

# The Behavioral Effects of Minimum Wages

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- Very preliminary -

Comments are very welcome

## Abstract

For decades the negative employment effects of minimum wage laws were part of economists' conventional wisdom. Recently new methods and new data have, however, questioned this view. We study the impact of the introduction and the removal of minimum wages on employment, wages and labor supply in an experimental labor market. In contrast to conventional wisdom the following facts emerged: The introduction of the minimum wage causes a significant increase in employment. In addition it causes a strong increase in workers reservation wages inducing firms to pay many workers above the minimum. The removal of the minimum wage leaves employment unchanged. If the minimum wage is removed there is only a small decrease in workers' reservation wages inducing firms to keep wages close to the previous minimum wage. Our results suggest that both the asymmetric effects of the introduction and the removal of minimum wages as well as the strong impact of minimum wages on reservation wages deserve more attention in future discussions.

**JEL-Classification:** C91, D63, E64, J38, J42, J58, J68

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## 1 Introduction

Minimum wages are one of the most important and often-used labor market instruments. Most labor markets in the developed world are somehow affected by minimum wage legislations.<sup>2</sup> Since minimum wages are very wide spread, their potential impact on economic outcomes is large. A more complete understanding of the economic effects of minimum wages is therefore of great importance for both, labor economists and policy makers.

In view of the conventional theory of competitive labor markets minimum wages inevitably reduce employment. As a consequence economists have criticized minimum wage legislations as highly inefficient. Recent empirical work has, however, called this view into question. Various studies have shown that moderate increases in the minimum wage do not necessarily cause a reduction in employment and can even have employment enhancing effects. Katz and Krueger (1992) and Card (1992a) analyze the 1990-1991 increases in the federal minimum wage and find no adverse employment impact. An empirical investigation of an earlier increase in the minimum wage in California by Card (1992b) and a study of minimum-wage floors in Britain by Machin and Manning (1994) reach similar conclusions. Card and Krueger (1994) examine the development of employment in the fast food industry in New Jersey and find that the 1992 increase in minimum wages had even positive employment effects. In the OECD Employment Outlook (1998) estimations of employment elasticities with respect to the minimum wage based on cross-country regression indicate that increasing minimum wages have a negative impact on teenage employment but no significant effect on employment of other worker groups.<sup>3</sup>

In response to the new empirical evidence economists have developed alternative theoretical models that are able to explain the observed employment effects of minimum wages. Bhaskar and To (1999) show, that in a model of monopsonistic competition with free entry, positive employment effects of minimum wages can emerge, if the monopsonistic market power of

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<sup>2</sup> National or statutory minimum wages exist in 19 OECD countries and in at least 6 more OECD countries minimum wages are effectively set through collective agreements (National or Statutory Minimum Wages: USA, Canada, Japan, UK, Belgium, France, Czech Republic, Greece, Hungary, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Poland, Portugal, Spain, Turkey, Ireland. Collective Agreements: Germany, Austria, Sweden, Denmark, Finland, Italy).

<sup>3</sup> An extensive review of the empirical evidence on economic effects of minimum wages is found in Card and Krueger (1995).

firms is sufficiently strong. In efficiency wage models Rebitzer and Taylor (1991) and Manning (1995) find, that an increase in the minimum wages may enhance employment, if firms use the threat of dismissal to elicit high levels of work effort. Burdett and Mortensen (1998) present a job search model, where positive employment effects of minimum wages arise as a consequence of monopsonistic competition generated by the existence of search frictions. Although the models have very different conceptions and structures, the ultimate reason for the possibility of positive employment effects is always the same: Individual firms face upward sloped labor supplies. To employ additional workers firms have to pay higher wages and therefore the marginal cost of labor exceeds the wage. The formal logic for the potential occurrence of positive employment effects is similar to that found in the well-known, classical monopsony model.<sup>4</sup>

The claim that labor markets are, in the absence of interventions, monopsonistic comes probably as kind of a surprise to some readers. In most labor economics textbooks theory is based on the assumption that the operation of labor markets is well approximated by the perfectly competitive model. There is, however, a growing literature arguing that the understanding of labor markets can be strongly improved by including models of incomplete competition in modern labor economics (Manning (2003), Boal and Ransom (1999), Manning (2001a), Manning (2001b)). Nobody assumes that monopsony in the traditional sense of there being only one buyer of labor is the right model of the labor market. This is clearly unrealistic since employers obviously compete with one another to some extent. Monopsony in a modern sense means that the supply of labor to an individual firm is not infinitely elastic and that employers have some market power in the setting of wages. Heterogeneous preferences over non-wage characteristics of jobs, moving costs and costly searches for jobs are good reasons to believe that labor markets have substantial frictions such that a small wage cut does not lead to an immediate quit of all workers. The advantage of the monopsonistic view of the labor market is that it leads to plausible and simple explanations not only for positive employment effects of minimum wages, but also for many others labor market phenomena

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<sup>4</sup> In the simple model with a single monopsonistic employer the employment effect of a moderate minimum wage is unambiguously positive. In more sophisticated models where multiple employers compete with each other (oligopsony or monopsonistic competition) the impact of the minimum wage on employment is less clear cut. Although the monopsony power of firms ensures that a moderate minimum wage raises employment in individual firms, firms' profits decrease and hence some firms possibly exit the market. Aggregate employment may therefore increase or decrease depending on whether the labor market is relatively distorted or not.

that are otherwise considered as puzzles (Bhaskar, Manning and To (2002), Manning (2001b)).

According to the new monopsonistic view of the labor market the existence of frictions gives employers potential market power. If profit-maximizing firms actually exercise this power economic rents may be generated. Given the existence of rents caused by frictions it must be determined how these rents are divided between employers and workers. In the last two decades experimental economics has contributed much to a better understanding of exactly this kind of bargaining process.

One of the most important and best-established results that emerged from experimental research is the existence of social preferences. Standard economic theory is based on the assumption that people are solely interested in maximizing their material rewards. There is, however, extensive experimental evidence that many people are not only concerned with their own material payoffs but also with the payoffs of their trading partners and with the way the payoff distribution is determined. The decision making of human beings is not only determined by material self-interest. Fairness considerations and other social motives play often a crucial role when people evaluate different alternatives.<sup>5</sup> We know from many experimental studies of the ultimatum game and other bargaining games that fairness considerations play a crucial role for the sharing of rents (Güth, Schmittberger and Schwarze (1982), Güth (1995), Camerer and Thaler (1995), Roth (1995)). We are therefore convinced that the economic effects of minimum wages in monopsonistic labor markets can only be fully understood if the existence of social preferences is taken into account.

In this study we experimentally examine the relevance of social preferences for the economic effects of minimum wages in a labor market with monopsony power of firms. The great advantage of laboratory experiments is control: Since exogenous and endogenous variables can be clearly distinguished, it is possible to observe the effects of an exogenous, *ceteris paribus* change of the minimum wage. The experimental game implemented captures the basic features of an economy, where firms have monopsonistic market power and produce output by employing workers with homogenous productivity. At the beginning of each period firms are randomly matched with workers. To hire workers, firms have to submit wage offers,

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<sup>5</sup> Since frequent personal interactions and social ties are often important parts of work relations, these findings have especially strong implications for the behavior of workers and employers on labor markets, (Fehr, Kirchsteiger and Riedl (1993), Fehr, Gächter and Kirchsteiger (1997), Fehr and Falk (1999a)).

which can be accepted or rejected by the workers. We study two treatments, one with and one without a minimum wage.

Our findings reveal interesting and new insights concerning the behavioral effects of minimum wages. In contrast to the standard prediction we observe that many workers reject low wage offers of firms. Since reservation wages are very heterogeneous across workers, each firm is confronted with an upward sloped individual labor supply. The introduction of the minimum wage causes a significant increase in employment. This result is in line with the findings in recent empirical studies and the arguments put forward in the theoretical models mentioned above. In addition the introduction of the minimum wage causes a strong increase in workers' reservation wages inducing firms to pay many workers above the minimum. Since reservation wages of workers are hardly observable in the field, an upward shift of labor supply as a consequence of the introduction of a minimum wage has not been observed empirically before. This behavioral effect is, however, of great importance, because it affects employment adversely and weakens the positive impact of the minimum wage considerably.

The removal of the minimum wage leaves employment unchanged. After the removal of the minimum there is only a small decrease in workers' reservation wages and firms are forced to keep wages close to the previous minimum wage. This result indicates that workers have the feeling to be entitled to the minimum wage even though firms are allowed to pay lower wages after its removal.

Until now the behavioral impacts of minimum wages have not been accentuated very much in the minimum wage discussion. Our findings, however, indicate that both the upward shift of labor supply after the introduction of the minimum wage and the entitlement effect after the elimination of the minimum wage can be crucial for employment and income distribution. These non-standard effects of minimum wages deserve therefore more attention in future debates and research.

The organization of the paper is as follows: In section 2 we give a detailed description of the experimental design and the procedure in the laboratory. Section 3 contains the predictions and hypotheses. Beside the standard prediction based on the assumption of strictly money-maximizing behavior, we also present an alternative prediction, where we take into account that fairness may play an important role in our setup. In section 4 we present our results and point out our interpretation of the observed behavior. Finally, in section 5 we give a short summary and conclude.

## 2 The Experimental Design

In this study we examine the impact of social preferences on the economic effects of minimum wages in labor markets with monopsony power. In order to be able to observe the behavior of people in a very clean and controlled environment, we set up a simple experimental labor market where only the absolutely basic structure is implemented.

### 2.1 The Experimental Game

The labor market is modeled by following experimental procedure. Before the start of the experiment subjects are randomly subdivided into two groups. Some of them are assigned the role of a firm; the others are in the role of workers. Roles of subjects are fixed for the whole session. Each participant knows only his own assignment.

At the beginning of a period each firm is randomly matched with three workers. Neither the firm nor the workers can identify the other three subjects in their group. Firms have identical production functions with labor as the only variable input and decreasing marginal returns. To hire workers firms can submit a unitary wage offer to each of the three workers. Workers can accept or reject received wage offers.

To be able to observe workers' reservation wages, we use the strategy method to collect workers' decisions. We ask them to indicate the lowest wage offer they are just willing to accept before they know the firms' decisions. If the actually received wage offer is lower than the worker's threshold value the wage offer is automatically rejected. If, however, the wage offer is higher than the threshold value it is accepted. If a worker accepts an offered wage, a binding and complete labor contract is concluded. Workers who don't accept or who don't get a wage offer are unemployed for the period.

Notice that the indication of a threshold value reveals the complete strategy of a worker, because the worker automatically states his response to every possible wage offer.<sup>6</sup> This procedure guarantees, that we know the reservation wage of each worker (including unemployed workers) in each period. We therefore observe the "true" labor supply curve.<sup>7</sup>

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<sup>6</sup> This is of course only true as long as workers have monotonic preferences.

<sup>7</sup> Besides the analytical gains the strategy method has also a technical advantage. Earlier experiments showed that social preferences of subjects can cause substantial heterogeneity of reservation wages (Falk and Fehr

After the decision process payoffs for the period are calculated and displayed on the subjects' screens. Firms' payoffs are determined by output minus wage payments to workers. Workers earn their wage if employed and zero if unemployed. Payoff functions of firms and workers are common knowledge. Firms are informed about their own payoff and the payoffs of the workers in their group. Workers get to know their own payoff and the payoff of their firm. When all subjects have reviewed the payoff information the next period begins.

To make sure that participants fully understand the decision process and the payment structure of the game, each subject has to read a detailed set of instructions before a session is started. After reading the instructions participants have to pass a test with control questions. We don't start a session before all subjects have correctly answered all control questions.<sup>8</sup>

## 2.2 Treatments

To study the economic effects of an introduction and the removal of a binding minimum wage, each session contains two treatments: a treatment without minimum wage (NO) and a treatment with minimum wage (MW). Both treatments are always played for 15 periods.

In half of the sessions the NO-treatment is played before the MW-treatment (NO/MW-sessions) and in the other half of the sessions the order of the treatments is reversed (MW/NO-sessions). This allows us to study the introduction and the removal of a minimum wage separately.

## 2.3 Parameters and Payoff Functions

The parameters of firms' production function are illustrated in Table 2.1. The production function has labor as the only variable input and is characterized by decreasing marginal returns.

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(1999b)). Because the number of participants in a laboratory experiment is very restricted, the size of a matching group is very small (one firm and only three workers). With complete random matching the small group size can therefore cause distortions in the structure of individual labor supplies of firms. In order to assure that individual labor supplies have a representative structure we divided workers into three groups (high-, medium- and low-wage group) after they have chosen their reservation wage. Each firm is randomly matched with a worker of each group in every period. Like this, firms are always confronted with upward sloped individual labor supplies which would also be the case if experiments could be conducted with a really large number of subjects.

<sup>8</sup> Instructions and control questions are available on request.

Employed Workers	Total Output	Marginal Product
0	0	-
1	390	390
2	740	350
3	1000	260

Table 2.1: Firm's production function

Subjects' incomes are calculated according to the following scheme, which is common knowledge in the experiment:

$$Firms: \quad \Pi_{Firm} = \begin{cases} 0, & \text{if no workers are employed} \\ 390 - \text{wage}, & \text{if one worker is employed} \\ 740 - 2 \cdot \text{wage}, & \text{if two workers are employed} \\ 1000 - 3 \cdot \text{wage}, & \text{if three workers are employed} \end{cases}$$

$$Workers: \quad \Pi_{Worker} = \begin{cases} 0, & \text{if no wage offer is received} \\ 0, & \text{if a wage offer is rejected} \\ \text{wage}, & \text{if a wage offer is accepted} \end{cases}$$

The payoff calculation and the conversion rate (150 Points = 1 Swiss Franc (~US \$ 1.60)) are identical in the two treatments. Total income of participating subjects consists of the show up fee and the sum of generated incomes in both treatments.

The minimum wage is set at a level of 220. Therefore the wage range for the firms is defined as follows in the two treatments:

$$\text{NO-Treatment:} \quad 0 \leq \text{wage offer} \leq 1000$$

$$\text{MW-Treatment:} \quad 220 \leq \text{wage offer} \leq 1000$$

## 2.4 Subjects and Sessions

All experimental subjects were volunteers. They were all participating for the first time in such an experiment, and each participant could only participate in one session. All participants were students of the University of Zurich or the Swiss Federal Institute of Technology Zurich (ETH). Economists and psychologists were excluded.

In total we conducted ten experimental sessions.<sup>9</sup> We had 24 subjects in each session (six firms and eighteen workers), which makes a total of 240 participants in the experiment. The computerized experiment was programmed and conducted with the experimental software z-Tree (Fischbacher (1999)). A session lasted approximately two hours and subjects earned on average 45 Swiss Francs (sFr. 45 ~ US \$ 28).

### 3 Predictions and Hypotheses

#### 3.1 Predictions for Money-Maximizing Agents

If we assume common knowledge of rationality and money-maximizing behavior the prediction for this experiment is straightforward. The fact that workers have to indicate a strategy ensures the sequential move structure of the game. Since the outside-option for workers is unemployment without income, completely selfish workers accept every positive wage offer. Firms anticipate the behavior of workers. Thus, in the only strict subgame-perfect Nash equilibrium firms offer the lowest possible positive wage and workers always accept.<sup>10</sup> In the NO-treatment firms' payoffs are maximized if they offer a wage of one to all three workers. The economy reaches full employment, because no wage offers are rejected. The income distribution, however, is very unequal, since firms skim almost all gains of trade. In the MW-treatment firms cannot offer wages below the minimum wage of 220. Notice that the minimum wage is smaller than the third worker's marginal product. Profit-maximizing firms offer therefore the minimum wage to all three workers. As in the NO-treatment all workers are employed. The income distribution, however, is much more equitable in the MW- compared to the NO-treatment. The quintessence of this prediction is that the minimum wage has no employment effects but leads to strong redistribution of income from firms to workers.

If subjects are completely rational money-maximizers the change of the treatment order does not influence any prediction for the behavior in the two treatments. We should therefore observe exactly the same kind of decisions in the MW/NO-session as in the NO/MW-sessions.

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<sup>9</sup> All sessions were performed at the computer lab at the University of Zurich.

<sup>10</sup> There is also another subgame-perfect Nash equilibrium, which is not strict. In this equilibrium workers accept all non-negative wage offers and therefore firms offer wages of zero.

These arguments are summarized in the following hypothesis:

### ***Money-Maximizing Hypothesis***

If subjects are strictly selfish money-maximizers, the following features characterize the experimental labor market:

- Workers accept every positive wage offer
- Firms anticipate workers behavior and offer the smallest possible positive wage to all their workers (NO:  $w = 1$  and MW:  $w = w_{\min} = 220$ )
- There is full employment in both the NO- and the MW-treatment
- The minimum wage has no employment but strong distribution effects
- The change of the treatment order has no effect on behavior

### **3.2 Predictions for Agents with Social Preferences**

Most economic models are based on the assumption that people are exclusively pursuing their material self-interest. There is, however, an extensive and growing experimental literature, which shows, that this assumption is often in sharp contrast to empirical observations. The behavior of subjects in a large number of experiments shows that many people are not only concerned with their own payoff but also care how close their payoff is to a certain reference standard. A very robust finding is that people do not like disparities between their own monetary payoffs and those of other people. In many experiments subjects exhibit a strong aversion against disadvantageous inequalities. Some subjects also have an aversion against advantageous inequality, but this effect is significantly weaker. Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) present formal models that incorporate inequality aversion of agents in economic theory. In both papers it is shown that theories of inequality aversion are able to explain many experimental results that are in sharp contrast to the predictions of economic standard theory (e.g. ultimatum games, public-goods games and other games where many subjects undertake costly actions to prevent inequality of payoffs).

Inequality aversion is clearly an important motive for human behavior. The problem with this simple and very intuitive concept is that it is purely outcome-orientated. Inequality aversion theories assume that people evaluate only the resulting payoff of an interaction and not the procedure by which those payoffs were determined. This is obviously an oversimplification. There is striking experimental evidence that people do not only care about the distribution of payoffs when they evaluate the fairness of an outcome but also take into account how those

payoffs were generated. For example, in ultimatum games many persons accept low offers if a random device determines these offers while they reject the same offers if human beings propose them (Blount (1995)). In general, people seem to decline unequal payoffs if they obviously result from unkind intentions of an opponent. But they are much more willing to accept unequal outcomes when they are caused by an outside mechanism or by a trading partner who does not have the opportunity to choose a fairer option. The important point is that in order to determine the fairness of a particular outcome people look at the opportunities open to their trading partners. Unequal payoffs are considered as less unfair if they are not caused by unkind intentions of one of the involved subjects.<sup>11</sup>

Both inequality aversion and the relevance of intentions can potentially be of great importance for the behavior in the present experiment. Typical situations where inequality aversion has strong implications arise if subjects have to decide how a certain pie should be shared between them. In our experiment exactly such a situation is implemented. By making and accepting or rejecting wage offers subjects determine the distribution of the generated output between workers and firms. The existence of inequality aversion changes the theoretical prediction for the outcome of this bargaining process dramatically. Inequality averse subjects experience disutility if their payoffs are different from the payoffs they perceive as fair. The immediate question that arises is: What determines the reference payoff that subjects consider as fair? From many experiments it is well known that an equitable share of payoffs is a salient and commonly held fairness standard (Fehr and Schmidt (1999)). A natural value for the reference payoff in our experiment is therefore the amount of points, which results if the firm's output at full employment is equally shared between the firm and the three workers. Given the parameters at hand in the experiment this fairness standard is:  $1000/4 = 250$ . Inequality aversion implies that workers do not accept all positive wage offers. The reservation wages of workers depend on the relative importance of fairness considerations in their utility functions. Subjects with strong fairness preferences state reservation wages that are close to the fairness standard, whereas selfish money-maximizing individuals who do not care about fairness, indicate reservation wages that are close or equal to one. Because of the heterogeneity of fairness preferences we expect reservation wages of workers to be somehow

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<sup>11</sup> Theoretic fairness models that explicitly account for the role of intentions are Falk and Fischbacher (1999), Rabin (1993), Levine (1997), and Dufwenberg and Kirchsteiger (1998). Further experimental evidence for the importance of intentions can be found in Bolle and Kritikos (1998), Falk, Fehr and Fischbacher (1999), Falk, Fehr and Fischbacher (2000), Charness (1996) and Blount (1995).

distributed between one and the fair wage. This reasoning implies that with heterogeneous inequality aversion of subjects the true labor supply in the experimental labor market is an upward sloped curve and not a horizontal line at one as implied by the standard prediction.

Intention-based models predict that people perceive the fairness of the same outcome differently in two situations where the involved subjects face different sets of opportunities. In our experiment this may be important because the minimum wage reduces the wage setting opportunities of firms considerably. In the NO-treatment firms can choose any wage between 0 and 1000, in the MW-treatment they have to offer a wage of at least 220 if they want to employ workers. It is therefore possible that workers consider a certain wage offers as quite fair if it is made in the NO-treatment but as not fair at all if it is made in the MW-treatment. For example: Many workers would think that a wage offer of 200 is a fair choice in the NO-treatment. It is not exactly equal to the fairness standard of 250 but it is quite close to it and the firm could also have chosen a much lower wage. The same workers may, however, find that a wage offer of 220 is not fair at all in the MW-treatment. The reason for this is that though the second wage offer is higher it signals much less kind intentions of the firm. The minimum wage legislation forces all firms to offer at least wages of 220, a fair action would therefore be to pay a wage above the minimum wage. If subjects have intention-based fairness preferences, they will in general state higher reservation wages in the MW-treatment, in order to avoid the disutility of experiencing unfairness. Hence we would expect that the introduction of the minimum wage causes an upward-shift of the positively sloped labor supply.

With inequality aversion of workers firms are confronted with a typical monopsony situation. Each firm faces an upward sloped individual labor supply. Other than in the textbook monopsony the firms do not exactly know the reservation wages of their workers but only have some expectations about the distribution. The positive slope of the total labor supply implies that the probability of acceptance is increasing in the level of the wage offer. It is important to notice, that it is always optimal for firms to make three wage offers, as long as the offered wage is lower than the marginal product of the third worker (260).<sup>12</sup> Since wage offers were not costly, a lower number of wage offers only reduces expected employment and hence shortens expected profits. For the wage setting behavior of firms we assume, that they maximize expected profits with respect to their expectations about the distribution of

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<sup>12</sup> In the experiment wage offers above 260 were rarely observed (0% in the NO-treatment and about 2% in MW-treatment).

reservation wages, achieved by learning through experience.<sup>13</sup> Given the upward sloped labor supply curve the optimization problem of firms can be described as a stochastic version of the standard profit maximization problem of a monopsony. The left part of Figure 3.1 is a graphical representation of such a situation.

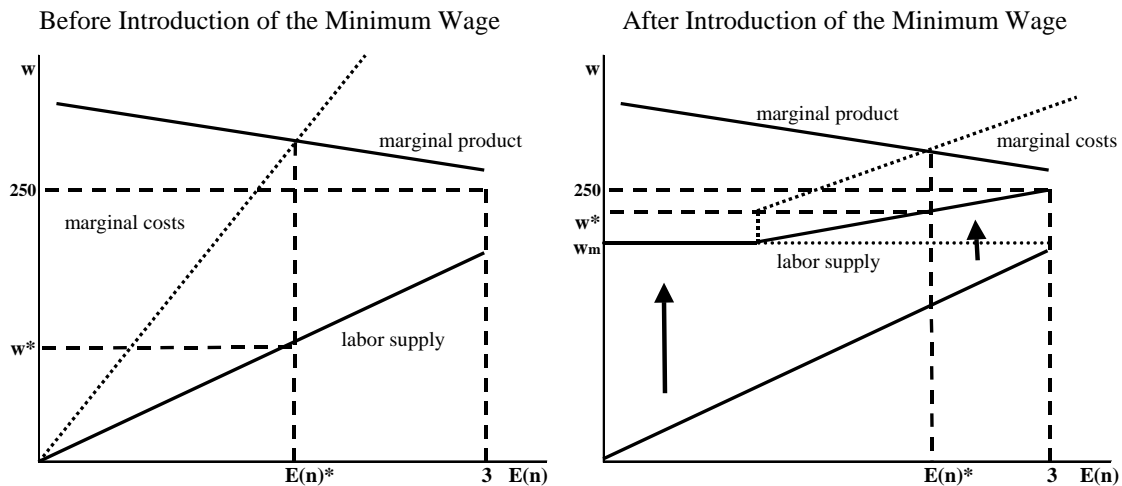


Figure 3.1: Monopsonistic Profit Maximization and Minimum Wages

The firm's maximal expected profit is reached when expected marginal costs of employment are equal to the expected marginal product. As in the traditional monopsony model marginal costs exceed the wage. Hence, in equilibrium the expected number of workers per firm ( $E(n)^*$ ) is smaller than the potential possible and efficient number of three workers.

Under the assumption that inequality aversion completely describes subjects' fairness preferences the introduction of a minimum wage would simply shift up the reservation wages below the minimum wage to the minimum wage and leave the rest of the labor supply unchanged. A 'moderate' minimum wage<sup>14</sup> would therefore unambiguously cause a positive employment effect like in the classical monopsony model. If intentions matter, however, labor supply changes more fundamentally. Since workers evaluate outcomes differently than before, all reservation wages potentially change with the introduction of the minimum wage. People

<sup>13</sup> One could object that it is not logical to assume fairness preferences for workers but purely selfish behavior for firms. The reason for this assumption is the following: Since reservation wages of workers are always below the fair wage, firms can always generate a payoff, which is higher than the workers' wage. Aversion against advantageous inequality is very weak in most situations. For simplicity we therefore neglect fairness preferences of firms.

<sup>14</sup> The minimum wage must not be higher than the expected marginal product at the expected level of employment realized in the monopsony case.

with reservation wages below the minimum wage in the NO-treatment may state threshold values above the minimum wage in the MW-treatment and also people with already high reservation wages may increase their claims under the minimum wage legislation. This means that in general more people have reservation wages above the minimum wage in the MW-treatment than in the NO-treatment. Assuming that the fairness standard does not change after the introduction of the minimum wage such that reservation wages are somehow distributed between the minimum wage of 220 and the fair wage of 250, this implies that the labor supply in the MW-treatment begins with a relatively short flat part at the level of the minimum wage and ends with a relatively long slightly increasing part. A graphical representation of a possible change of labor supply is presented in the right part of Figure 3.1.

The effect of the minimum wage on labor supply has some important implications for wages and employment. First, it is not clear that a minimum wage that is clearly binding in the NO-treatment is still a constraint for the firm after the change of labor supply in the MW-treatment. Depending on the magnitude of the shift and the rotation of the labor supply it is possible that the profit-maximizing wage for the firm is above the minimum wage (see Figure 3.1). Second, although the minimum wage forces firms to pay clearly higher wages than before the sign of the employment effect is ambiguous. Whether firms employ more or less workers than before is determined by the characteristics of the new labor supply. In general, the smaller the upward shift and the flatter the new curve the more likely it is that the employment effect is positive (in Figure 3.1 we show the case of a positive effect). However, for large negative employment effects extreme shifts of labor supply are necessary. It is therefore reasonable to expect a relatively small decrease or an increase of employment. If the fairness preferences of workers are not unexpectedly strong a minimum wage of 220 causes a considerable increase of wages. The combination of the expected changes of employment and wages implies that the minimum wage leads to redistribution of income from firms to workers.

Under the assumption that subjects exhibit fairness preferences of the kind described above the reversal of the treatment order does not lead to any changes in the predictions for the behavior of subjects in the two treatments. There are, however, two lines of research in experimental economics that give rise to the presumption that the sequence of treatments could be important in our experiment. First, the large literature on anchoring effects includes several studies that show the impact of so-called anchor values on preferences (Johnson and Schkade (1989), Green, Jacowitz, Kahnemann and McFadden (1998), Kahnemann and

Knetsch (1993), Ariely, Loewenstein and Prelec (2000) and (2001)). In standard economic theory it is assumed that individuals derive their willingness-to-pay or willingness-to-accept from their valuation of the pleasure or displeasure they anticipate receiving from the concerning choice. This theory is derived from the assumption that people know precisely how to evaluate different options. Experiments on anchoring effects clearly show that people's valuation of simple choices is strongly influenced by non-informative (often randomly chosen) anchor-values. These findings imply that people do not always know their fundamental valuation of an option and that therefore their stated willingness-to-pay or willingness-to-accept is often surprisingly arbitrary. If people (wrongfully) interpret the minimum wage in the MW-treatment as reference value for their true reservation wage, the minimum wage can cause anchoring effects. In this case we would observe that reservation wages of workers do not decline after the removal of the minimum wage.

Second, in some experiments where subjects had to determine the distribution of a certain pie between group members entitlement effects played a crucial role<sup>15</sup>. To clarify what is exactly meant by entitlements in this context, we refer to the definition provided by Schlicht (1998, p. 24): "*Entitlements are rights, as perceived by the individual. They are not, however, legal rights. Rather they denote the subjectively perceived rights that go along with a motivational disposition to defend them.*" Derived from subjective fairness judgments people feel entitled to a specific allocation of the pie. In contrast to legal rights entitlements are not exogenously enforceable, but often people seem to be willing to accept costs to defend their entitlements. Important sources for the formation of entitlements are past allocations. It is an established fact in the literature, that many people have a "sense of ownership in the status quo" (Zajac (1995), p. 121). This implies that past allocations play possibly an important role for the present fairness judgments of individuals, even if the past is objectively irrelevant for the present situation.<sup>16</sup> Once workers are exposed to a minimum wage they are used to a relatively fair split of incomes between firms and workers, but even with the minimum wage firms earn always more than workers. This experience may create entitlements in turn, which lead to relatively high reservation wages after the elimination of the minimum wage.

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<sup>15</sup> Experimental evidence for the importance of entitlements in bargaining is found in Gächter and Riedl (2002).

<sup>16</sup> A typical real life example are New York City tenants who sometimes violently resisted raising their long-standing regulated low rents, because they felt strongly entitled to them (for this and many other examples see Zajac (1995)).

This means that if anchoring or entitlement effects occur the elimination of the minimum wage does not cause reservation wages to decline such that firms are forced to keep wages close to the former minimum wage. In this case we should more or less observe the same economic outcomes in both the MW- and the NO-treatments.

All these arguments are summarized in the following hypothesis:

### ***Fairness Hypothesis***

If social preferences are important, the following features characterize the experimental labor market:

- Labor supply is upward sloped
- Firms offer relatively high wages in the NO-Treatment
- Firms offer the minimum wage or even higher wages in the MW-Treatment
- The introduction of the minimum wage changes labor supply
- The employment effect of the minimum wage is ambiguous
- The minimum wage redistributes income from firms to workers

With anchoring or entitlements the variation of the treatment order changes behavior:

- In contrast to the introduction of the minimum wage its elimination does not considerably change economic outcomes
- Workers' reservation wages do not decline much
- Firms are forced to pay wages close to the former minimum wage
- Employment and income distribution remain unchanged

## **4 Results**

In this section we report our main findings. On the whole, the experimental results are very favorable for our fairness hypothesis. Average reservation wages of workers lie between one and the fairness standard defined before. Accordingly wage offers of firms are much higher than predicted by the money-maximizing hypothesis. The introduction of the minimum wage causes a significant but rather small positive employment effect and leads to strong redistribution of incomes. As predicted the minimum wage changes the fairness perceptions of subjects and provokes a considerable upward shift in labor supply, which forces firms to pay wages above the minimum wage. The elimination of the minimum wage causes no significant employment effects. Subjects feel a strong entitlement to wages at the level of the

minimum wage and accordingly reservation wages decline only insignificantly. Firms continue to pay wages close to the minimum wage and therefore the removal of the minimum wage does not have substantial effects on the outcome in the experimental economy.

The remainder of this section contains a detailed description of our results. The section is organized as follows: In the first part we report our observations in the situation with no limits for the wage setting and then describe the effects of the introduction of the minimum wage on individual behavior and aggregated economic outcomes. In the second part we discuss the economic effects that arise after the elimination of the minimum wage.

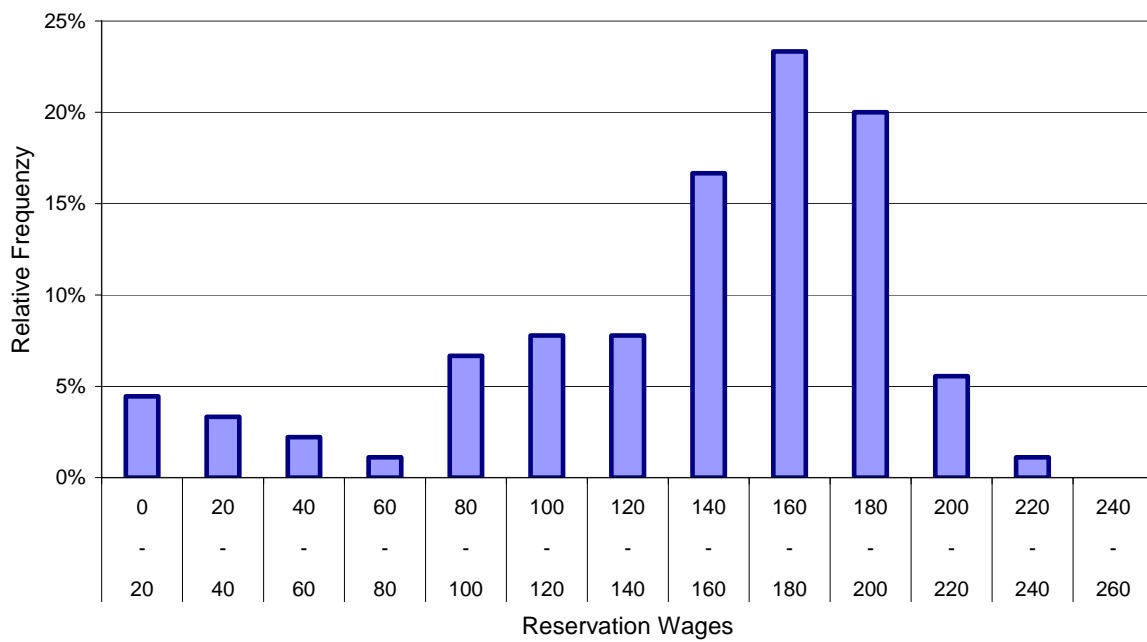
#### **4.1 Economic Effects of the Introduction of a Minimum Wage (NO/MW-Sessions)**

According to our fairness prediction inequality aversion of workers causes reservation wages to lie in the range between one and the equally shared full employment output (250). Figure 4.1 shows that this is indeed the case. All average reservation wages in the NO-treatment (in all NO/MW-sessions) are in the predicted interval between 1 and 250 and more than 50% lie between 140 and 200.<sup>17</sup> The heterogeneity of reservation wages is substantial. There is a small group of selfish subjects with reservation wages close to one, but most participants exhibit considerable fairness preferences, such that the average reservation wage is found at 145.

The true labor supply in the experimental labor market can be obtained by arranging average reservation wages. In Figure 4.2 the total labor supply for the NO-treatments of all five NO/MW-sessions is displayed. Since this is the aggregated labor supply for five sessions, it is not the labor supply a single firm was confronted with in the experiment. It is informative, however, for the overall structure of the labor supply. Labor supplies for single sessions, which were relevant for the behavior of firms, look very similar and have the same structure. Notice that this kind of distribution of reservation wages implies that the probability of acceptance of a wage offer rises in the wage level. Accordingly firms were exactly in the monopsony situation with upward sloped individual labor supply described before.

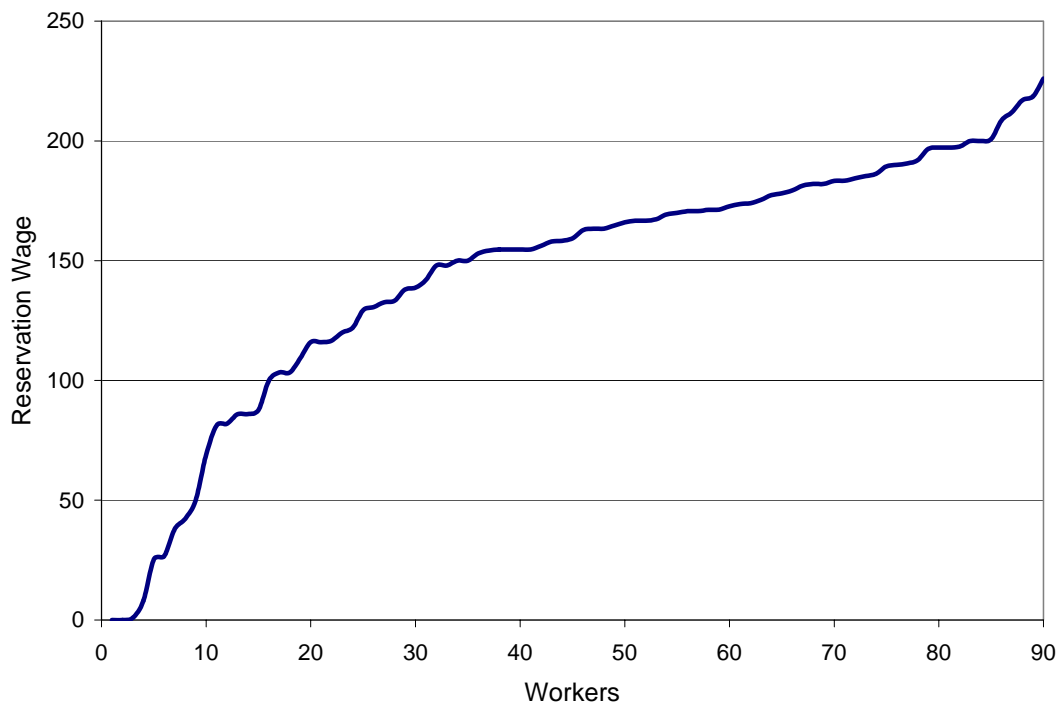
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<sup>17</sup> In total we observed 1350 (=5\*18\*15) reservation wages in the NO-treatments of the NO/MW-sessions and only ten of them are higher than the defined fair wage of 250.



*Figure 4.1: Relative Frequency of Average Reservation Wages in the NO-Treatment*

Our findings relating to the determination of reservation wages illustrate very perspicuously that the assumption of strictly money-maximizing behavior cannot be sustained and that fairness considerations play an important role in our setting.



*Figure 4.2: Aggregated Labor Supply in the NO-Treatment*

Firms anticipate the labor supply curve quite well and accordingly most of them do not even try to make very low offers but pay relatively high wages. In the first period of the NO-treatment in the NO/MW-sessions firms offer on average a wage of 138, whereas the lowest wage offered was 25. After the first period average wage offers increase until they reach a level of around 180 in the fourth period and then remain at approximately that level in the following periods (detailed information in Table 4.1).<sup>18</sup> This finding confirms our prediction that fairness preferences of workers force firms to pay wages far above one.

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Average Offer	138	160	164	180	179	180	180	181	184	182	179	187	185	181	181
Minimum Offer	25	50	25	100	100	100	50	100	100	125	50	140	125	100	50
Standard Deviation	63	59	59	35	30	29	39	29	31	25	36	25	26	29	34

*Table 4.1: Wage Offers of Firms in the NO-Treatment*

The level of wage payments achieved before the introduction of the minimum wage results in an average employment of 2.1 workers per firm. On average firms profits are at a level of 346 points and workers earn on average 131 points. Since there are no reservation wages that lie above the marginal product of the third worker (260), the efficient state for the labor market would be reached at full employment (3 workers per firm). Before the implementation of the minimum wage legislation our experimental labor market is therefore characterized by considerable inefficiencies and a very unequal income distribution.

We now turn to the economic effects of the introduction of a binding minimum wage into such an economy. That the minimum wage of 220 was really binding can be seen from the fact that among the 450 wage offers observed in the NO-treatments, there were only 24 offers (5.3%) above the implemented minimum wage. In the prediction section we argued that for workers with intention-based fairness preferences the evaluation of a certain outcome is depending on the opportunities open to the firm. Since firms are exogenously forced to pay high wages by the minimum wage legislation, workers consider high wage offers as less fair in the MW-treatment than in the NO-treatment. As a consequence the fairness hypothesis predicts that the minimum wage causes an upward shift of the labor supply. Our experimental results are completely in line with this prediction. Figure 4.3 shows that we observe a considerable non-trivial change of labor supply after the introduction of the minimum wage. In the NO-treatment only one of the ninety average reservation wages is above the minimum

<sup>18</sup> After the third period only two of the 30 firms ever offered wages below 100 again.

wage level. In the MW-treatment, however, sixty-three workers state average reservation wages above 220. Thus the same individuals' reservation wages must be different in the two treatments. It seems that the assumption of intention-based fairness preferences of subjects is accurate. Furthermore as expected the fairness standard of 250 is still an upper bound for the reservation wages of most workers. Only five of the ninety average reservation wages exceed the fairness standard.<sup>19</sup> As a consequence the bandwidth of the stated reservation wages is much narrower in the MW-treatment than in the NO-treatment. This clearly makes the coordination problem of firms and workers easier, since the lower variance of reservation wages allows firms to build up much better expectations about workers reservation wages.<sup>20</sup>

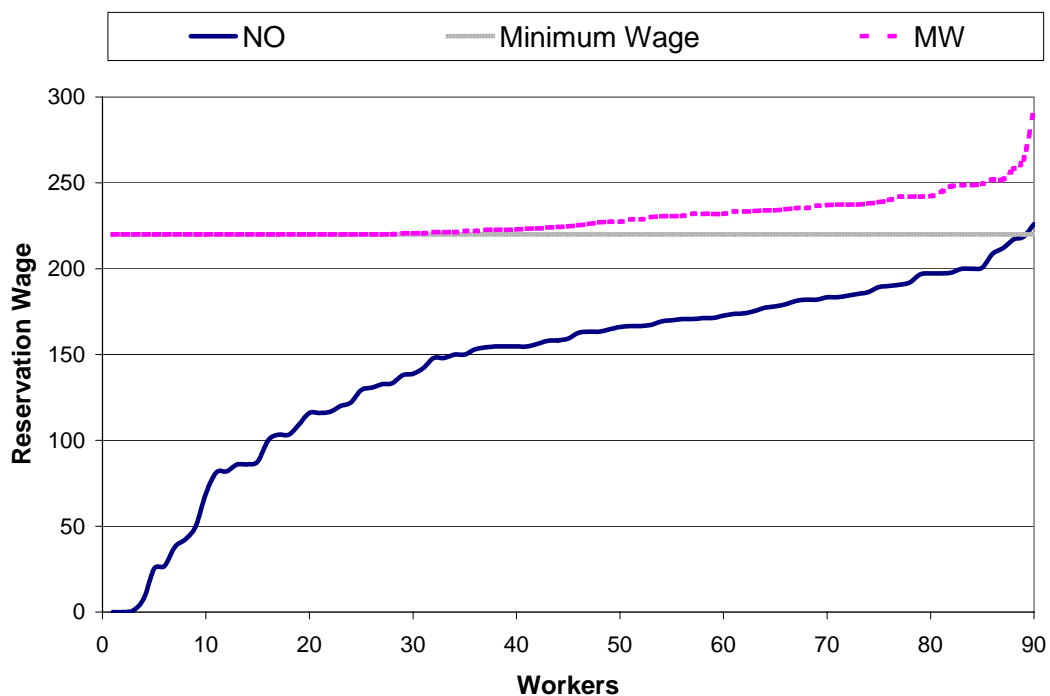


Figure 4.3: Labor Supply in the NO- and in the MW-Treatment

The upward-shift of labor supply is large enough such that firms are forced to pay wages above the minimum wage. 400 of the 450 observed wage offers (88.8%) in the MW-treatments are higher than 220. Average wage offers of firms are very constant and lie in the

<sup>19</sup> In total we observe 1350 (=5·18·15) single reservation wages. Only 35 of these reservation wages (2.6%) are above the fairness standard of 250 (19 of them appear in the first two periods). 18 of the 90 workers ever state a reservation wage above 250 (one of them does it 5 times, the others don't do it more than 3 times).

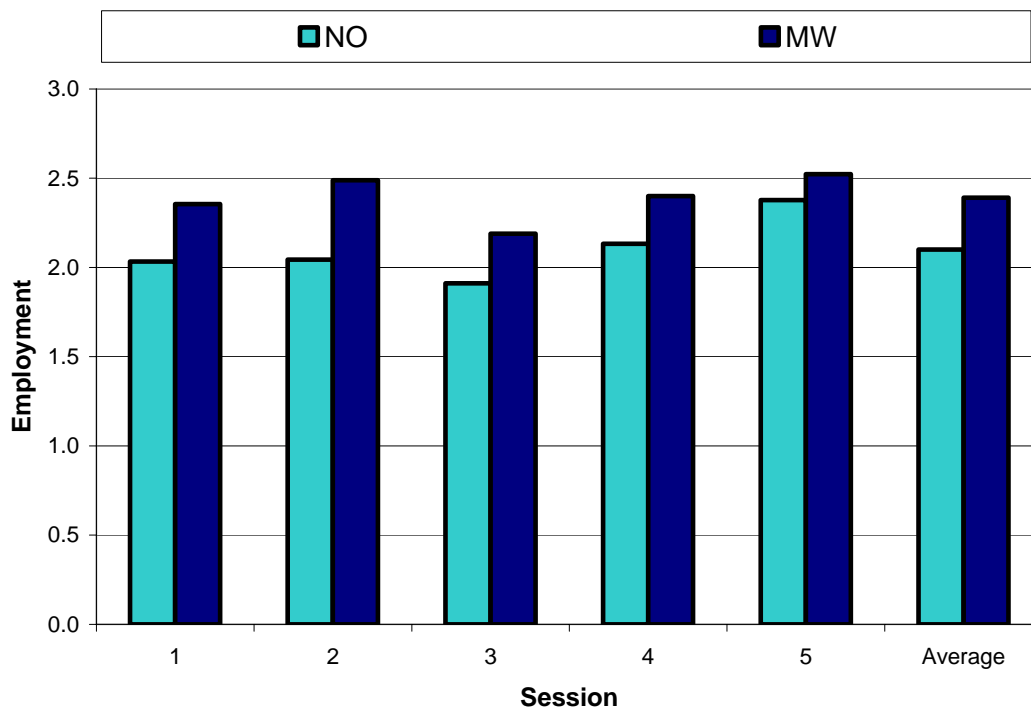
<sup>20</sup> The variance of reservation wages in the NO-treatments is 5113. After the introduction of the minimum wage the variance is 2564.

range between 230 and 240. In Table 4.2 average and minimal wage offers of firms are displayed.

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Average Offer	236	234	240	237	240	232	232	236	235	231	235	235	234	233	232
Minimum Offer	220	220	220	220	220	220	220	220	220	230	230	230	220	225	225
Standard Deviation	9	6	5	10	6	5	14	11	9	5	4	5	19	13	10

*Table 4.2: Wage Offers of Firms in the MW-Treatment*

A comparison of Table 4.1 und 4.2 clearly shows that standard deviations of wage offers declined very much after the introduction of the minimum wage. This means that there was less disagreement about the optimal wage among firms and therefore reinforces our conclusion that the coordination problem of firms and workers was less severe in the MW-treatments.



*Figure 4.4: Average Employment per Firm in the NO/MW-Sessions*

According to the fairness prediction the employment effects of the introduction of the minimum wage are ambiguous. It is theoretically possible that the upward shift of labor supply is so large that employment declines even if firms pay wages above the minimum

wage. In our experiment, however, we observe significantly positive employment effects after the implementation of the minimum wage legislation.<sup>21</sup> On average the employment per firm increases from 2.1 workers in the NO-treatments to 2.4 workers in the MW-treatments.<sup>22</sup> In Figure 4.4 a comparison of the employment levels per firm in the two experimental treatments for every session is shown. Since also in the MW-treatments almost no reservation wages are above the marginal product of the third worker (260), the efficient state of the economy would still be full employment. The positive impact on employment therefore means that the minimum wage is efficiency enhancing in our economy.

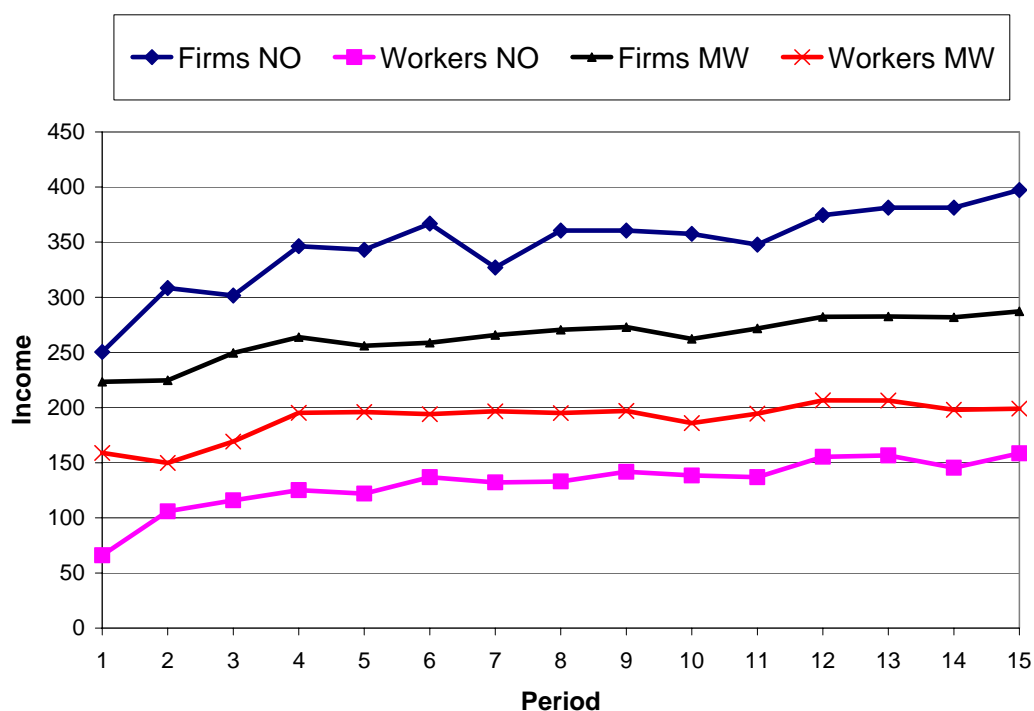


Figure 4.5: Incomes of Firms and Workers in the NO- and in the MW-Treatment

What are the consequences of the minimum wage with respect to distributional questions? As predicted the minimum wage leads to redistribution of income from firms to workers. Logically the combination of higher average employment and higher wages improves the

<sup>21</sup> One-sided Wilcoxon-Signed-Ranks Test with session averages as observations (p-Value = 0.031).

<sup>22</sup> Notice that the upward shift of labor supply lowers the positive impact of the minimum wage on employment considerably. With a stable labor supply (as in the theoretical models) we would observe nearly full employment after the introduction of the minimum wage. As you can see in the Figures 4.1 and 4.2, all but one reservation wages are below the minimum wage before the introduction of the minimum wage. Therefore without the shift of labor supply, firms could simply offer the minimum wage and workers would almost always accept those offers.

situation of the workers considerably. This can be seen from Figure 4.5, where the development of average income of workers and firms is shown graphically.<sup>23</sup> Notice, however, that incomes of firms are still clearly higher than incomes of workers after the introduction of the minimum wage. The reason for this is that reservation wages of workers did not exceed the fair wage of 250. As a consequence firms could always skim a larger part of the generated output than they had to pay to the workers.

#### 4.2 Economic Effects of the Elimination of a Minimum Wage (MW/NO-Sessions)

In this section we analyze the economic effects that occur after the elimination of the minimum wage. A comparison of the reservation wages across sessions shows very clearly that there is no significant difference between NO/MW- and MW/NO-sessions concerning reservation wages of workers in the MW-treatment.<sup>24</sup> Since there is no difference in the structure of reservation wages the economies are in the same state and hence reach approximately the same outcomes. For the MW-treatments the reversal of the treatment order does not cause a statistical significant difference in any of the observed variables. Wage payments of firms, employment levels and incomes of firms and workers are not statistically different in the two treatments.<sup>25</sup>

	NO/MW-Sessions	MW/NO-Sessions
Median Reservation Wage NO-Treatment	150	200
Median Reservation Wage MW-Treatment	220	220

*Table 4.3: Median Reservation Wages*

A comparing analysis of the NO-treatments in the two treatment orders, however, reveals interesting insights. Median reservation wages of workers are significantly higher in the MW/NO-sessions than in the NO/MW-sessions (see Table 4.3).<sup>26</sup> A comparison of the

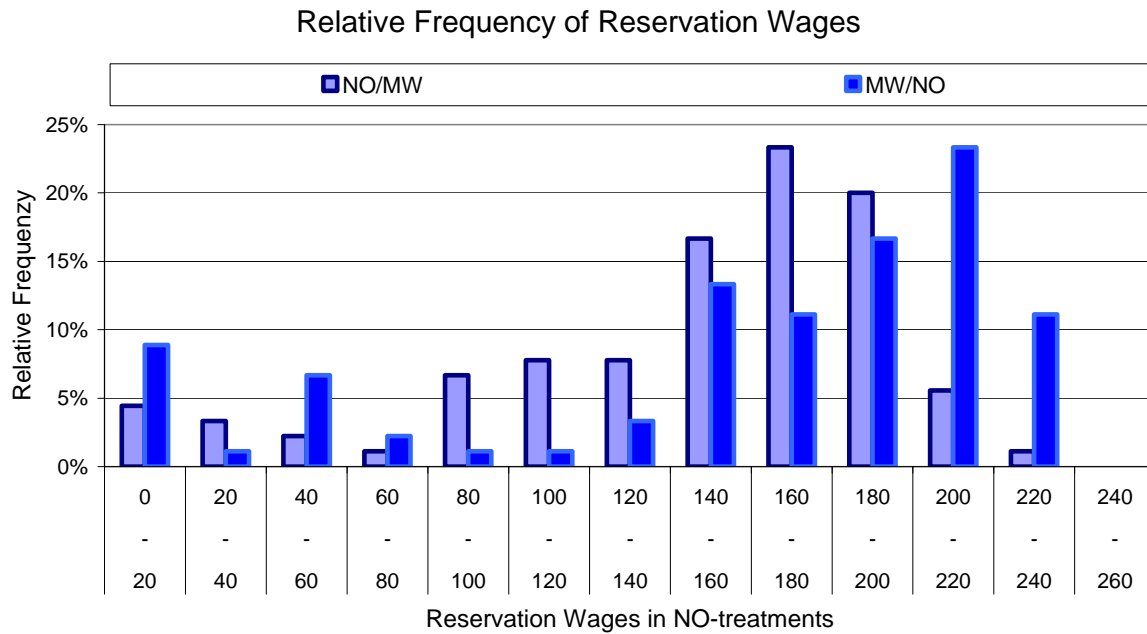
<sup>23</sup> One-sided Wilcoxon-signed-Ranks Tests with session averages as observations show that the increase of workers' incomes and the decrease of firms' profits are statistically significant (Workers: p-Value = 0.031; Firms: p-Value= 0.031).

<sup>24</sup> This finding supports our interpretation of the shift of the labor supply as a result of intention-based fairness preferences. Another possible explanation would have been, that workers try to take revenge for the lower incomes in the NO-treatment. Since reservation wages have the same magnitude if the MW-treatment is conducted before the NO-treatment, this intertemporal argumentation cannot be sustained.

<sup>25</sup> Wilcoxon-Mann-Whitney-Tests.

<sup>26</sup> One-sided Wilcoxon-Mann-Whitney-Test with session medians as observations (p-Value = 0.048). A comparison of average reservation wages gives a qualitatively identical picture. However, since averages are strongly influenced by extreme values (a small number of workers lowers reservation wages dramatically), the

distributions of average reservation wages of workers in the NO-treatment shows a clear difference between the NO/MW- and the MW/NO-sessions. In the NO/MW-sessions less than 10% of the workers indicate average reservation wages higher than 200, while in the MW/NO-sessions more than a third reaches that area (see Figure 4.6).



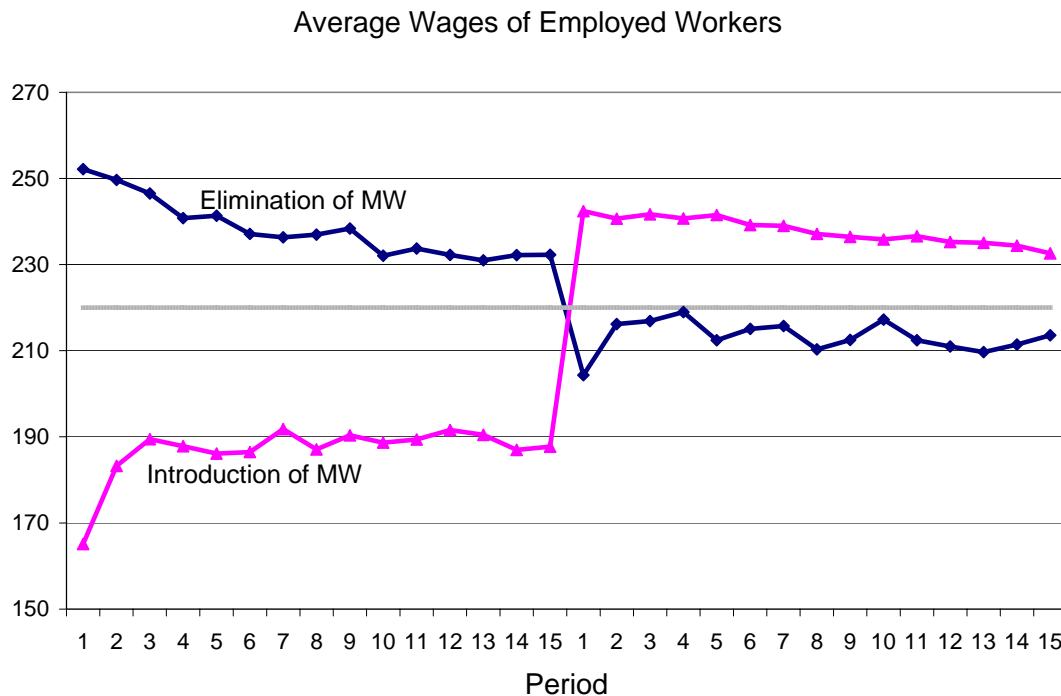
*Figure 4.6: Distribution of Average Reservation Wages of Workers*

These findings reflect perfectly what one would expect to find if either anchoring or entitlements or both effects are at work. It is nearly impossible to distinguish the two potential explanations from our data. The possibility that both interpretations are of some relevance is reinforced by the questionnaire data we collected after the sessions. There is a small number of statements in the questionnaires that allow for the conclusion that some subjects have taken the minimum wage as reference value for the determination of their reservation wage. Many participants, however, indicate, that they have a strong feeling to be entitled to get wages in the amount of the former minimum wage, despite the fact that firms are allowed to pay lower

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picture is not as clear: One-sided Wilcoxon-Mann-Whitney-Test with session averages as observations (p-Value = 0.075). Since firms do not know the reservation wages of their assigned workers, they have to build up expectations about the distribution of reservation wages. For this purpose the information contained in the median (what the majority does) is more relevant than the information in the average value (driven by extreme values indicated by a very small group of workers).

wages. Therefore it seems, that our results are mainly driven by entitlement effects and only to a small degree by anchoring effects.<sup>27</sup>



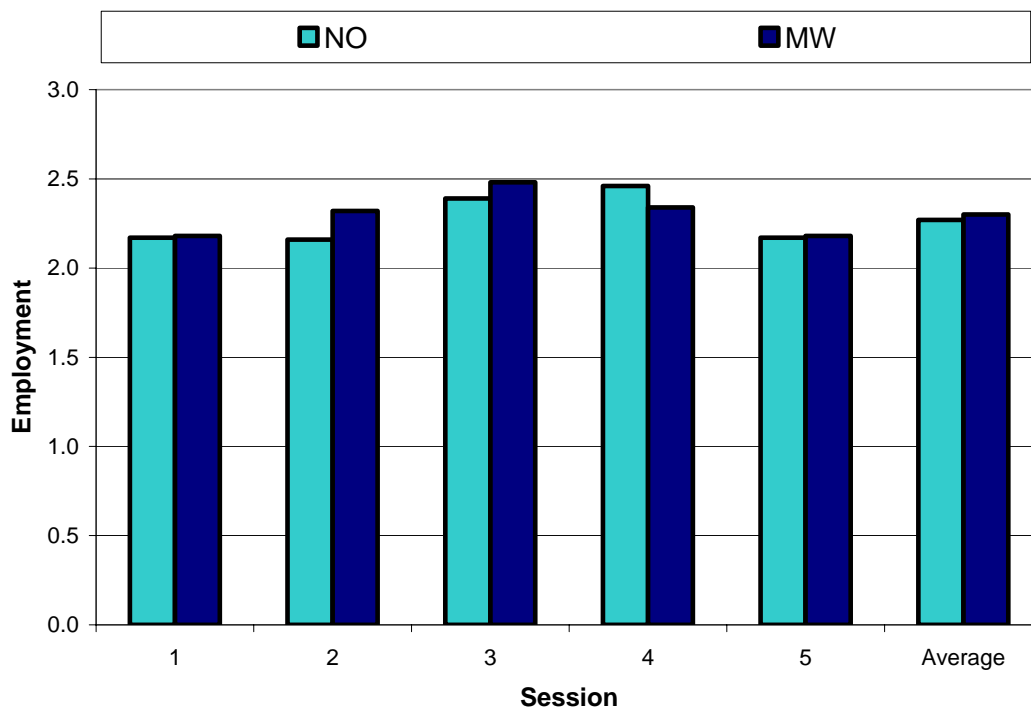
*Figure 4.7: Average Wage Offers of Firms*

For the firms, which are confronted with the according labor supplies this means, that probability of acceptance for wages below 200 is much lower in MW/NO-sessions than in the NO/MW-sessions. It could be expected that the rigidity of reservation wages in the MW/NO-sessions causes substantial coordination problems and that it takes a longer adjustment process until subjects agree on a certain wage level. This does, however, not happen. Surprisingly most firms do not even try to bring down wages very much. There may be two reasons for that. First, it could be that firms anticipate the behavior of workers very well and are therefore aware of the entitlement effects. Second, it is possible that firms had somehow the feeling to have an obligation to pay high wages, although they were not forced to do so anymore. We think that both arguments played a role. In the questionnaires a considerable

<sup>27</sup> There is experimental evidence that entitlements on the basis of past allocations are stronger, when past allocations were endogenously determined. That means subjects feel stronger entitlements if their past share was earned and not exogenously assigned (for a short review of the literature see Gächter and Riedl (2002), p. 20). In our MW/NO-treatment the relevant past split of benefits was only partly determined endogenously. The minimum wage, which is mainly accountable for the resulting payoffs, was exogenously given. Our results show, however, that entitlement effects can also be substantial in cases with assigned past payoffs.

number of the participants, who acted in the role of firms, stated that they had the feeling that workers were somehow entitled to get a wage close to the former minimum wage. Some even indicated that they had tried to relinquish a fair share of total payoffs to the workers.

After the elimination of the minimum wage labor supply only changes slightly. The fact that workers do only marginally lower their reservation wages forces firms to continue to pay wages in the region of the minimum wage (see Figure 4.7).<sup>28</sup> Accordingly since neither labor supply nor wages change dramatically the impact of the elimination of the minimum wage on employment is very small. In all sessions but one, however, average employment per firm is slightly decreasing, but the effect is not statistically significant (see Figure 4.8).<sup>29</sup> We therefore observe strongly asymmetric aggregated effects of the introduction and elimination of minimum wages.



*Figure 4.8: Average Employment per Firm in the MW/NO-Sessions*

<sup>28</sup> A one-sided Wilcoxon-Mann-Whitney Test with session averages as observations shows that the reversal of the treatment order causes a statistical significant difference for the wage payments in the NO-treatments (p-Value = 0.008) but not for the wage payments in the MW-treatments (p-Value = 0.5).

<sup>29</sup> One-sided Wilcoxon-signed-Ranks Test with session averages as observations (p-Value = 0.219)

Since average wages paid by the firms are lower and employment decreases slightly after the removal of the minimum wage the inequality of the income distribution is rising. Firms get statistically significant higher profits and workers earn less<sup>30</sup>, but the effect is clearly not as strong as the inverse effect in the opposite treatment order (see Figure 4.9).<sup>31</sup>

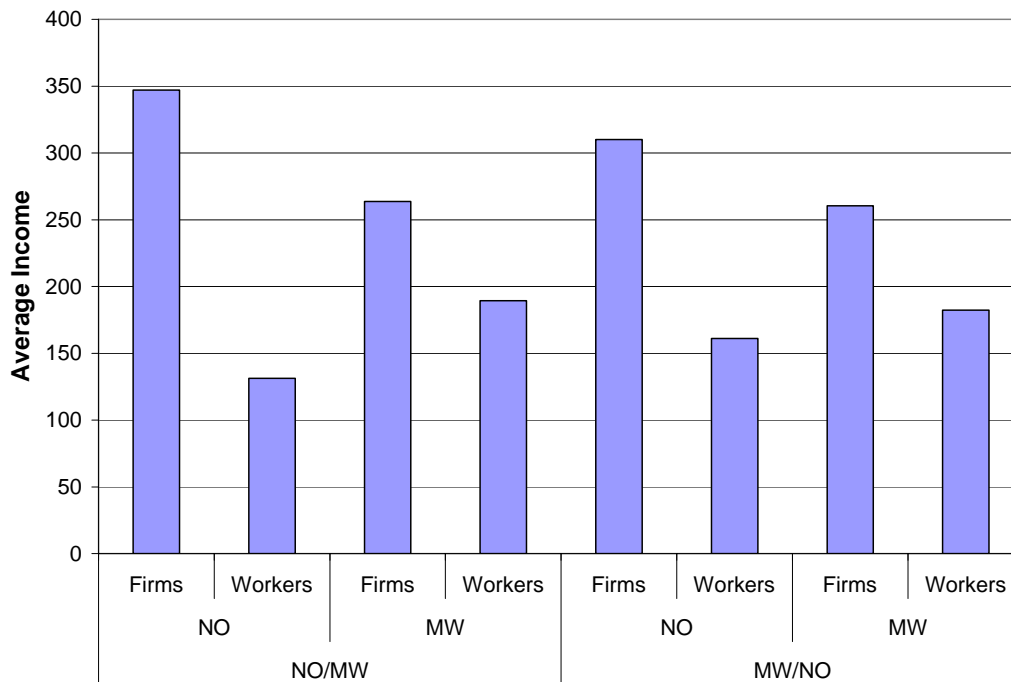


Figure 4.9: Average Payoffs of Firms and Workers

## 5 Discussion and Conclusions

In this paper we examine the economic effects of the introduction and the elimination of a minimum wage in an experimental labor market. In our setup firms with monopsonistic market power can produce output by hiring workers with homogenous productivity. According to the standard prediction this economy should be characterized by full employment in both treatments and the introduction of the minimum wage should only have distributive effects. Heterogeneous fairness preferences of workers imply, however, that firms are confronted with upward sloped labor supplies. In line with the arguments put forward in

<sup>30</sup> One-sided Wilcoxon-signed-Ranks Tests with session averages as observations (Firms: p-Value = 0.031; Workers: p-Value = 0.031).

<sup>31</sup> For the NO-treatments one-sided Wilcoxon-Mann-Whitney Tests with session averages as observations reveal that workers earn more and firms have lower profits in MW/NO than in the NO/MW-Sessions (Workers: p-Value = 0.048; Firms: p-Value = 0.048). For the MW-treatments we don't find a statistical significant difference.

recent theoretical models of intention-based fairness preferences we find that the introduction of the minimum wage causes a substantial upward shift of labor supply. The change of reservation wages forces firms to pay wages above the minimum wage. The introduction of the minimum enhances employment significantly. The positive employment is, however, relatively small in magnitude since the upward shift of labor supply partly compensates the positive effect of the higher wages. The elimination of the minimum wage does not change employment significantly. Because of substantial entitlement effects workers do not lower reservation wages and force firms to keep wages close to the level of the minimum wage.

In the present study we have shown for the first time, that the behavioral effects of minimum wage, specifically the impacts on the determination of reservation wages of workers, can have substantial consequences for the development of an economy after changes in the minimum wage legislations. We think that this study can be seen as a starting point for a new line of research on economic effects of minimum wages. Our results clearly indicate that social preferences play a very important role for the effects of minimum wages and that behavioral arguments deserve much more attention in future research and in political discussions.

It is obvious that more research is needed to fully understand the effects of minimum wages on individual behavior. Interesting extensions of our present setup would be the integration of an endogenous matching process of workers and firms or the examination of the additional effects in a market with incomplete contracts.

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