

RESEARCH ARTICLE

WILEY

Spillover effects of the minimum wage introduction based on horizontal fairness: A lab experiment

Burak Kağan Demirtaş 

Department of Economics, Abdullah Gül University, Kayseri, Turkey

Correspondence

Burak Kağan Demirtaş, Department of Economics, Abdullah Gül University, Sümer Kampüsü, Kocasinan, Kayseri, Turkey.
Email: burakkagan.demirtas@agu.edu.tr

Funding information

School of Social Sciences, University of Southampton; ESRC National Centre for Research Methods, University of Southampton

This paper analyses how a minimum wage introduction affects reservation wages and wage offers based on horizontal fairness with a lab experiment with two experimental settings. The first experimental setting was applied to two types of workers (low or high skills), whereas there are one type of workers in the second setting but two types of sectors, covered and uncovered sectors, depending on whether the minimum wage is enforced. Results show the minimum wage introduction generates spillover effects on the high-skilled workers' reservation wages and wage offers, whereas there is no evidence of the spillover effect on the uncovered sector.

JEL CLASSIFICATION

C90, C91, J01

1 | INTRODUCTION

Experimental studies show that workers have strong fairness concerns, in terms of labour market-related issues (Falk et al., 2006; Falk & Fischbacher, 2006; Fehr & Schmidt, 2005; Gächter & Fehr, 2002; Lee & Shahriar, 2017). Nosenzo (2013) states that workers consider their co-workers' payoffs as a judgment of the fairness of their own payoffs, which is known as horizontal fairness. In addition, Charness and Kuhn (2007, p. 693) discuss the efficiency wage models and state that '[...] workers' perceptions of fairness depend, at least in part, on the wages paid to their co-workers'. Empirical studies support these arguments, and the results show that workers compare their wages to others, and based on this comparison, people who feel underpaid decrease their effort levels (Abeler et al., 2010; Gächter & Thöni, 2010), experience less job satisfaction and are more likely to leave their jobs (Brown, 2001; Card et al., 2012; Fizek et al., 2002; Wade et al., 2006).

Grund and Rubin (2017) explain that workers use other employees' wages as a reference point and when there is a wage increase for others, it is interpreted as a deviation from the reference point. A worker's wage may not be increased at the same time as other workers' wages are increased, or a worker is offered a smaller wage increase compared to other workers. For this reason, a worker who previously believed that his/her wage was fair may now feel the wages are unfair considering the different levels of wage increases.

Because of this, employers may prefer treating their workers fairly, or they may consider workers' fairness perceptions and consequently arrange the wage increases based on the relative wages of the workers. As a result of these fairness considerations, an increase in wages of some workers might generate spillover effects on other workers' wages.

The purpose of this study is to examine whether or not the introduction of a minimum wage generates spillover effects on wages and wage demands of workers, who are not legally bound by the minimum wage,¹ due to horizontal fairness considerations of the employees and employers. The minimum wage introduction, which is an exogenous change in the market, may affect employees differently from wage increases made by employers. Falk et al. (2008) state that people not only care about whether the outcomes are fair or not, but they also care about fair or unfair intentions behind the results. For this reason, if the minimum wage changes perceptions of horizontal fairness in wage differences, then observed effects of wage demands or wage offers may be different from the effects caused by wage increases from employers.

Although there are empirical studies finding spillover effects of minimum wage changes on wage levels (Fajnzylber, 2001; Jaramillo Baanante, 2004; Lemos, 2009; Neumark & Wascher, 2008), it is not easy to identify causal factors,² their relative importance and whether or not the fairness concerns are one of the reasons behind these results since these studies are based on non-experimental data. For

this reason, a laboratory experiment is conducted for this study. Due to the advantages of the lab experiment, it is possible to distinguish between these effects by excluding all other effects except the possible fairness concerns.

The experimental design is based on Falk et al.'s (2006) study. They focused on fairness issues between employers and workers based on the self-interest hypotheses instead of workers' concerns about horizontal fairness based on the co-workers' wages as it is examined in this study. As in the original design, wage offers are measured for the employers' fairness perceptions, whereas the workers' reservation wage decisions are focused on observing employees' fairness concerns. The reservation wage is the lowest wage a job seeker accepts to work (Cahuc & Zylberberg, 2004). This can be interpreted that a worker having fairness concerns determines his/her reservation wage as the least fair offer he/she will accept.

The main contribution of this study is to provide causal evidence of whether minimum wage introduction causes spillover effects on wage offers and reservation wages by using a controlled lab experiment. The experiment consists of two experimental settings. There are two different worker types based on their productivity levels in the first experimental setting: low-skilled worker (LSW) and high-skilled worker (HSW). There are also firm owners (FOs) matched with these workers. Before each period starts, one FO is rematched with three LSWs and HSWs. While FOs decide wage offers and the number of workers of each type they would like to hire, workers decide on their reservation wages. After everyone makes their respective decisions, the computer accepts or rejects the wage offers based on the reservation wages on behalf of the workers, and one period ends with learning the payoffs. The experimental setting consists of 30 periods. After the 15th period, the minimum wage is introduced unexpectedly, and participants play the same game with the minimum wage for 15 more periods. In the second experimental setting, there is one type of worker (LSW); however, all of these LSWs are assigned to one of the two sectors randomly before the experiment starts: covered and uncovered sectors.³ The game is the same as the first experimental setting; however, after the 15th period, the minimum wage is introduced only for the workers in the covered sector.

Under this experimental design, the main analysis for horizontal fairness in the first experimental setting is whether or not HSWs increase their reservation wages and/or FOs increase their wage offers for these workers after the minimum wage is introduced. On the other hand, for the second experimental setting, based on horizontal fairness, it is tested whether or not workers in the uncovered sector also increase their reservation wages after the minimum wage is introduced in the covered sector. In terms of the wages, it is analysed if the FOs increase the wage offers for the workers in the uncovered sector to provide horizontal fairness after the minimum wage is introduced in the other sector.

The results show that there is evidence of horizontal fairness concerns in the first experimental setting. FOs increased the wage offers for the HSWs after the minimum wage was introduced, although their offers were already higher than the minimum wage in its absence, and this shows evidence of the spillover effect of the minimum wage

introduction. The average value of the reservation wages of the HSWs was less than the minimum wage level in the absence of the minimum wage; however, these workers not only demanded more than the minimum wage level but more than the LSWs, after the minimum wage was introduced. In the second experimental setting, there is no evidence of spillover effect based on the horizontal fairness concerns. Neither reservation wages of the workers in the uncovered sector nor the wage offers for these workers increased after the minimum wage was introduced.

There may be two explanations why workers did not react to the violation of horizontal fairness in the second experimental setting. Firstly, they may not have considered this case as a violation of horizontal fairness because the new regulation in the market is not implemented by the employer. Secondly, although it was not the employers' decision, workers may have considered it unfair because employers still could have increased their wages. However, they might have preferred not to react to the violation of horizontal fairness by increasing their reservation wages. Studies about how workers react to the violation of horizontal fairness are mostly based on the gift-exchange games and results show that workers react to the violation with decreased effort in the workplace. However, decreasing effort and increasing the reservation wages generate different consequences. In a gift-exchange game, decreasing the effort increases the worker's payoff, while increasing the reservation wage may result in zero earnings for the worker. Therefore, they may not have considered it worthy to take the risk just to punish the FOs in the case of a violation of horizontal fairness. Then, it should be discussed why HSWs in the first experimental setting did not behave similarly. One possible explanation for these results is that people might be more sensitive towards losing an advantage, meaning earning higher wages due to having a higher productivity level and feeling more valuable at the beginning of the experiment and then losing it. For this reason, these workers might have thought that punishing the firm by providing zero revenue is worth it even if they have to pay the price.

This study proceeds as follows: Section 2 mentions the related literature, and Section 3 explains the experimental design and procedure. The results are shown in Section 4 which is followed by the discussion and concluding remarks in Section 5.

2 | LITERATURE REVIEW

Many empirical studies focusing on the minimum wage and wage levels also show that introducing or increasing the minimum wage indeed not only does affect the wages of people who are bound by wage changes (LSWs), but it also generates spillover effects onto the wages of people who already earn more than minimum wage (HSWs) (Fajnzylber, 2001; Neumark & Wascher, 2008). However, there are mixed results in terms of the spillover effects on the wages in uncovered sectors. Although there are some papers such as Hohberg and Lay (2015), which do not find any spillover effects, there are also studies showing that introducing or increasing the minimum wage

increases the wages in the uncovered sectors (Fajnzylber, 2001; Jaramillo Baanante, 2004; Lemos, 2009). Therefore, the results of this study related to HSWs are consistent with the previous studies; however, it cannot be claimed for the uncovered sectors.

There are also experimental studies related to the minimum wage introduction and fairness perceptions apart from Falk et al.'s (2006) study. Wang (2012) also conducted a lab experiment based on Falk et al.'s (2006) experimental design and analysed asymmetric information between workers and FOs in terms of the minimum wage level. He replicated the study and found similar results to the original study. In addition, he found that if workers did not know the minimum wage level and if employers were aware of this situation, employers set the wage offers equal to minimum wage or they significantly decreased them compared to the case when the workers knew the minimum wage level. On the other hand, Brandts and Charness (2004) analysed how market condition changes affected people's behaviours in a gift-exchange game. They found that minimum wage affected people's behaviours modestly. Having a minimum wage decreased the effort levels for all wage offers and the probability of paying a higher wage. In another paper on the minimum wage and gift-exchange game, Owens and Kagel (2010) studied how minimum wage affected gift-exchange game results when the minimum wage was introduced within an ongoing labour market. They found that minimum wage introduction increased both the wages and effort levels. In addition, Dittrich et al. (2014) focused on how bargaining results over a rent change after the minimum wage introduction in a bilateral firm-worker bargaining setting. They found that minimum wage introduction leads to an increase in wages even if the minimum wage binding level is significantly low. Finally, Koenig et al. (2019) conducted a lab experiment based on a real-effort task to analyse how the minimum wage affects workers' fair wage perceptions. The results show no evidence that the workers use the minimum wage as a reference point in the evaluation of their fair wages. Although these experimental studies analysed minimum wage and changes in fairness perceptions, minimum wages were introduced for everyone in these experiments. Thus, they could not infer something about whether or not a minimum wage causes spillover effects on the wages of others who are not directly affected.

3 | EXPERIMENTAL DESIGN

This experiment has two experimental settings, and each experimental setting consists of a group game. I designed both experimental settings on the software called z-Tree (Fischbacher, 2007). As stated above, the design is a modified version of Falk et al.'s (2006) experiment. In their experiment, a group consisted of one FO and three homogenous workers in terms of productivity levels. In this experiment, in addition to this group consisting of four participants, I added three more workers who either had the same level of productivity or higher level of productivity depending on the experimental setting.

3.1 | Design of the game

3.1.1 | The first experimental setting

There were different roles for the participants, and each participant was randomly assigned to a certain role at the beginning of the session, and all participants kept their roles throughout the session. There were three roles that participants were assigned: FO, LSW and HSW. The participants were divided into groups before each period started. One group included seven participants: one FO, three LSWs and three HSWs. Each FO was assigned to the workers randomly in every period.

None of the participants' role identities were revealed to other participants, and all participants were aware that everybody in the experiment should remain anonymous during the experiment. In addition, instead of using pounds (GBP), participants used *experimental currency units* (ECU).

When a period started, each FO was required to submit four different hiring decisions:

1. A wage offer to LSW.
2. The number of LSWs he/she would like to hire (0 or 1 or 2 or 3 LSWs).
3. A wage offer to HSW.
4. The number of HSWs he/she would like to hire (0 or 1 or 2 or 3 HSWs).

As in Falk et al. (2006), there was no wage discrimination in the same skill group. This meant that the wage an FO proposed to the LSW was valid for all LSWs who received an offer from him. This rule was also applied to HSW.

FOs entered their wage offers, while workers entered the lowest wage (reservation wage) they were willing to accept in the current period. If an FO wanted to hire X workers from either the LSWs or HSWs, the computer chose X workers randomly among the three workers from that group, and only these chosen workers received an offer. Then, these workers' reservation wages were compared to the wage offers by the computer. If the reservation wage was equal to or less than the offer, the offer was accepted by the computer on behalf of the worker. If the reservation wage was greater than the offer, it was rejected by the computer automatically. All workers entered their reservation wages without knowing the decisions of the other participants.

At the end of each round, FOs were informed of their earnings for each skill group and of the number of LSWs and HSWs that accepted their offers. However, they were not informed of the workers' reservation wages. On the other hand, workers who did not receive an offer were just informed that they would not receive an offer and their payoffs were zero for that period. No further information was shared with them. However, if a worker received an offer, they were informed about the wage offer, their payoff which was either the wage offer or 0 based on whether or not they accepted the offer and how much the FO earned as a result of LSWs and HSWs.

An FO's profit was defined as

Profit = total revenue – total cost

Table 1 shows how much ECU an FO earns for each skill category by hiring an additional worker. The table applied to all FOs and was common knowledge for all participants in the experiment. For example, if an FO owner hired only one LSW, he/she received 400 ECU revenue for the LSWs. Similarly, if two HSWs were hired, the owner's revenue would be 1500 for the HSWs.

At the same time, there are hiring costs (wages) for the FOs, which are to be subtracted from the revenue as mentioned above. If the wage was WL for the LSWs and WH for the HSWs, the payoff function for an FO depending on the number of the workers he/she hired was

$$\text{Payoff function of an FO for LSWs} = \begin{cases} 0 & \text{zero worker} \\ 400 - WL & \text{one worker} \\ 750 - 2WL & \text{two workers} \\ 1000 - 3WL & \text{three workers} \end{cases} \quad (1)$$

$$\text{Payoff function of an FO for HSWs} = \begin{cases} 0 & \text{zero worker} \\ 800 - WH & \text{one worker} \\ 1500 - 2WH & \text{two workers} \\ 2000 - 3WH & \text{three workers} \end{cases} \quad (2)$$

On the other side, a worker's payoff function is illustrated as follows:

$$\text{Payoff function of a worker} = \begin{cases} 0 & \text{if he/she does not receive an offer} \\ 0 & \text{if he/she receives an offer but rejects it} \\ w & \text{if he/she receives an offer and accepts it} \end{cases} \quad (3)$$

The experiment consisted of 30 periods. Until the 16th period, the wage interval (wage offers and reservation wages) was $[0, 1000]$. However, after the 15th period, participants received an unexpected notification of the introduction of minimum wage. They were informed that a new rule had been introduced and FOs could not offer any wages less than 220, and all participants were informed that the new rule was common knowledge and known by everybody in the experiment.⁴

At the end of the experiment, three of 30 periods were randomly chosen, and the summation of these three periods was the amount

TABLE 1 Firm's revenue function in the first experimental setting

Number of workers hired	Total revenue (LSW)	Total revenue (HSW)
1	400	800
2	750	1500
3	1,000	2000

participants earned from the experiment. The same three periods were chosen for everybody in the experiment. Furthermore, there was an additional lottery for FOs. A number was chosen between 1 and 2, and when a 1 was drawn, the FOs earned profit as a result of the LSWs, and if a 2 was drawn, they earned profit as a result of the HSWs. Thanks to this feature, it could be excluded all possible effects, such as the substitution effect because the payoffs for the different types of workers are independent for the FO. On the other hand, this feature might affect the FOs in terms of the number of workers they would like to hire based on their risk preferences. They might be induced to hire both types of workers if they are risk-averse. For this reason, employment-related issues are not included in this study in contrast to Falk et al.'s (2006) study.

The total amount of ECU the participants earned in the course of the experiment was converted into pounds after completion of the experiment with an exchange rate of $100 \text{ ECU} = 1.0 \text{ (GBP)}$. After the conversion, the earnings from the experiment were added to the amount of £4 (show-up fee), and the participants received this money at the end of the experiment.

3.1.2 | The second experimental setting

Almost all the rules which have been applied in the first experimental setting were also valid for this experimental setting. Although the second experimental setting was similar to the first, there are two important differences. The first difference was that, in this experimental setting, workers were divided into two groups, T1W (Type 1 workers) and T2W (Type 2 workers), as in the first experimental setting, though, unlike the first experimental setting where each group included workers with different levels of skill, here all the workers were low skilled.⁵ The revenue table for this experimental setting appeared as in Table 2.

The second important difference was that the minimum wage was introduced only to T2Ws. After the 15th period, participants were informed about the minimum wage introduction and that this new rule covered only T2Ws, while there was no new rule for T1Ws. They were also informed that this information was communicated to all participants in the experiment. Calculation of the payment based on the chosen three periods for the workers and the FOs and chosen group of workers was the same as the first experimental setting.

The total amount of ECU the participants earned over the course of the experiment was converted into pounds after completion of the

TABLE 2 Firm's revenue function in the second experimental setting

Number of workers hired	Total revenue (T1W)	Total revenue (T2W)
1	400	400
2	750	750
3	1000	1000

experiment with the exchange rate set at $100\text{ECU} = 1.5$ (GBP). After this conversion, the earnings from the experiment were added to £4 (show-up fee), and this was the amount received by participants at the end of the experiment.⁶

3.2 | Running the experiment

The experiment was run in the ExpReSS Lab at Royal Holloway, the University of London, in November 2015. All students who participated in all sessions were undergraduate students at Royal Holloway, University of London. Students who were registered for the database to participate in the experiments were informed via emails. Four sessions were run for each experimental setting. For the first experimental setting, there were three sessions with 28 participants (four groups in each session) and one session with 21 participants (three groups in the session). The reason for having fewer participants in the last session of the first experimental setting was the lack of participants for that day. However, there were four sessions with 28 participants in each session for the second experimental setting.⁷

When the participants arrived at the lab, they picked a number from a bag and sat at the terminal according to the numbers they picked. After everyone sat at a terminal, consent forms and participant information sheets were distributed to the participants, and they were told to read the information sheet carefully before they completed the consent forms. After a while, the paper that explains the general rules of the experiment was distributed to the participants. These general rules were read aloud by the computer. Since there were different roles for the participants, there were different instructions for each role. After the general rules, specific instructions for each role were distributed to the participants. Then, all participants were asked to solve some quiz questions.

After all participants entered the correct answers for the quiz questions on the computer screen, they started the first practice period. They were told that they would have three practice periods to familiarize themselves with the game on the computer. These practice periods would not affect their earnings. Following the third practice period, they started the first period of the experiment.

These sessions typically lasted no longer than 75 min, from the moment the consent form and the participant information sheet were distributed, to the end of the 30th period. Participants were paid £11.80 on average.

3.3 | Hypotheses

The hypotheses related to the horizontal fairness and spillover effects of the minimum wage introduction are discussed below.

H1. *HSWs' (T1Ws') reservation wages will be higher than (equal to) the LSWs' (T2Ws') reservation wages on average in the absence of the minimum wage.*

Workers compare their wages to other workers' based on the productivities, and it is believed that workers with different productivities should earn different wages and workers with similar productivities should earn similar wages due to horizontal fairness perceptions (Abeler et al., 2010; Gartenberg & Wulf, 2017; Kacperczyk & Bazzazian, 2015). The HSWs are aware that they provide more revenue to their employers than the LSWs, whereas T1Ws and T2Ws workers are aware that they provide the same revenue to their employers in these experimental settings. For this reason, HSWs are expected to demand higher wages than the LSWs, and T1Ws and T2Ws should demand similar wages before the minimum wage is introduced.

H2. *FOs will offer higher (equal) wages to the HSWs than the LSWs (to the T1Ws and T2Ws) on average before the minimum wage introduction.*

FOs offer higher wages to the HSWs than the LSWs due to two possible reasons. Firstly, FOs may want to behave fairly towards their employees so that they consider the differences and want to provide horizontal fairness between them. Secondly, they may be aware of the workers' fairness concerns and expect the difference in reservation wages between HSWs and LSWs. As a result, in order to hire these workers, they have to offer higher wages to the HSWs than the LSWs.

Similarly, since both types of workers in the second experimental setting provide the same level of revenue, FOs would not discriminate the wages between T1Ws and T2Ws, or these two types of workers' reservation wages may be similar, and this leads FOs to offer similar wages to these workers.

H3. *HSWs (T1Ws) increase their reservation wages after the minimum wage introduction.*

If the HSWs' reservation wages are higher than the minimum wage level before it is introduced, it should not be binding for these workers. For this reason, they should not change their reservation wages with the minimum wage according to the reservation wage concept. However, the wage difference between HSWs and LSWs decreases with the minimum wage. Therefore, due to their horizontal fairness concerns, it would be expected that the HSWs also increase their reservation wages, since they consider the relative wage changes. On the other hand, if the HSWs' reservation wages are below or equal to the minimum wage level in the absence of it, they should be content with earning the minimum wage level since they should accept all the wage offers which are equal or greater than their reservation wages. However, since the LSWs will earn at least the minimum wage level, HSWs increase their reservation wages above the minimum wage level and keep demanding higher wages than the LSWs.

On the other hand, the minimum wage is not binding for the T1Ws in the second experimental setting. However, it would be expected that they also increase their reservation wages with the minimum wage introduction since they think that they should earn similar

wages to T2Ws who are bound by the minimum wage, due to their horizontal fairness concerns.

H4. FOs increase their wage offers for the HSWs (T1Ws) after the minimum wage introduction.

Even if the FOs already offer higher wages to the HSWs than the minimum wage level in absence of it, we could still expect that they increase their wage offers with the minimum wage introduction for two possible reasons as discussed in H2. Either these workers increase their reservation wages and FOs are compelled to increase the wages in order to hire these workers, or they increase the wages in order to provide horizontal fairness between HSWs and LSWs since the minimum wage introduction decreases the difference between the wages of these workers.

In the second experimental setting, although FOs do not have to increase the wage offers for the T1Ws since the minimum wage does not cover them, they also increase the wage offers for these workers to provide horizontal fairness. Alternatively, these workers also might demand higher wages by increasing their reservation wages due to their horizontal fairness concerns as discussed above. For either of the reasons, minimum wage introduction leads FOs to increase their wage offers for the T1Ws.

4 | RESULTS

The results of each experimental setting will begin with the reservation wages followed by the FOs' wage offers.

4.1 | Results of the first experimental setting

Result 1: HSWs' reservation wages on average are greater than the LSWs', with and without the minimum wage. There is evidence of the spillover effect of the minimum wage introduction on the HSWs' reservation wages.

The table below shows the average values of the reservation wages for each group, before and after the minimum wage.⁸

As can be seen from Table 3, the HSWs' reservation wages are greater than the LSWs' in the absence of the minimum wage. The

TABLE 3 Average values of the reservation wages

	Reservation wage (LSW)	Reservation wage (HSW)
Before the minimum wage introduction	80.27 (70.63)	118.69 (117.19)
N/observations	45/675	45/675
After the minimum wage introduction	221.8 (7.67)	246.04 (46.25)
N/observations	45/675	45/675

Note: Standard deviations are in parentheses.

difference is statistically significant according to the Mann–Whitney (M-W) test with a p -value of .000. It means that HSWs demanded more than the LSWs based on horizontal comparisons, as discussed in H1. After the minimum wage introduction, the average value of the LSWs' reservation wages increases to 221.8, whereas the average value of the HSWs' reservation wages increases to 246.04, as shown in Table 3. The difference between the two types of workers' reservation wages is still statistically significant according to the M-W test result with a p -value of .000.

There are 12 reservation wage observations (from a total of 675 observations) which are greater than 220 for the LSWs in the first 15 periods. Following the introduction of the minimum wage, the number the observations greater than 220 increased to 79 (from a total of 675). In other words, within the LSWs, the percentage of the observations where the reservation wages are higher than 220 increased from 2.1% to 11.7% with the introduction of the minimum wage. On the other side, before the minimum wage introduction, 136 out of 675 observations (20%) are greater than 220, whereas the number increases to 267 (39.56%) after the minimum wage introduction. This is also consistent with the claim that the spillover effect exists for the HSWs' reservation wages.

The change in reservation wages with the minimum wage introduction might be due to the mandatory increase of the values below 220 in the absence of the minimum wage. However, if all the reservation wages below 220 are increased to 220 and all the reservation wages equal or greater than 220 are kept constant, then the change in reservation wages due to the mandatory increase can be estimated. According to this calculation, the average reservation wage value for the LSWs should be 220.62. However, this value is 221.8 as can be seen from Table 3. Although the difference seems very small, it is significantly different according to the M-W test with a p -value of .000. In accordance with the above calculation, the average value of HSWs' reservation wages should be 238.73. However, it is 246.04 as can be seen from the same table. This difference is significant with a p -value of .000 according to the M-W test. As a result, these calculations show that reservation wages of the workers increased more than they were supposed to in terms of reservation wage property.

The interesting point is that the difference between HSWs' and LSWs' average reservation wages decreases after the minimum wage introduction from 38.4 to 24.2. This means that the increase in reservation wages of LSWs is higher than the increase in the HSWs' reservation wages after the minimum wage introduction. However, the difference in these increases between the two types of workers' reservation wages is not statistically significant according to the M-W test with a p -value of .61.

For both LSWs' and HSWs' reservation wage, distributions can be seen from the figures below. Figure 1 shows the distribution of the reservation wages among the LSWs, with and without the minimum wage, whereas Figure 2 shows the distribution of the reservation wages among the HSWs.

Table 4 shows the regression results for the reservation wages of both LSWs and HSWs. The dependent variable is the value of the reservation wage for LSWs (Column 1) and HSWs (Column 2), and the

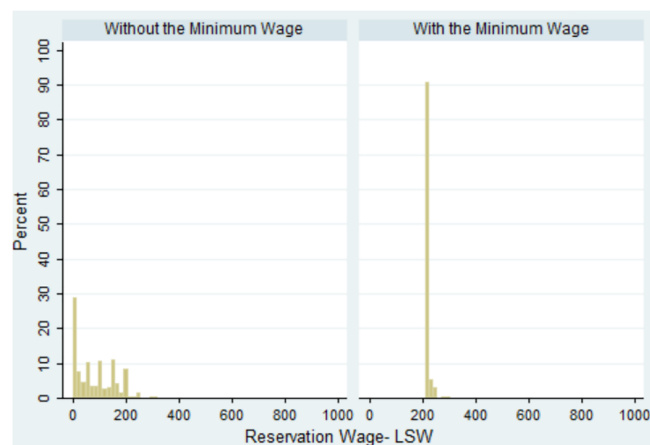


FIGURE 1 Reservation wages: LSW [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/mede.3602)]



FIGURE 2 Reservation wages: HSW [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/mede.3602)]

TABLE 4 OLS regression results for the reservation wages

Dependent variable	Reservation wage (LSW)(1)	Reservation wage (HSW)(2)
Constant	85.54 ^{***} (6.41)	82.08 ^{***} (4.99)
Minimum wage dummy	148.90 ^{***} (7.74)	128.00 ^{***} (17.01)
Period	Yes	Yes
Session fixed effect	Yes	Yes
Observations	1350	1350
Prob > F	0.000	0.000
R-squared	0.67	0.42

Note: Robust standard errors clustered at the session level are in parentheses.

* $p < .10$. ** $p < .05$. *** $p < .01$.

main independent variable showing the treatment effect is the dummy for the minimum wage introduction. In addition, there are session fixed effect dummies and the period variable. Coefficients of the minimum wage dummies are positive and statistically significant at the 1% level according to the results below for both LSW and HSW regressions.

Result 2: FOs offered higher wages to the HSWs than the LSWs before the minimum wage introduction. There is evidence of the spill-over effect of the minimum wage introduction on the wage offers to the HSWs. The results are similar for the actual wages.

Table 5 shows the mean values of the wage offers and actual wages for both worker groups, with and without the minimum wage. As can be seen from the table, wage offers for the HSWs are much greater than for the LSWs in the absence of the minimum wage, which demonstrates that FOs offer different wages to the workers dependent on the level of productivity as discussed in H2. The difference is statistically significant with a p -value of .000 according to the M-W test. In terms of the difference between before and after the minimum wage introduction, there is a small increase for the HSWs on average, but the increase is not statistically significant according to the M-W test result with the p -value of .35.

Changes in actual wages due to the introduction of the minimum wage also show similar results to the wage offers. As is shown in Table 5, the average value of the actual wages of LSWs was below the minimum wage in the absence of the minimum wage, and it increased above the minimum wage after it was introduced. According to the Wilcoxon signed-rank (W-S-R) test results, actual wage values of LSWs, after the minimum wage introduction, are significantly different than 220 with the p -value of .000. In contrast, the mean value of the actual wages of HSWs decreases with the minimum wage introduction as can be seen from the table. However, this is not statistically significant according to the M-W test result with a p -value of .22.

The distribution figures below show the differences in the wage offers before and after the minimum wage introduction for both the LSWs and HSWs (Figures 3 and 4).

The average wage offers over the periods were also checked to determine if there are any observable differences between the first several periods and the periods which follow as a result of the learning process of the participants. Figures 5 and 6 show that the first couple of periods and the later periods which follow indeed have large differences which may be caused by the learning process. For example, M-W test results show that the wage offers in the first five periods are significantly different from the offers in periods 6–15, with p -values of .000 for both LSWs' and HSWs' wage offers.

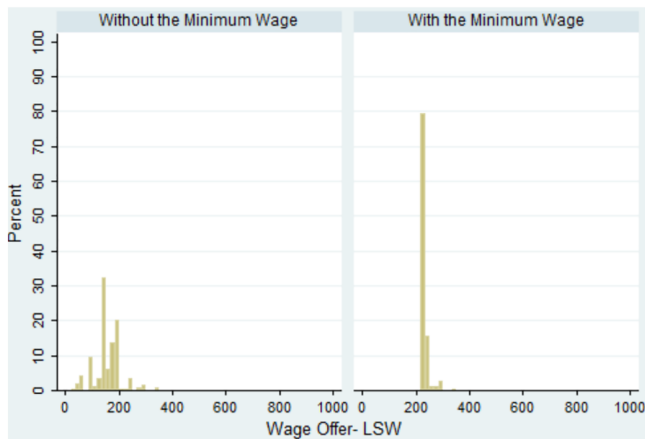
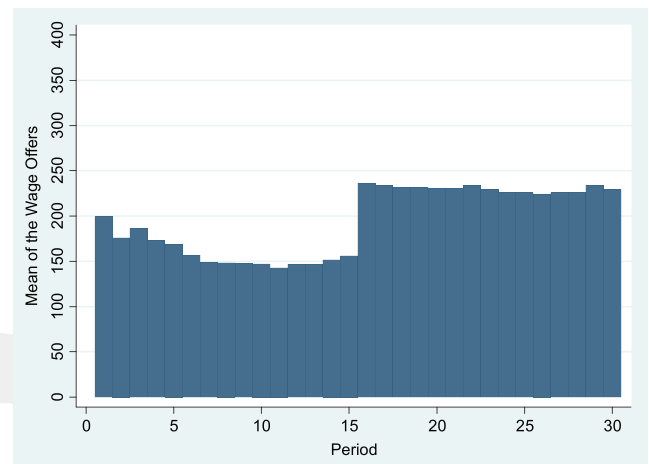
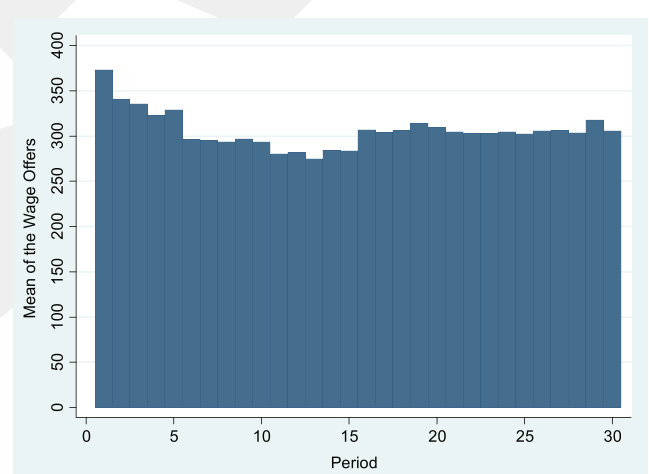
As can be seen in Table 6, if the first five periods are omitted (as an example), the average values of the wage offer before the minimum wage introduction decreases for both LSWs and HSWs. It increases the differences in the average values of wage offers for LSWs and HSWs before and after the minimum wage, and the difference (before and after the minimum wage introduction) for the HSWs becomes statistically significant according to the M-W test result with a p -value of .000. These results are also valid for the actual wages.⁹

For the wage offers, the reason for the change with the minimum wage introduction might be the mandatory increase by the minimum wage as is discussed for reservation wages above. For this reason, the same method is applied for the wage offers. This means that all the wage offer values below 220 before the minimum wage was introduced were increased to 220 and the rest remained constant.

TABLE 5 Average values of the wage offers and actual wages

	Wage offer (LSW)	Wage offer (HSW)	Actual wage (LSW)	Actual wage (HSW)
Before the minimum wage introduction	159.29 (50.04)	304.22 (95.24)	164.97 (48.70)	311.81 (91.69)
N/observations	15/624	15/625	-/536	-/575
After the minimum wage introduction	230.03 (17.52)	306.70 (58.54)	230.61 (18.03)	308.4 (59.77)
N/observations	15/630	15/620	-/575	-/570

Note: Standard deviations are in parentheses.

**FIGURE 3** Wage offers: LSW [Color figure can be viewed at wileyonlinelibrary.com]**FIGURE 5** Wage offers over periods: LSW [Color figure can be viewed at wileyonlinelibrary.com]**FIGURE 4** Wage offers: HSW [Color figure can be viewed at wileyonlinelibrary.com]**FIGURE 6** Wage offers over periods: HSW [Color figure can be viewed at wileyonlinelibrary.com]

According to this calculation, the wage offers for LSWs were supposed to be 223.54. However, it is equal to 230.03 as can be seen from Table 5. The difference is statistically significant according to the M-W test result with a p -value of .000. Similarly, the average value of wage offers for the HSWs was supposed to be 316.56. The real value is lower than this as can be seen from Table 5 (306.70). However, this difference is not statistically significant according to the M-W test result with a p -value of .44. If the first five periods are excluded, then the average wage offer value for the HSWs becomes 300.47, and it is significantly different from the real value (306.70) according to the

M-W test result with a p -value of .006. These results show that the wage offers increased more than the mandatory increase.

Regression results in Table 7 provide more precise information about the changes. The dependent variable is the value of the wage offer for LSWs (Column 1) and HSWs (Column 2), and the main independent variable showing the treatment effect is the dummy for the minimum wage introduction. In addition, there are session fixed effect dummies and the period variable to deal with the period problem as discussed above. In addition, Columns 3 and 4 show the results of the

TABLE 6 Average values of the wage offers and actual wages without the first five periods

	Wage offer (LSW)	Wage offer (HSW)	Actual wage (LSW)	Actual wage (HSW)
Before the minimum wage introduction	149.08 (39.75)	287.98 (81.08)	152.73 (38.94)	293.57 (78.52)
N/observations	15/422	15/429	−/361	−/388
After the minimum wage introduction	230.03 (17.52)	306.70 (58.54)	230.61 (18.03)	308.4 (59.77)
N/observations	15/620	15/630	−/575	/570

Note: Standard deviations are in parentheses.

TABLE 7 OLS regression results for the wage offers and actual wages

Dependent variable	Wage offer (LSW)(1)	Wage offer (HSW)(2)	Actual wage (LSW)(3)	Actual wage (HSW)(4)
Constant	180.33*** (6.93)	297.27*** (14.97)	186.97*** (6.75)	304.71*** (12.27)
Minimum wage dummy	96.41** (18.39)	43.44* (14.29)	96.38** (18.28)	41.67** (12.05)
Period	Yes	Yes	Yes	Yes
Session fixed effect	Yes	Yes	Yes	Yes
Observations	1244	1255	1111	1140
Prob > F	0.000	0.000	0.000	0.000
R-squared	0.51	0.10	0.50	0.11

Note: Robust standard errors clustered at the session level are in parentheses.
* $p < .10$. ** $p < .05$. *** $p < .01$.

same regression models for the dependent variable actual wage for LSWs and HSWs, respectively.

As can be seen in the table, introducing the minimum wage has a significant effect on the LSWs' wage offers as it is expected (Column 1) since the minimum wage is binding on average for these workers. The coefficient of the minimum wage dummy variable in the HSW regression (Column 2) is positive and significant at the 10% level with a p -value of .056. This result shows that FOs increased the wage offers for HSWs after the minimum wage introduction although they were already offering wages greater than the minimum wage level on average. This means that introduction of the minimum wage generated a spillover effect on the HSWs' wages, as discussed in H4. The results for the actual wages in the last two columns are consistent with the wage offer results. It means that actual wages increased after the minimum wage introduction although the value was already greater than the minimum wage level before the minimum wage was introduced for HSWs.

Tables 8 and 9 show both average actual wages and the profit-maximizing average wage offers over the sessions for LSWs and HSWs, respectively.¹⁰ The profit-maximizing wage values are calculated based on the reservation wage decision discussed above. As can be seen from the tables, actual wages are greater than the profit-maximizing wages, and it can be interpreted as FOs offered more than they were supposed to offer in terms of the profit maximization values. Actual wages are statistically different from the profit-maximizing wage values for all sessions according to the W-S-R test results with all the p -values at .000 for both LSWs and HSWs.

On the other hand, for the aggregate-level data including all the sessions, the average actual wage for the HSWs is 164.97, whereas the average profit-maximizing wage value is 89.23 before the

minimum wage introduction. The difference is statistically significant according to the W-S-R test with a p -value of .000. In addition, the average actual wage is 230.61, and the average profit-maximizing wage is 221.41 for these workers after the minimum wage introduction. The difference is also significant with a p -value of .000 based on the W-S-R test. For the HSWs, the aggregate-level data including all the sessions show that the average value of actual wages is 311.81 (308.40) and the average profit-maximizing wage value is 137.67 (255.21) before (after) the minimum wage introduction. The average actual wages are statistically different than the profit-maximizing wages before and after the minimum wage introduction with the p -values of .000 according to W-S-R test results.

4.2 | Results of the second experimental setting

Result 1: There is no evidence of the spillover effect of the minimum wage introduction on the T1Ws' reservation wages.

As can be seen in Table 10, surprisingly, the average reservation wage of the T1Ws decreased after the minimum wage was introduced. However, there is no significant difference between the reservation wages of these workers before and after the minimum wage introduction according to the M-W test result with a p -value of .80. There is also another interesting result in terms of the reservation wage: The average value of the T1Ws' reservation wages is much higher than the T2Ws' reservation wages before the minimum wage introduction although the difference is not statistically significant according to the M-W test with a p -value of .23. Figure 7 shows the average reservation wages over the subjects for T1Ws. Two outliers can be easily identified in the figure. These two outliers represent

TABLE 8 Profit maximization wage offers for LSW

Session number	Before the minimum wage				After the minimum wage			
	1	2	3	4	1	2	3	4
Actual wage	180.75 (29.74)	144.25 (62.16)	170.14 (54.94)	163.87 (25.76)	226.14 (7.79)	230.52 (14.19)	233.76 (21.02)	232.91 (26.70)
Profit-maximizing wage	94.70 (58.61)	79.08 (52.94)	110.62 (49.41)	67.35 (56.73)	223.14 (4.56)	219.75 (16.20)	221.30 (5.17)	221.51 (5.84)
Observations:	157	147	132	100	158	161	154	102

Note: Standard deviations are in parentheses.

TABLE 9 Profit maximization wage offers for HSW

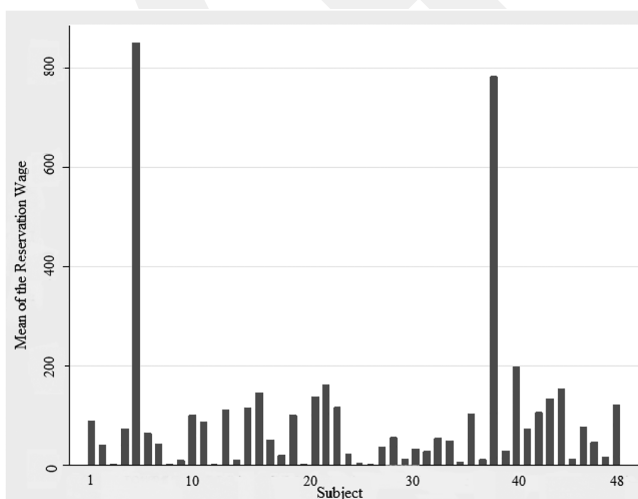
Session number:	Before the minimum wage				After the minimum wage			
	1	2	3	4	1	2	3	4
Actual wage	285.29 (97.86)	314.38 (107.75)	343.68 (85.57)	309.88 (42.63)	270.76 (65.44)	344.09 (17.27)	315.24 (58.20)	309.66 (55.54)
Profit-maximizing wage	116.38 (54.76)	169.09 (103.85)	164.47 (100.01)	98.49 (66.31)	224.18 (10.61)	293.00 (46.41)	262.30 (38.49)	242.51 (24.30)
Observations	176	139	142	113	171	149	144	106

Note: Standard deviations are in parentheses.

TABLE 10 Average values of the reservation wages

	Reservation wage (T1W)	Reservation wage (T2W)
Before the minimum wage introduction	96.01 (168.66)	62.7 (57.14)
N/observations	48/720	48/720
After the minimum wage introduction	93.45 (164.487)	221.1 (5.82)
N/observations	48/720	48/720

Note: Standard deviations are in parentheses.

**FIGURE 7** Reservation wages of the T1Ws over subjects

significantly higher average reservation wages, which could increase the average of all T1Ws' reservation wages significantly.

If these two outliers are excluded, then the remainder of the T1Ws' reservation wages becomes 64.66 on average, which is close to the T2Ws' average reservation wages. Without these two subjects, there is no significant difference between the T1Ws' and T2Ws' reservation wages according to the M-W test result (with a p -value of .84) in the absence of the minimum wage as it was expected based on the horizontal fairness discussed in H1. In addition, if these two outliers are excluded, the average value of the reservation wages of the T1Ws becomes 62.31 following the introduction of the minimum wage. M-W test result shows that the difference of these workers' reservation wages before and after the minimum wage introduction is not statistically significant with a p -value of .79. However, these two outliers are not excluded for the further analysis explained below.¹¹

Distributions of the reservation wages for both types, with and without the minimum wage, can also be seen from the figures below. Figure 8 shows the reservation wage distributions for the T1Ws before and after the minimum wage introduction, whereas Figure 9 shows the distributions for the T2Ws' reservation wages.

On the other hand, regression results in Table 11 show similar findings to those explained before. The reservation wages of the T2Ws increased above the minimum wage level, and the coefficient of the minimum wage dummy is significant at the 1% level (Column 2). However, although there is a decrease for the T1Ws, the coefficient is not statistically significant for the T1Ws (Column 1). This can be interpreted as there is no evidence that the T1Ws were affected by the minimum wage introduction for similar workers in the

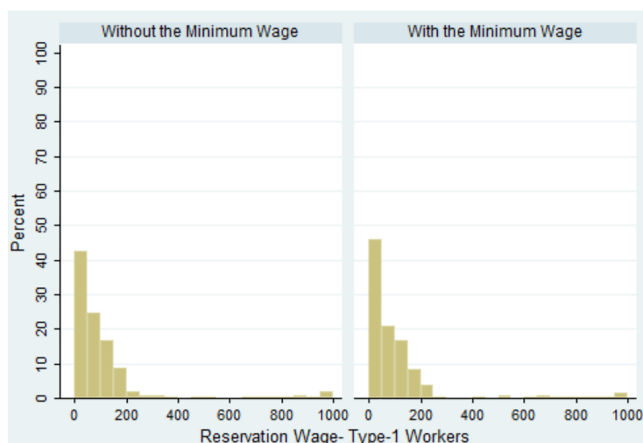


FIGURE 8 Reservation wages: T1Ws [Color figure can be viewed at wileyonlinelibrary.com]

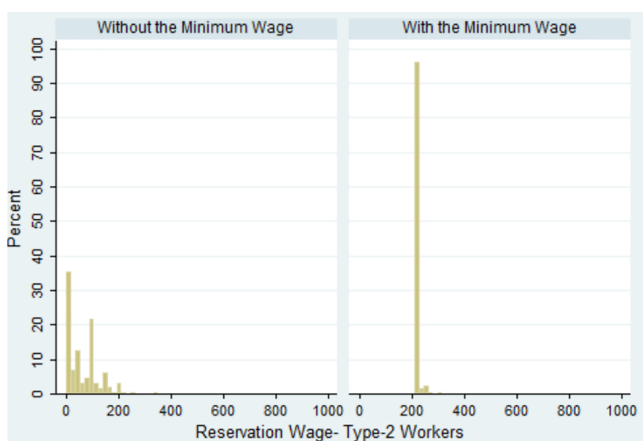


FIGURE 9 Reservation wages: T2Ws [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 11 OLS regression results for the reservation wages

Dependent variable	Reservation wage (T1W)(1)	Reservation wage (T2W)(2)
Constant	116.06*** (5.76)	68.72*** (6.26)
Minimum wage dummy	-1.83 (14.13)	166.23*** (14.64)
Period	Yes	Yes
Session fixed effect	Yes	Yes
Observations	1440	1440
Prob > F	0.000	0.000
R-squared	0.06	0.80

Note: Robust standard errors clustered at the session level are in parentheses.

* $p < .10$. ** $p < .05$. *** $p < .01$.

other sector since they did not change their reservation wages with the introduction of the minimum wage in contrast to H3.

Result 2: There is no evidence of the spillover effect of the minimum wage introduction on the wage offers for the T1Ws.

Table 12 shows the average values of the wage offers and the actual wages for both worker groups with and without the minimum wage.¹² According to these average values, the interesting point is the wage offer difference between T1Ws and T2Ws in the absence of the minimum wage. According to the M-W test result, the difference is statistically significant with a p -value of .002. This result is not consistent with the expectation based on horizontal fairness discussed in H4.¹³ For the T1Ws, there is a small increase in the average value of the wage offers after the minimum wage is introduced. However, the M-W test result shows that this difference is not statistically significant with a p -value of .14. There is an increase in the average values of the wage offers for the T2Ws as is expected, and the increase is statistically significant according to the M-W test with a p -value of .000.

The introduction of the minimum wage caused similar changes in actual wages with the wage offers. As can be seen in Table 12, although there is a small increase in the average actual wages for the T1Ws with the minimum wage introduction, this difference is not statistically significant according to the M-W test result with a p -value of .15. However, for the T2Ws, the difference between the average values before and after the minimum wage introduction is statistically significant according to the M-W test result with a p -value of .000.

The figures above show the distributions of the wage offers. Figure 10 shows the distributions for the T1Ws, whereas Figure 11 shows for the T2Ws before and after the minimum wage introduction.

Table 13 shows the regression results for the wage offers and actual wages of two types of workers. As can be seen from the table, the coefficient of the minimum wage dummy for the T2Ws is positive and significant at the 1% level (Column 2) as is expected, since the minimum wage is binding for these workers. On the other hand, the coefficient of the minimum wage dummy for the T1Ws is not statistically significant, although it is positive (Column 1). This shows that there is no effect of the minimum wage introduction on the wage offers for the T1Ws in contrast to H4. On the other hand, according to the regression results presented in the last two columns, introducing the minimum wage increases the actual wages for the T1Ws; however, the coefficient is not statistically significant (Column 3). The actual wages of the T2Ws increase above the minimum wage level after the minimum wage introduction, as can be seen in Column 4, and the coefficient of the minimum wage dummy is significant at the 5% level. As a result, actual wage results are consistent with the wage offer regression results, and there is no evidence of the spillover effect of the minimum wage introduction in the covered sector on the uncovered sector.

Tables 14 and 15 both show average actual wages and the average profit-maximizing wage offers over the sessions for T1Ws and T2Ws, respectively. As can be seen from the tables, actual wages are greater than the profit-maximizing wages, and it can be interpreted as FOs offered more than they were supposed to offer in terms of the profit maximization values. Actual wages are statistically different than the profit-maximizing wage values for all sessions, with or

TABLE 12 Average values of the wage offers and actual wages

	Wage offer (T1W)	Wage offer (T2W)	Actual wage (T1W)	Actual wage (T2W)
Before the minimum wage introduction	124.42 (59.48)	116.47 (55.48)	132.33 (59.16)	121.71 (55.69)
N/observations	16/685	16/695	539	592
After the minimum wage introduction	126.93 (61.68)	226.47 (12.89)	133.93 (60.39)	226.62 (13.11)
N/observations	16/706	16/687	579	657

Note: Standard deviations are in parentheses.

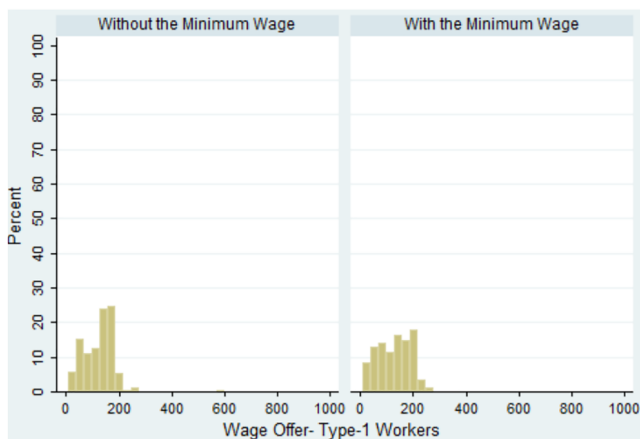


FIGURE 10 Wage offers: Type 1 workers [Color figure can be viewed at wileyonlinelibrary.com]

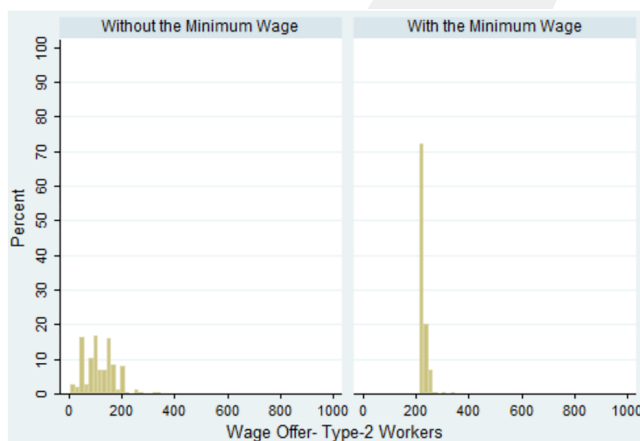


FIGURE 11 Wage offers: Type 2 workers [Color figure can be viewed at wileyonlinelibrary.com]

without the minimum wage according to the W-S-R test results, with p -values of .000 for both T1Ws and T2Ws.

For the aggregate-level data including all the sessions, the average actual wage for the T1Ws is 132.33, whereas the average profit-maximizing wage value is 72.00 before the minimum wage introduction. The difference is statistically significant according to the W-S-R test with a p -value of .000. The average actual wage is 133.93, and the average profit-maximizing wage is 76.72 for these workers after the minimum wage introduction. The difference is also

significant with a p -value of .000 based on the W-S-R test. For the T2Ws, the average value of actual wages is 121.71 (226.62), and the average profit-maximizing wage value is 75.80 (220.72) before (after) the minimum wage introduction. The differences between the actual wages and the profit-maximizing wages before and after the minimum wage introduction are statistically significant with the p -values of .000 according to the W-S-R test.

4.3 | Comparison of the experimental settings

The LSWs in the first experimental setting and the T2Ws in the second experimental setting are identical in terms of their productivities and being bounded by the minimum wage. However, the two types of workers have different peers: LSWs in the first experimental setting have peers with higher productivity, whereas T2Ws in the second experimental setting have peers who are similar but not bound by the minimum wage. The comparison of these two groups might give us more information about the social comparisons.

In the absence of minimum wage, the LSWs' reservation wages are higher than the T2Ws' reservation wages, and the difference is statistically significant according to the M-W test with a p -value of .000. After the minimum wage is introduced, the LSWs' reservation wages are still greater than the T2Ws' reservation wages, and this difference is also significant according to the M-W test with a p -value of .002.

The reason for the LSWs having greater reservation wages might be related to the existence of the HSWs. This means that these workers' reservation wage decisions might be affected by the fact that HSWs get higher wage offers. This could cause an increase in their reservation wages and higher reservation wages compared to the T2Ws, whose peers are similar in terms of productivities.

The wage offers for LSWs are also higher than the wage offers for T2Ws before and after the minimum wage introduction, and the differences are statistically significant according to the M-W test results with p -values of .000.

These results can be interpreted with two possible explanations. Firstly, FOs in the first experimental setting may have decided the HSWs' wage offers to begin with, and then they use these workers' wage offers' as reference points to determine the LSWs' wage offers. For this reason, this perhaps leads them to offer higher wages to the LSWs, compared to the T2Ws' wage offers. Secondly, due to higher reservation wages of the LSWs in the first experimental setting, they

TABLE 13 OLS regression results for the wage offers and actual wages

Dependent variable	Wage offer (T1W)(1)	Wage offer (T2W)(2)	Actual wage (T1W)(3)	Actual wage (T2W)(4)
Constant	148.44*** (10.62)	128.92*** (12.35)	152.04*** (3.71)	134.13*** (13.57)
Minimum wage dummy	3.59 (8.10)	128.64*** (22.77)	1.61 (5.27)	125.52** (22.99)
Period	Yes	Yes	Yes	Yes
Session fixed effect	Yes	Yes	Yes	Yes
Observations	1,391	1,382	1,118	1,249
Prob > F	0.000	0.000	0.000	0.000
R-squared	0.43	0.73	0.47	0.72

Note: Robust standard errors clustered at the session level are in parentheses.

* $p < .10$. ** $p < .05$. *** $p < .01$.

TABLE 14 Profit maximization wage offers for T1Ws

Session number	Before the minimum wage				After the minimum wage			
	1	2	3	4	1	2	3	4
Actual wage	157.32 (29.00)	158.43 (37.26)	66.20 (68.34)	146.06 (37.81)	148.15 (54.63)	148.77 (41.76)	56.70 (20.30)	180.37 (29.86)
Profit-maximizing wage	68.94 (39.84)	81.53 (57.09)	48.91 (26.63)	90.00 (44.26)	68.94 (29.63)	97.45 (55.19)	40.19 (27.27)	101.82 (46.50)
Observations	152	122	133	132	158	134	142	145

Note: Standard deviations are in parentheses.

TABLE 15 Profit maximization wage offers for T2Ws

Session number	Before the minimum wage				After the minimum wage			
	1	2	3	4	1	2	3	4
Actual wage	124.44 (32.38)	157.09 (44.24)	54.27 (38.01)	151.01 (40.52)	226.27 (11.56)	227.35 (8.93)	227.77 (19.47)	225.28 (10.15)
Profit-maximizing wage	87.78 (30.18)	102.34 (46.82)	38.02 (23.60)	75.11 (45.66)	220.23 (1.50)	221.24 (5.83)	221.12 (2.40)	220.40 (1.65)
Observations	163	134	143	152	173	154	157	173

Note: Standard deviations are in parentheses.

could be triggered to offer higher wages to be able to hire these workers.

5 | DISCUSSION AND CONCLUDING REMARKS

The purpose of this study was to analyse how employers and employees reacted to the introduction of a minimum wage in terms of horizontal fairness. A lab experiment was conducted for the research.

According to the results, both HSWs' reservation wages and FOs' wage offers for the HSWs show that horizontal fairness concern is an important issue for the agents in the absence of the minimum wage.

The reason is that HSWs' reservation wages are higher than the LSWs' reservation wages and the wage offers for these workers are also higher than the wage offers for the LSWs. After the minimum wage was introduced, HSWs increased their reservation wages above the minimum wage level, and the average value is still greater than the LSWs' reservation wages. This also shows that HSWs wanted to keep earning more than the LSWs due to their fairness concerns. FOs also increased their wage offers to the HSWs with the minimum wage introduction, although they were offering more than the minimum wage level in the absence of the minimum wage, on average.

The interesting point is, on the contrary to many studies, I did not find any spillover effects of the minimum wage introduction on the uncovered sector due to horizontal fairness concerns. There were no

significant changes in terms of wage offers or reservation wages in the uncovered sector after the minimum wage was introduced. First of all, it should be understood why FOs did not increase the wage offers. Falk et al. (2006) explain that workers are the driving force to increase the wage offers. Since there was no increase in the reservation wages of the T1Ws in the uncovered sector, FOs perhaps did not increase the wage offers. Therefore, the focus should be on why T1Ws did not increase their reservation wages.

There may be two reasons to explain why workers did not react to the violation of horizontal fairness in the second experimental setting. Firstly, they may not have accepted the violation of horizontal fairness as an unfair situation because the change of the regulation in the market, which ultimately was not the employer's decision. Studies show that peoples' intentions are very important in terms of evaluating whether or not the outcome is fair or not. For example, in a regular ultimatum game, if the offers are made by the computers, the rejection rates of the offers decrease substantially because it is not related to the greedy behaviours of the proposers (Blount, 1995; Fehr & Schmidt, 1999). For this reason, workers in the uncovered sector perhaps did not consider that the violation was the FOs' decision, so they did not want to react to this regularity in the market. Secondly, although it was not the employers' decision, they may still have thought that it was unfair because employers might also increase their wages, but they did not react to this unfairness by increasing their reservation wages.

Experimental studies about horizontal fairness issues are mostly based on gift-exchange games. Most of these studies show that the violations lead the workers to decrease their effort levels, demonstrating that they do have horizontal fairness concerns (Abeler et al., 2010; Gächter & Thöni, 2010). However, there may be differences between decreasing effort levels and increasing reservation wages. When a worker reduces their effort level in a gift-exchange game, his/her pay-off increases due to a feature of this game. However, increasing the reservation wage may lead to zero earnings in this experimental design. Therefore, workers perhaps felt dissatisfied due to the violation of the horizontal fairness, although the reason was the regulatory changes in the market; however, they may have considered it not worth taking the risk of earning nothing, just in order to punish the FOs.

Therefore, it is important to discuss why HSWs in the first experimental setting did not behave similarly but reacted to the minimum wage introduction. HSWs might have felt that they were more valuable and had an advantage over the LSWs since they were providing more revenue to the FOs. This might lead them to become more interested in relative income or envy. However, when the minimum wage was introduced, they may have felt that they lost their advantage and considered the decreased wage difference between HSWs and LSWs unfair. The results show that the horizontal fairness concerns were more important for the workers who have higher productivities than for workers with similar productivities. This suggests that beginning the experiment with a higher status and subsequently losing it with the minimum wage introduction was more important for the participants compared with starting the experiment

at the same point and experiencing disadvantages after the minimum wage was introduced.

The design and the results of the experiment may introduce speculation over whether or not they measure and reflect the fairness considerations of the participants, especially under the circumstances of random role assignment and the random act of the minimum wage introduction for a certain group. These types of random role assignments for the different productivity levels and/or different treatment of the participants in the experiments have been used in previous studies (Charness & Kuhn, 2007; Nosenzo, 2013; Ohana, 2011).¹⁴ For example, Charness and Kuhn (2007) studied how co-workers' wages affect effort levels in a three-person gift-exchange experiment. The participants were assigned one of the three roles randomly: firm, Type 1 worker and Type 2 worker. The Type 2 workers were more productive than the Type 1 workers since they could provide more revenue to the firms. However, workers were not aware of whether they were considered low- or high-productivity workers although the firms knew the difference. In addition, in the first part of the experimental setting, workers were not even able to observe the wage or effort information of their co-workers who were in the same group. However, the results show that Type 2 workers were offered higher wages than Type 1 workers by the firms, although firms knew that the wage offers were not public. This shows that although the roles were assigned randomly and wages are not announced publicly, firms or employers consider the differences between the workers in terms of productivities. On the other hand, although no one was aware of whether they were high- or low-productivity workers and which wage was offered to their co-workers, Type 2 workers' average effort levels were lower than the Type 1 workers' average effort levels for the same wage offers. These results show that participants in the lab experiments are good at adopting rules about the revenues they provide to the firms and how much wage they should be offered based on the fairness considerations, although they were assigned to these roles randomly. For this reason, random role assignment based on productivity levels is not expected to be an issue in measuring the fairness considerations.

These results may further understanding of how an exogenous regulation change in the market affects workers' and employers' behaviours, in terms of horizontal fairness concerns. For future research, it might be interesting to study whether or not horizontal fairness concerns have more or fewer effects on the agents in different exogenous changes in the market. In addition, this research is not just a contribution to the fairness literature but also the minimum wage literature. Therefore, it may be beneficial to focus more on fairness issues when one tries to explain the effects of minimum wages.

ACKNOWLEDGEMENTS

This project was funded by the ESRC National Centre for Research Methods, University of Southampton, and the School of Social Sciences, University of Southampton. Firstly, I thank the anonymous referees for their valuable comments to the earlier draft of this paper. In addition, I would like to thank to Michael Vlassopoulos and Mirco Tonin for their invaluable guidance. I would also like to thank

Zacharias Maniadis and Miguel Fonseca for comments, discussions and suggestions. Finally, I wish to thank Rebecca Morton, Nikos Nikiforakis, Amaney Jamal and Macartan Humphreys for insightful comments at Wessi 2016.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

ETHICS STATEMENT

The study was approved by the Ethics Committee of the University of Southampton.

DATA AVAILABILITY STATEMENT

The data are available upon request.

ORCID

Burak Kağan Demirtas  <https://orcid.org/0000-0001-9477-8128>

ENDNOTES

- ¹ There are two groups of workers who are not legally bound by the minimum wage change: (i) workers who already earn higher than the minimum wage level (high-skilled workers) and (ii) employees working in an uncovered sector (informal workers and/or workers earning different sectoral/occupational minimum wages).
- ² There are possible explanations as to why a minimum wage might cause spillover effects on the wages of workers who are not legally bound by the minimum wage. For example, the demand for high-skilled workers increases as low-skilled workers become more expensive due to minimum wage change, and this leads to an increase in the wages of high-skilled workers (Cahuc & Zylberberg, 2004; Stewart, 2012). For the uncovered sectors, one explanation is that introducing or increasing the minimum wage causes an increase in wages of low-skilled workers in the covered sector, and they are substituted by capital. This causes an increase in the price of capital followed by an increase in demand for low-skilled workers in labour-intensive, uncovered sectors which results in higher wages for the low-skilled workers in the uncovered sectors (Harrison & Leamer, 1997).
- ³ If the minimum wage is not introduced for a certain group, then it is considered as an uncovered sector in this study. There are countries which have a federal minimum wage; however, different minimum wage levels can be observed across different states or industries within these countries. In fact, according to ILO's (2012) Working Conditions Laws Report, approximately 55% of the countries they analysed had minimum wages which were determined based on regions and/or industries and/or occupations (among 154 countries). This experimental setting can be evaluated as an example for these cases.
- ⁴ The minimum wage value and the firm's revenue values for LSW in Table 1 are the same, except one point, as Falk et al. (2006). The only difference is that if an FO hires only one worker, then he/she earns 400 ECU in this experiment whereas it was 390 in Falk et al.'s experiment. The reason for this difference is to make the calculations easier for the participants in the experiment.
- ⁵ The research was based on the different type of workers in the first phase, and the second experimental setting was added to the study much later. In order for participants to feel that they were different type of workers in terms of their skills, low-skilled worker and high-skilled worker labels were preferred in the first experimental setting. Since there were the same type of workers in terms of skills in the

second experimental setting, the labels were changed to Type 1 and Type 2 workers based on whether they were covered by the minimum wage. The reason not to change the labels of low- and high-skilled workers to Type 1 and Type 2 workers after the second experimental setting was added to the study was that sessions of the first experimental setting were already being conducted.

- ⁶ The reason for determining the exchange rates differently in two experimental settings was in order to provide sufficient average earnings for the participants. Since only LSWs featured in the second experimental setting, the average value of the earnings in this experimental setting was insufficient for the 75-min experiment.
- ⁷ A pilot session was conducted for each treatment. Based on the mean and standard deviation values obtained from the pilot sessions, the required sample sizes varied between 13 and 40 for different hypotheses discussed below. All required sample size calculations were based on 0.05 significance level, 0.80 power level and repeated measurement method (15 observations for each participant before and after the minimum wage introduction).
- ⁸ Average values over the periods were checked in case there was any learning process. However, there were no significant differences between the first several (five or less) periods and the remaining periods, according to M-W test results, with all *p*-values greater than .10.
- ⁹ The reason for their being less change or lack of a learning process for the workers compared to FOs is perhaps due to the fact that workers adapted to the game faster than FOs which makes sense. While a worker only decides his/her own reservation wage which determines how much share he/she wants to receive from the FO, an FO has to make four different decisions (wage offers for two different types of workers and how many workers he/she would like to hire from each group). Therefore, it might be said that an FO in this experimental setting requires more practice or experience to adapt to the experiment game.
- ¹⁰ Profit-maximizing wage offers were calculated based on the reservation wages of the workers that the FOs were matched in each period. For example, let us assume that an FO wanted to hire three LSWs for the second period and he/she offered 200 ECU as the wage. If the reservation wages of these workers were 50, 100 and 150, then these workers would be hired and the actual wage would be 200. However, if the FO would know the reservation wages, offering 150 was going to be the profit-maximizing value since he/she could still hire three workers but also increase his/her payoff as decreasing the costs. As a result, the profit-maximizing wage would be 150.
- ¹¹ Average values over the periods were also checked in case there was any learning process, as it was in the first experimental setting. However, there were no significant differences between the first several (five or less) periods and the remaining periods, according to M-W test results, with all *p*-values greater than .10.
- ¹² Average values over the periods were also checked in case there was any learning process, as it was in the first experimental setting. However, there were no significant differences between the first several (five or less) periods and the remaining periods, according to M-W test results, with all *p*-values greater than .10.
- ¹³ In case there were some framing problems which led FOs to think that T1Ws were more valuable, the average wage offers for each session and for each type of worker were checked in the absence of the minimum wage. According to the averages, there is no regular differences in wage offers between two types. For example, in the first session, FOs offered higher wages to T1Ws on average, whereas other FOs offered higher wages to the T2Ws in the second session. The reason for this difference is probably the differences of the reservation wage values between two types of workers that these FOs faced. As discussed in

the reservation wage section above, there are two outliers having the role of T1W in this experimental setting.

- ¹⁴ Nosenzo (2013) studied pay secrecy and pay comparisons with co-workers based on the three-person gift-exchange experiment. Participants were divided as employers, blue workers and red workers randomly, with one employer, one red worker and one blue worker in each group. In some of the experimental settings, red workers' wages were determined exogenously by the experimenter, while the blue workers received the wage offer from the participant having the employer role. This is an example of exposure to different implementations randomly as being bound by the minimum wage by random.

REFERENCES

- Abeler, J., Altmann, S., Kube, S., & Wibrall, M. (2010). Gift exchange and workers' fairness concerns: When equality is unfair. *Journal of the European Economic Association*, 8, 1299–1324. <https://doi.org/10.1111/j.1542-4774.2010.tb00556.x>
- Blount, S. (1995). When social outcomes aren't fair: The effect of causal attributions on preferences. *Organizational Behavior and Human Decision Processes*, 63(2), 131–144. <https://doi.org/10.1006/obhd.1995.1068>
- Brandts, J., & Charness, G. (2004). Do labour market conditions affect gift exchange? Some experimental evidence. *The Economic Journal*, 114, 684–708. <https://doi.org/10.1111/j.1468-0297.2004.00237.x>
- Brown, M. (2001). Unequal pay, unequal responses? Pay referents and their implications for pay level satisfaction. *Journal of Management Studies*, 38(6), 879–896. <https://doi.org/10.1111/1467-6486.00263>
- Cahuc, P., & Zylberberg, A. (2004). *Labor economics*. The MIT Press.
- Card, D., Mas, A., Moretti, E., & Saez, E. (2012). Inequality at work: The effect of peer salaries on job satisfaction. *American Economic Review*, 102(6), 2981–3003. <https://doi.org/10.1257/aer.102.6.2981>
- Charness, G., & Kuhn, P. (2007). Does pay inequality affect worker effort? Experimental evidence. *Journal of Labor Economics*, 25(4), 693–723. <https://doi.org/10.1086/519540>
- Dittrich, M., Knabe, A., & Leipold, K. (2014). Spillover effects of minimum wages in experimental wage negotiations. *CESifo Economic Studies*, 60(4), 780–804. <https://doi.org/10.1093/cesifo/ifu034>
- Fajnzylber, P. (2001). Minimum wage effects throughout the wage distribution: Evidence from Brazil's formal and informal sectors. Universidade Federal de Minas Gerais Discussion Paper 151. <https://doi.org/10.2139/ssrn.269622>
- Falk, A., Fehr, E., & Fischbacher, U. (2008). Testing theories of fairness—Intentions matter. *Games and Economic Behavior*, 62(1), 287–303. <https://doi.org/10.1016/j.geb.2007.06.001>
- Falk, A., Fehr, E., & Zehnder, C. (2006). Fairness perceptions and reservation wages—The behavioral effects of minimum wage laws. *The Quarterly Journal of Economics*, 121(4), 1347–1381. <https://doi.org/10.1093/qje/121.4.1347>
- Falk, A., & Fischbacher, U. (2006). A theory of reciprocity. *Games and Economic Behavior*, 54(2), 293–315. <https://doi.org/10.1016/j.geb.2007.06.001>
- Fehr, E., & Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. *The Quarterly Journal of Economics*, 114(3), 817–868. <https://doi.org/10.1162/003355399556151>
- Fehr, E., & Schmidt, K. M. (2005). The economics of fairness, reciprocity and altruism - experimental evidence and new theories. University of Munich Discussion Paper 20.
- Fischbacher, U. (2007). Z-tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, 10, 171–178. <https://doi.org/10.1007/s10683-006-9159-4>
- Fizel, J., Krautmann, A. C., & Hadley, L. (2002). Equity and arbitration in Major League Baseball. *Managerial and Decision Economics*, 23(7), 427–435. <https://doi.org/10.1002/mde.1090>
- Gächter, S., & Fehr, E. (2002). Fairness in the labour market: A survey of experimental results. In F. Bolle & M. Lehmann-Waffenschmidt (Eds.), *Surveys in experimental economics: Bargaining, cooperation and election stock markets* (pp. 95–132). Physica-Verlag.
- Gächter, S., & Thöni, S. (2010). Social comparison and performance: Experimental evidence on the fair-wage effort hypothesis. *Journal of Economic Behavior and Organization*, 76(3), 531–543. <https://doi.org/10.1016/j.jebo.2010.08.008>
- Gartenberg, C., & Wulf, J. (2017). Pay harmony? Social comparison and performance compensation in multi-business firms. *Organisation Science*, 28, 39–55. <https://doi.org/10.1287/orsc.2017.1109>
- Grund, C., & Rubin, M. (2017). Social comparisons of wage increases and job satisfaction. *Applied Economics*, 49(14), 1345–1350. <https://doi.org/10.1080/00036846.2016.1217311>
- Harrison, A., & Leamer, E. (1997). Labor markets in developing countries: An agenda for research. *Journal of Labor Economics*, 15, 1–9. <https://doi.org/10.1086/209852>
- Hohberg, M., & Lay, J. (2015). The impact of minimum wages on informal and formal labor market outcomes: Evidence from Indonesia. *IZA Journal of Labor and Development*, 4, 14. <https://doi.org/10.1186/s40175-015-0036-4>
- ILO. (2012). Working conditions laws report 2012 [online access]. https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/--travail/documents/publication/wcms_235155.pdf
- Jaramillo Baanante, M. (2004). Minimum wage effects under endogenous compliance: Evidence from Peru. *Economica*, 1(2), 85–123.
- Kacperczyk, A., & Bazzazian, N. (2015). Vertical and horizontal comparisons and mobility outcomes: Evidence from the Swedish microdata. MIT Sloan Research Paper 5169-16. <https://doi.org/10.2139/ssrn.2662211>
- Koenig, J., Neyses, L., & Schroeder, C. (2019). Fair enough? Minimum wage effects on fair wages. Discussion Paper SSRN 3409913.
- Lee, K., & Shahriar, Q. (2017). Fairness, one's source of income, and others' decisions: An ultimatum game experiment. *Managerial and Decision Economics*, 38(3), 423–431. <https://doi.org/10.1002/mde.2785>
- Lemos, S. (2009). Minimum wage effects in a developing country. *Labour Economics*, 16(2), 224–237. <https://doi.org/10.1016/j.labeco.2008.07.003>
- Neumark, D., & Wascher, W. L. (2008). *Minimum wage*. The MIT Press.
- Nosenzo, D. (2013). Pay secrecy and effort provision. *Economic Inquiry*, 51, 1779–1794. <https://doi.org/10.1111/j.1465-7295.2012.00484.x>
- Ohana, M. (2011). Horizontal social comparisons and vertical reciprocity in a principal–multi-agent experiment. *Bulletin of Economic Research*, 63(3), 243–254. <https://doi.org/10.1111/j.1467-8586.2009.00348.x>
- Owens, M. F., & Kagel, J. (2010). Minimum wage restriction and employee effort in incomplete labor markets: An experimental investigation. *Journal of Economic Behavior and Organization*, 73(3), 317–326. <https://doi.org/10.1016/j.jebo.2009.12.002>
- Stewart, M. (2012). Wage inequality, minimum wage effects, and spillovers. *Oxford Economic Paper*, 64, 616–634. <https://doi.org/10.1093/oep/gps003>
- Wade, J. B., O'Reilly, C. A., & Pollock, T. G. (2006). Overpaid CEOs and underpaid managers: Fairness and executive compensation. *Organization Science*, 17(5), 527–544. <https://doi.org/10.1287/orsc.1060.0204>
- Wang, X. (2012). When workers do not know—The behavioral effects of minimum wage laws revisited. *Journal of Economic Psychology*, 33, 951–962. <https://doi.org/10.1016/j.joep.2012.05.004>

How to cite this article: Demirtaş, B. K. (2022). Spillover effects of the minimum wage introduction based on horizontal fairness: A lab experiment. *Managerial and Decision Economics*, 43(8), 3370–3385. <https://doi.org/10.1002/mde.3602>