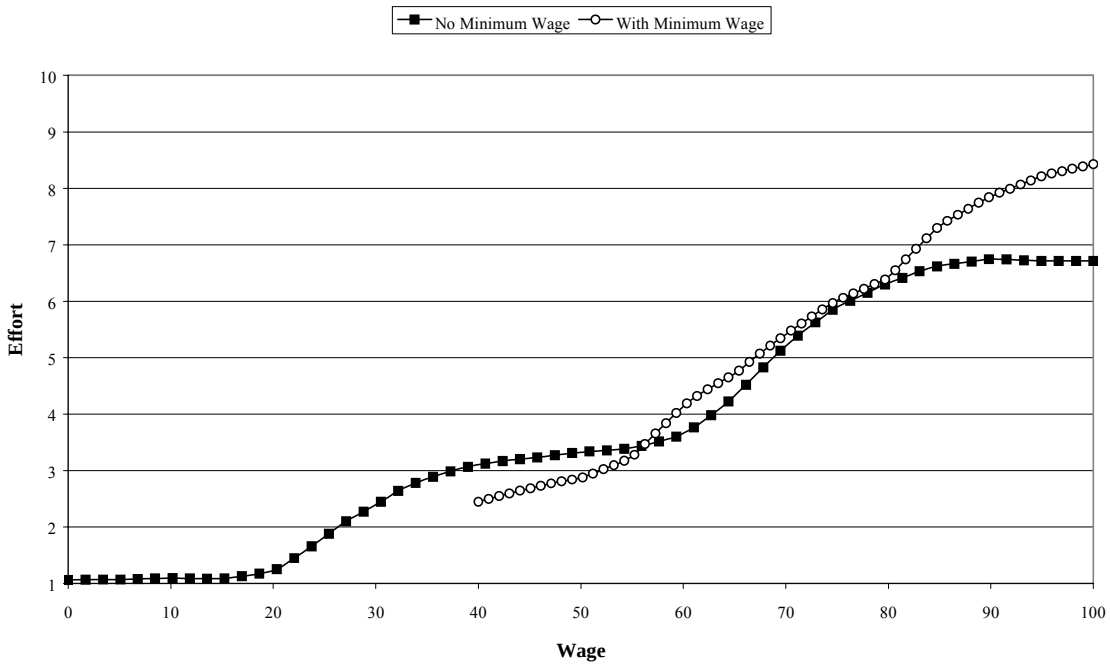


Figure 3: Average Wage and Effort in Experiment 1: Comparison of Sessions 1-2 (No Minimum Wage) with Sessions 3-4 (Minimum Wage)

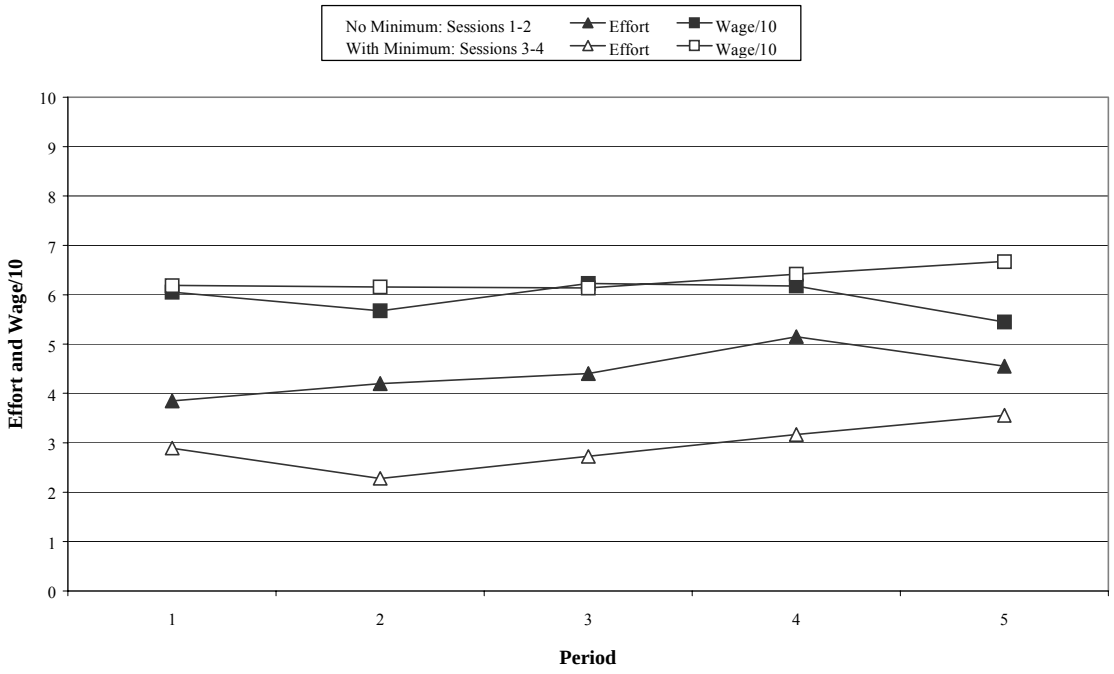


Figure 4: Kernel Regressions of Effort as a Function of Wages in Experiment 1: Comparison of Sessions 1-2 (No Minimum Wage) to Sessions 3-4 (With Minimum Wage)

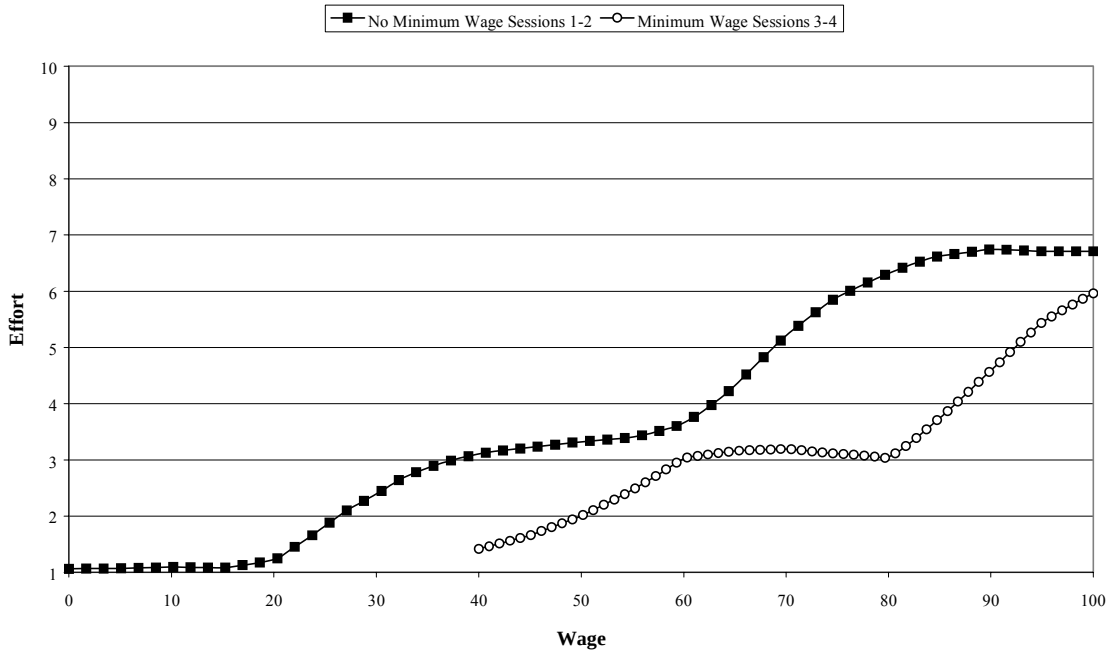


Figure 5: Kernel Regressions of Effort as a Function of Wages: After Setting the Zero Wage Reference Point in Sessions 3-4 at the Minimum Wage

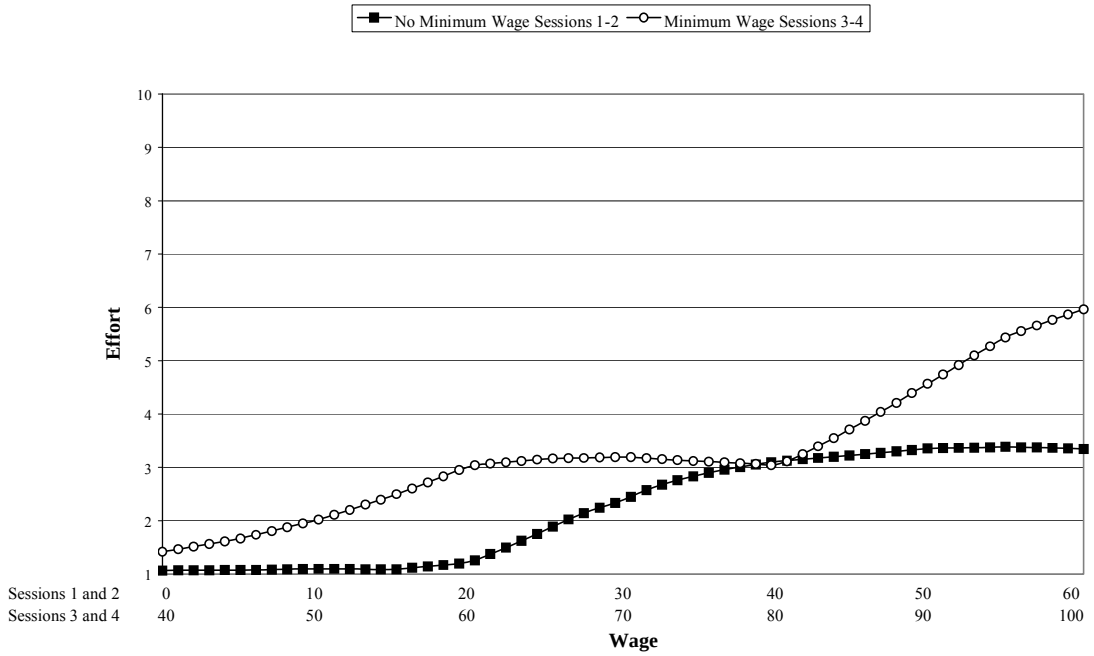
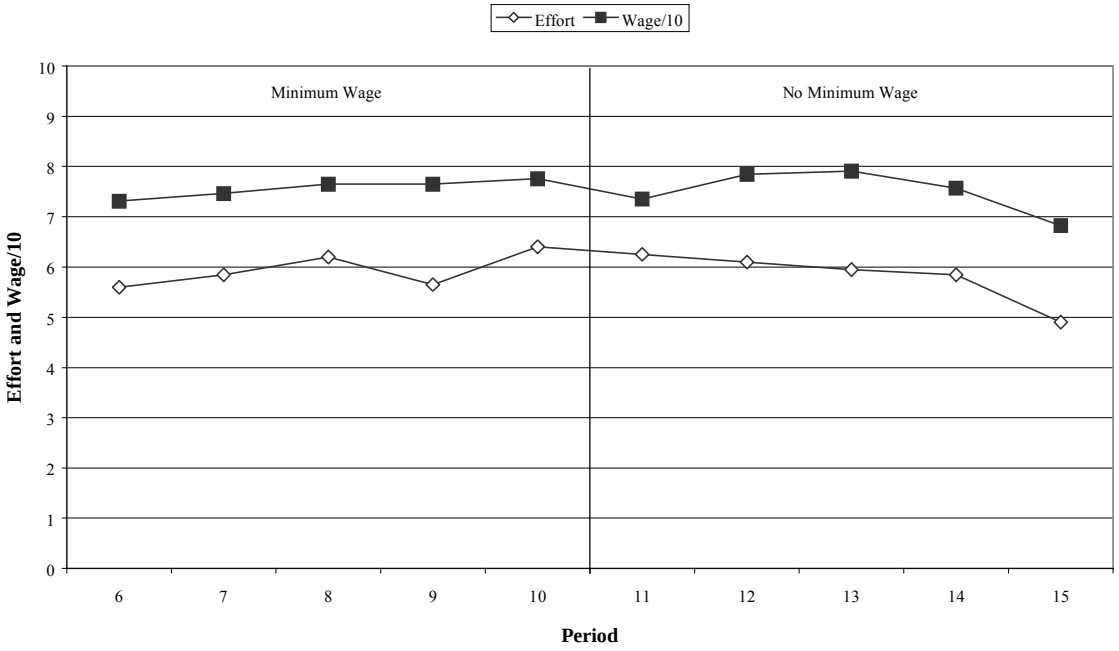


Figure 6: Mean Effort and Wage by Period After Dropping the Minimum Wage: Experiment 1

Sessions 1 and 2, Periods 6-15



Sessions 3 and 4, Periods 1-10

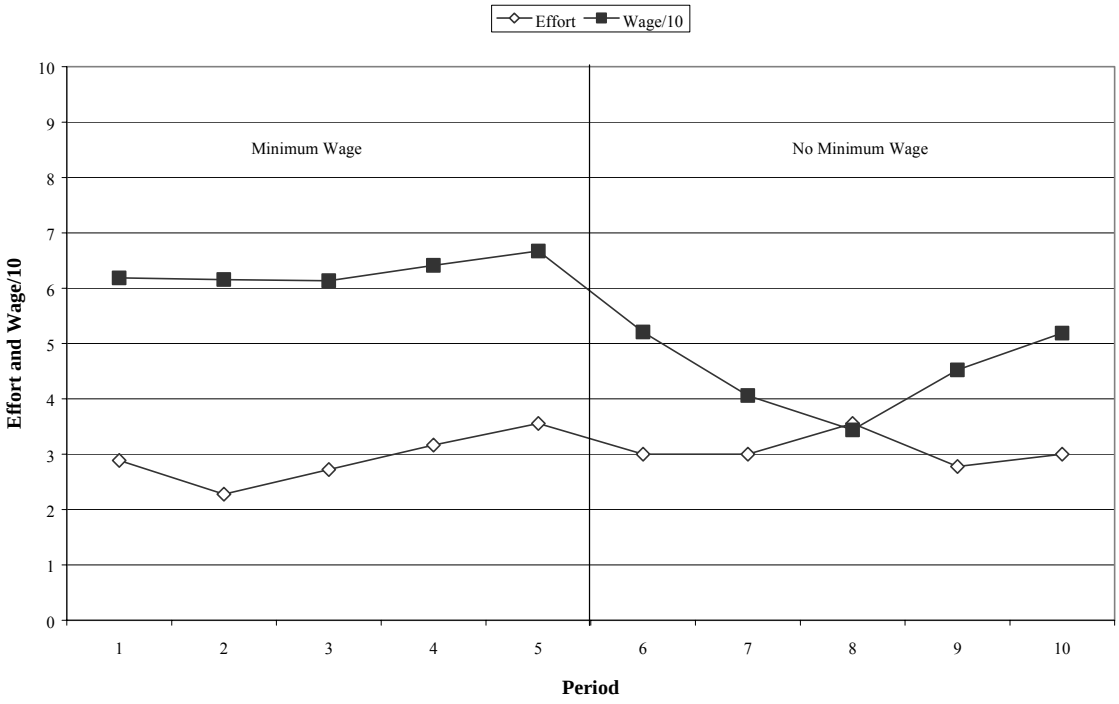


Figure 7: Average Wage and Effort by Period: Experiment 2

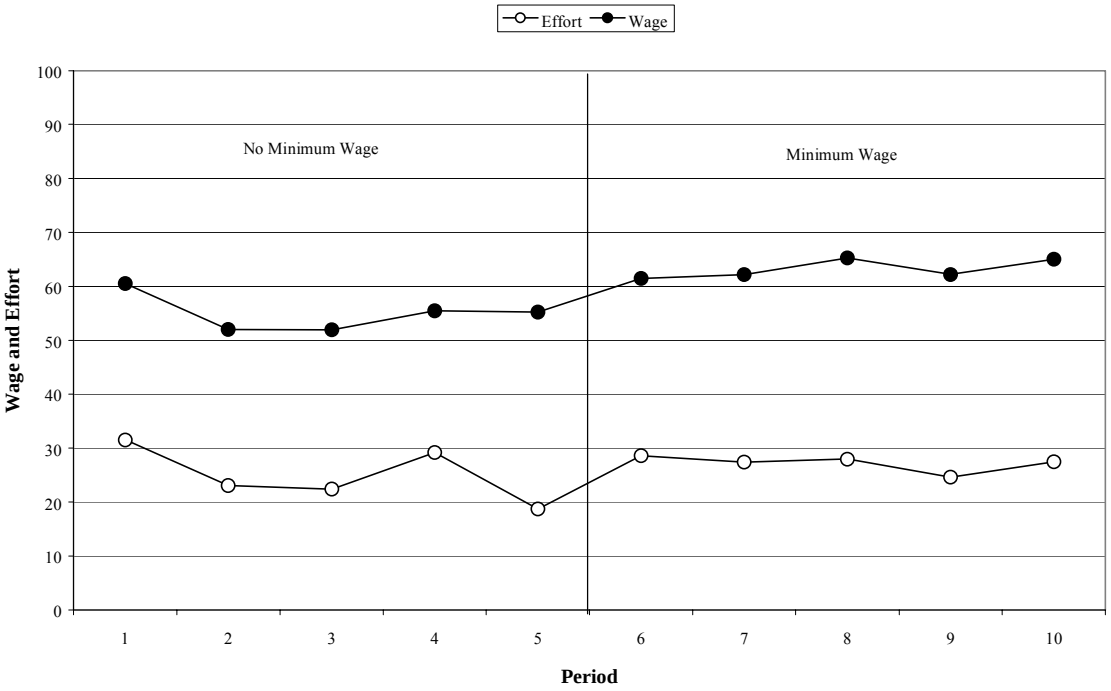


Figure 8: Kernel Regressions of Effort as a Function of Wages in Experiment 2 (Comparison with and without a Minimum Wage within Sessions 6 and 7)

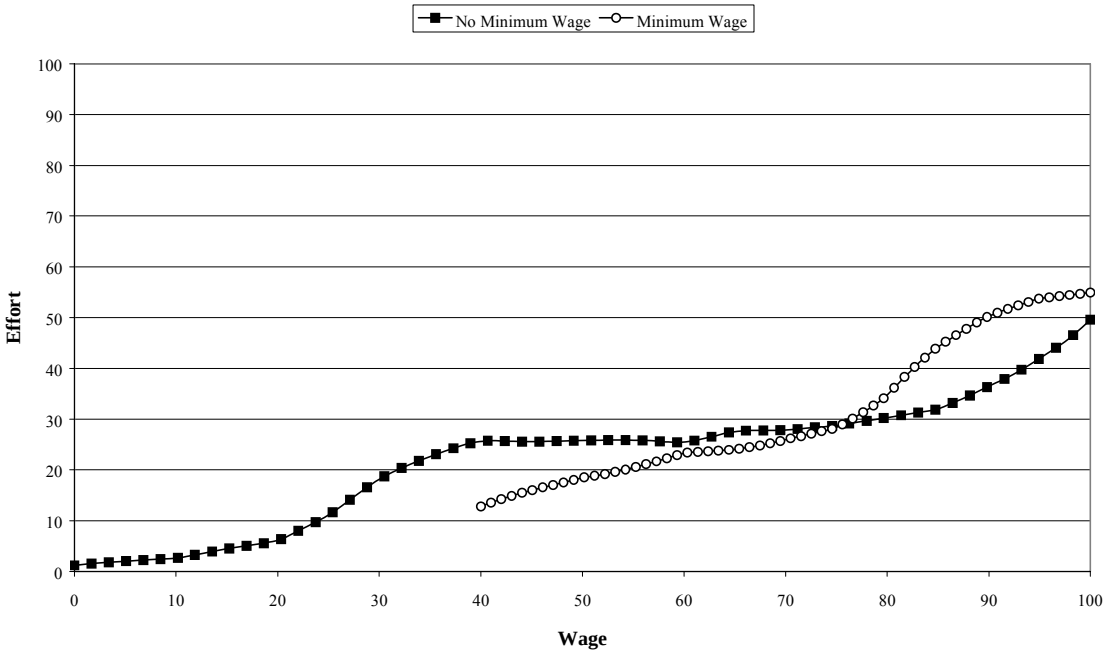


Table 1: Random Effects Tobits for the Effect of Current versus Past Wages on Effort: Experiment 1 (periods 1-10 of sessions 1 and 2)

	Random Effects Tobit	Random Effects Tobit
Wage	0.101***	0.101***
	(0.014)	(0.015)
MW	-1.280	-1.448
	(1.381)	(1.601)
HW	1.020*	1.107
	(0.608)	(0.738)
Wage*MW	0.030*	0.033
	(0.018)	(0.024)
HW*MW		-0.240
		(1.156)
Constant	-2.850***	-2.819***
	(0.986)	(0.994)
	N=198	N=198
Joint test of HW and HW*MW		$\chi^2(2)=2.88$ P=0.237

MW = 1 if minimum wage is in effect, 0 otherwise; HW = 1 if the wage received this period is greater than any wage received in previous periods, 0 otherwise.
*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.

Appendix

The Appendix reports the results of statistical tests of the treatment effects reported in the text. We employ random effects Tobits throughout. The Tobits account for censoring of effort at both the minimum of 1 and the maximum of 10 in Experiment 1, and at 0 and 100 for Experiment 2. Qualitatively similar results have also been obtained using random effects ordered probits (see Owens, 2006). However; the Tobits are reported because they are somewhat easier to interpret. We also report the marginal effects on effort implied by the Tobit estimates at different wage rates where relevant.

Effects on Effort of the Minimum Wage Within an Ongoing Labor Market: Experiment 1

Table 1A reports a number of specifications for the effect of the minimum wage requirement on effort. The most relevant specification is the last one where we introduce both a dummy variable for the minimum wage (MW = 1 with a minimum wage, 0 otherwise) and an interaction effect between wage and the minimum wage dummy (Wage*MW).[21]

The dummy variable for the minimum wage effect is negative but not statistically significant at conventional levels, while the Wage*MW variable is positive and significant at the 5% level. Evaluating the joint impact of these two variables (see the last data column of Table 1A) the cutoff point for which the minimum wage has zero impact is 52.8. For wages below this cutoff point effort is lower with the minimum wage, but not significantly lower, compared to before the minimum wage. For wages above this cutoff point effort is higher in the presence of the minimum wage than it was before, with this difference statistically significant at the highest wage rates (80 and above).

[21] We tried an alternative specification including $Wage^2$ and $Wage^2$*MW terms, but were unable to reject the null hypothesis that these two variables are jointly equal to zero (χ^2 (2) =3.35, p = 0.187). We dropped two outlier observations where the effort level provided resulted in the worker earning a negative return for that period. Both observations came form the same subject and were not repeated by that subject or any other subject.

Table 1A: Random Effects Tobits for the Effects on Effort of the Minimum Wage Within an Ongoing Labor Market: Experiment 1 (sessions 1 and 2)

Dependent Variable is Effort[a]					Wage	Marginal Effect of Minimum Wage
MW	2.593*** (0.646)		0.697* (0.412)	-1.847 (1.353)	40	-0.431 (0.701)
Wage		0.132*** (0.010)	0.129*** (0.010)	0.114*** (0.012)	60	0.277 (0.159)
Wage*MW				0.035** (0.018)	80	0.985** (0.435)
Constant	3.272*** (0.849)	-4.254*** (0.808)	-4.387*** (0.802)	-3.344*** (0.919)	100	1.693*** (0.653)
Joint test of MW and Wage*MW				χ^2 (2)=6.73 P=0.035**	Cutoff wage	52.8

MW = 1 if minimum wage is in effect; 0 otherwise. [a] Number of observations is 198 in all cases.
*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.

Effects on Effort of a Minimum Wage Comparing Between Markets that Begin With a Minimum Wage versus Markets with No Minimum Wage: Experiment 1

A random effects Tobit for the between group effect of the minimum wage is reported in Table 2A, along with the implied effects on effort at different wage rates. We drop the different specifications for the Tobits to conserve space.[22] The coefficient estimates for the minimum wage effect have a similar pattern to the results reported for sessions 1 and 2 – the intercept dummy for the minimum wage effect (MW) is negative and the MW*Wage interaction effect is positive, with the MW variable statistically significant at the 1% level. The big difference between the two cases is that the minimum wage dummy is three times larger in absolute value here compared to Table 1A, so that the effort level is lower over all wages with the minimum wage here (the cutoff point is greater than 100), and significantly lower for all but the very highest wage rates (91-100).

Table 2A: Random Effects Tobit for the Between Group Effect of Minimum Wages on Effort: Experiment 1 (first five periods of sessions 1-4)

Dependent Variable is Effort[a]	Random Effects Tobit	Wage	Marginal Effect of Minimum Wage
MW	-5.852*** (1.664)	40	-4.719*** (1.010)
Wage	0.122*** (0.012)	60	-4.153*** (1.068)
Wage*MW	0.028 (0.029)	80	-3.586** (1.387)
Constant	-4.054*** (0.886)	100	-3.020 (1.836)
Joint test of MW and Wage*MW	χ^2 (2)=21.85 P=0.000***	Cutoff wage	209

MW = 1 if minimum wage is in effect, 0 otherwise. [a] Number of observations is 188. Two observations where the employee lost money were dropped from the sample.
*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.

Table 3A reports the random effects Tobit which tests whether employees in sessions 3 and 4 are treating deviations from the minimum wage of 40 in the same way as those in sessions 1 and 2 treated deviations from the zero wage. We pooled the data from sessions 1 and 2 with 3 and 4, subtracted 40 from all wages in sessions 3 and 4, and restricted the analysis to wages (and adjusted wages) of 60 or less. Using the same specification as in Table 2A, but replacing the MW

[22] We tried an alternative specification which included $Wage^2$ and $Wage^2$*MW terms but were unable to reject the null hypothesis that these two variables are jointly equal to zero (χ^2 (2) =2.52, p = 0.284).

dummy with a dummy variable D34 = 1 for sessions 3 and 4, 0 otherwise, and replacing the Wage*MW term with Wage*D34, neither the D34 dummy nor the Wage*D34 variable is significant on its own account. Further, a joint test fails to reject the null hypothesis that both variables are jointly equal to 0 (χ^2 (2) = 1.10, p = 0.58).

Table 3A: Random Effects Tobit for the Wage Adjusted Between Group Effect of Minimum Wages on Effort: Experiment 1 (first five periods of sessions 1-4)

Dependent Variable is Effort	D34	Adjusted Wage	Adjusted Wage*D34	Constant	Joint test of D34 and Wage*D34
Random Effects Tobit (N=141)	1.883 (2.102)	0.164*** (0.040)	-0.010 (0.049)	-6.116*** (2.002)	χ^2 (2)=1.10 P=0.58

D34 = 1 if observation is from sessions 3 and 4, 0 otherwise. Wage in sessions 3 and 4 equals actual wage less 40.
*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.

The Effects of Eliminating the Minimum Wage:

Table 4A reports random effect Tobits which test for the effect on effort for removing the minimum wage in Experiment 1. We are unable to reject a null hypothesis that removing the minimum wage treatment had no significant effect on effort in sessions 1 and 2 or in sessions 3 and 4.[23]

[23] We tried alternative specifications including Wage^2 and Wage^2*MW terms in both cases but were unable to reject the null hypothesis that these two variables are jointly equal to zero (χ^2 (2) =1.08, p = 0.583 for sessions 1 and 2; χ^2 (2) =1.73, p = 0.420 for sessions 3 and 4).

Table 4A: Random Effects Tobits for Impact of Removing Minimum Wage on Effort: Experiment 1

The Dependent Variable is Effort	Sessions 1 and 2	Sessions 3 and 4
MW	-0.386 (2.074)	-0.815 (2.512)
Wage	0.145*** (0.018)	0.142*** (0.021)
Wage*MW	0.012 (0.026)	0.002 (0.035)
Constant	-5.388*** (1.581)	-9.104*** (2.155)
	N=200	N=180
Joint test of MW and Wage*MW	χ^2 (2)=1.04 P=0.595	χ^2 (2)=0.73 P=0.693

MW = 1 if minimum wage is in effect, 0 otherwise.
*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.

Effects on Effort of the Minimum Wage Within an Ongoing Labor Market: Experiment 2

Table 5A reports the random effects Tobit for the effect of the minimum wage treatment on employee effort within an ongoing labor market in Experiment 2.[24] 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 (χ^2 (2) = 2.83, p = 0.24).

Table 5A: Random Effects Tobit for the Effects on Effort of the Minimum Wage Within an Ongoing Labor Market: Experiment 2

The Dependent Variable is Effort	MW	Wage	Wage*MW	Constant	Joint test of MW and Wage*MW
Random Effects Tobit	-10.244 (9.052)	0.712*** (0.085)	0.089 (0.139)	-18.495*** (6.000)	χ^2 (2)=2.83 P=0.243

MW = 1 if minimum wage is in effect, 0 otherwise. Number of observations is 200.
*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.

[24] We tried an alternative specification including Wage^2 and Wage^2*MW terms but were unable to reject the null hypothesis that these two variables are jointly equal to zero (χ^2 (2) =0.44, p = 0.804).