UNIVERSITY OF SOUTHAMPTON

FACULTY OF SOCIAL, HUMAN AND MATHEMATICAL SCIENCES

Department of Economics

Three Essays in Labour Economics

by

Burak Kagan Demirtas

Thesis for the degree of PhD Economics

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ABSTRACT

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The purpose of this thesis, consisting of three unique papers, is to study how workers react to exogenous and endogenous policy changes keeping in view different perspectives. In the first paper, I conduct a lab experiment consisting of two treatments to examine how the introduction of a minimum wage affects the wage offers and wage demands of workers who are not bound by the minimum wage, based on horizontal fairness. In the first treatment, I focus on how workers already earning higher wages than the minimum wage level react to the minimum wage introduction, whereas for the second treatment, I focus on how workers earning less than the minimum wage level react to the minimum wage introduction in another sector. The results from the first treatment show that wage demands and wage offers increase after the minimum wage introduction whereas results from the second treatment show that there is no significant effect of the minimum wage introduction on the wage demands or wage offers. The second paper deals with how increase in the minimum wage affects workers' performance, if workers are paid a fixed wage equalling the minimum wage and the piece rate together. The study is based on a unique dataset obtained from a Turkish company. The results show that there are mixed effects of the increase in minimum wage on workers' overall performance. However, when workers are classified as low and high productivity worker, it is observed that low productivity workers increase their performance while high productivity workers decrease their performance. The third study focuses on the tournament incentives and peer effects in the workplaces. The aim of this study is to disentangle the effect of observing the others and being observed by the others during the tournament with a lab experiment. The results show that neither observing nor being observed generate negative peer effects. In addition, being observed leads to underdogs increasing their performance.

Table of Contents

Table of Contents i
Table of Tables iii
Table of Figures v
Academic Thesis: Declaration Of Authorship vii
Acknowledgements ix
Definitions and Abbreviations xi
Chapter 1: Introduction 1
Chapter 2: Spillover Effects of the Minimum Wage Based On Horizontal Fairness: A Lab Experiment 7
2.1 Introduction 7
2.2 Literature Review 12
2.2.1 Non-Experimental Studies 12
2.2.2 Experimental Studies 14
2.3 Experimental Design 15
2.3.1 Design of the Game 16
2.3.1.1 The First Treatment 16
2.3.1.2 The Second Treatment 19
2.3.2 Running the Experiment 23
2.3.3 Hypotheses 24
2.4 Results 26
2.4.1 The First Treatment 26
2.4.2 The Second Treatment 36
2.4.3 Comparison of the Treatments 46
2.5 Discussion and Concluding Remarks 47
Chapter 3: Minimum Wage Increase and Worker Performance: Firm-Level Evidence 53
3.1 Introduction 53
3.2 Literature Review 58
3.3 Data 62

3.3.1 Payment Scheme and Minimum Wage Increase 64
3.3.2 Variables 66
3.3.3 Hypotheses 67
3.4 Results 70
3.4.1 Descriptive Statistics 70
3.4.2 Main Analysis 74
3.4.2.1 Low and High Productivity Workers 81
3.4.3 Robustness Check 97
3.5 Discussion and Concluding Remarks 101
Chapter 4: Peer Effects in Tournaments: A Lab Experiment 105
4.1 Introduction 105
4.2 Literature Review 110
4.3 Experimental Design 112
4.3.1 Running the Experiment 116
4.3.2 Hypotheses 116
4.4 Results 119
4.4.1 The First Stage Statistics 119
4.4.2 The Second Stage Statistics 120
4.4.3 Regression Analysis 123
4.4.4 Robustness Check 130
4.5 Discussion and Concluding Remarks 132
Chapter 5: Conclusion 135
Appendix A 139
Appendix B 163
Appendix C 169
Bibliography 181

Table of Tables

Table 1: Firm's Revenue Function in the First Treatment 18

Table 2: Firm's Revenue Function in the Second Treatment 20

Table 3:Average Values of the Wage Offers 27

Table 4: Average Values of the Wage Offers without the First Five Periods 29

Table 5:OLS Regression Results for the Wage Offers 30

Table 6: Average Values of the Actual Wages 31

Table 7: OLS Regression Results for the Actual Wages 32

Table 8: Profit Maximization Wage Offers for LSW 33

Table 9: Profit Maximization Wage Offers for HSW 33

Table 10: Average Values of the Reservation Wages 34

Table 11: OLS Regression Results for the Reservation Wages 37

Table 12: Average Values of the Wage Offers 38

Table 13: OLS Regression Results for the Wage Offers 39

Table 14: Average Values of the Actual Wages 40

Table 15 : OLS Regression Results for the Actual Wages 41

Table 16: Profit Maximization Wage Offers for Type-1 Workers 42

Table 17: Profit Maximization Wage Offers for Type-2 Workers 42

Table 18: Average Values of the Reservation Wages 43

Table 19: OLS Regression Results for the Reservation Wages 45

Table 20: Summary Statistics 71

Table 21: Average Daily Values Related to the Production for a Worker 75

Table 22: Average Daily Values of the Performance for a Worker 77

Table 23: Fixed Effect and Pooled Cross-Sectional Model Results-
3 Months Before and 3 Months After 79

Table 24: Fixed Effect and Pooled Cross-Sectional Model Results-
2 Months Before and 2 Months After 81

Table 25: Fixed Effect and Pooled Cross-Sectional Model Results-
1 Month Before and 1 Month After 82

Table 26: Summary Statistics for Low and High-Productivity Workers 83

Table 27: Average Daily Values Related to the Production for a Low-Productivity
Worker 84

Table 28: Average Daily Values of the Performance for a Low-Productivity
Worker 86

Table 29: Average Daily Values Related to the Production for a High-Productivity
Worker 88

Table 30: Average Daily Values of the Performance for a High-Productivity
Worker 90

Table 31: Fixed Effect and Pooled Cross-Sectional Model Results-
3 Months Before and After 93

Table 32: Fixed Effect and Pooled Cross-Sectional Model Results-
2 Months Before and After 94

Table 33: Fixed Effect and Pooled Cross-Sectional Model Results-
1 Month Before and After 96

Table 34: Average Values of the Performance In the First Stage 120

Table 35: Average Values of the Performance In the Second Stage 121

Table 36: Regression Results for the Effect of Observing 125

Table 37: Regression Results for the Effect of Being Observed 127

Table 38: Regression Results for the Overall Performance Among the
Treatments 129

Table 39: Low and High Productivity Statistics 130

Table 40: Regression Results for the Low and High-Productivity Participants 131

Table of Figures

Figure 1: Wage Offer Distributions- LSW 27

Figure 2: Wage Offer Distributions- HSW 28

Figure 3: Wage Offers over Periods- LSW 28

Figure 4: Wage Offers over Periods- HSW 28

Figure 5: Distributions of the Reservation Wages- LSW 35

Figure 6: Distributions of the Reservation Wages- HSW 36

Figure 7: Distributions of the Wage Offers- Type-1 38

Figure 8: Distributions of the Wage Offers- Type-2 39

Figure 9: Reservation Wages of the Type-1 Workers over Subjects 44

Figure 10: Distributions of the Reservation Wages-Type-1 44

Figure 11: Distributions of the Reservation Wages-Type-2 45

Figure 12: Distributions of the Monthly Net Production Based on Monthly Target -3 Months 72

Figure 13: Distributions of the Monthly Piece Rate Earnings- 3 Months 72

Figure 14: Average Monthly Piece Rate Earnings over Months 73

Figure 15: Distributions of Workers' Daily Production- 3 Months 75

Figure 16: Distributions of Workers' Daily Production- 2 Months 76

Figure 17: Distributions of Workers' Daily Production- 1 Month 76

Figure 18: Distributions of Workers' Daily Performance- 3 Months 78

Figure 19: Distributions of Workers' Daily Performance- 2 Months 78

Figure 20: Distributions of Workers' Daily Performance- 1 Month 78

Figure 21: Distributions of Workers' Daily Production- Low-Productivity Workers - 3 Months 85

Figure 22: Distributions of Workers' Daily Production- Low-Productivity Workers - 2 Months 85

Figure 23: Distributions of Workers' Daily Production- Low-Productivity Workers - 1 Month 85

Figure 24: Distributions of Workers' Daily Performance- Low-Productivity Workers- 3 Months 87

Figure 25: Distributions of Workers' Daily Performance- Low-Productivity Workers- 2 Months 87

Figure 26: Distributions of Workers' Daily Performance- Low-Productivity Workers- 1 Month 87

Figure 27: Distributions of Workers' Daily Production- High-Productivity Workers- 3 Months 89

Figure 28: Distributions of Workers' Daily Production- High-Productivity Workers- 2 Months 89

Figure 29: Distributions of Workers' Daily Production- High-Productivity Workers - 1 Month 90

Figure 30: Distributions of Workers' Daily Performance- High-Productivity Workers- 3 Months 91

Figure 31: Distributions of Workers' Daily Performance- High-Productivity Workers- 2 Months 91

Figure 32: Distributions of Workers' Daily Performance- High-Productivity Workers- 1 Month 92

Figure 33: Real Effort Task 113

Figure 34: Comparison of the Treatments 115

Figure 35: Distributions of the Performance in Three Treatments 120

Figure 36: Distributions of the Performance in Three Treatments 122

Figure 37: Mean of the Performance over Periods for Each Treatment in the Second Stage 122

Academic Thesis: Declaration Of Authorship

I, Burak Kagan Demirtas, declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

Three Essays in Labour Economics

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before submission

Signed:

Date: 27.06.2019

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This thesis is dedicated to the most important people in my life; my sister, my mother and my father…

Definitions and Abbreviations

A.W.	Actual Wage
BOR	Being Observed Role
CFT	Continuous Feedback Treatment
HSW	High-Skilled Worker
ILO	International Labor Organisation
K-S	Kolmogorov-Smirnov
LSW	Low-Skilled Worker
MLA	Minimum Living Allowance
MWI	Minimum Wage Increase
M-W	Mann-Whitney
NFT	No Feedback Treatment
OR	Observer Role
R.W.	Reservation Wage
W.O.	Wage Offer
W-S-R	Wilcoxon Signed-Rank

Chapter 1: Introduction

Workers are one of the driving forces of companies. The number of employees was 3.45 billion (World Bank, 2018) whereas the number of unemployed people was 190 million around the world in 2017 (ILO, 2018). Their decisions or behaviours related to their performance, wage demands, job seeking or career plans affect firms' productivities, turnover rates or costs which might also generate many consequences on very important economic parameters such as growth, unemployment or inflation. For this reason, there are many studies that seek to understand what affects the behaviour and decisions of workers and how these processes might work.

Employees are exposed to many different policies introduced endogenously within their companies or exogenously in the labour market. Each of these policies might trigger workers to change their decisions or behaviours in some way. For example, applying a new compensation policy in order to incentivize workers to increase their performance, such as changing from fixed wage payment to piece rate payment, might motivate workers to work harder in order to increase their income (Smoot and Duncan, 1997; Lazear, 2000; Fernie and Metcalf, 1999). However, although the purpose of the new policy is to increase workers' performance so that the firm's productivity can increase, it could lead to a negative: workers focusing solely on the quantity of their output to increase their income could cause a decrease in quality and subsequently a decrease in the firm's productivity (Heywood *et al*., 2013; Prendergast, 1999; Baker *et al*., 1988). On the other hand, an exogenous policy change which is not under the control of the firms, in the labour market might also affect workers' behaviours and decisions so that firms also might need to apply new policies within their firms. For example, if the government introduces or increases the minimum wage, the labour cost of the firms increases due to the increase in wages of workers who are bound by the minimum wage. Workers already earning more than the minimum wage might also demand a wage increase since the new minimum wage policy decreases the difference of these workers' wages and wages of workers who are bound by the minimum wage. Studies show that workers consider other workers' wages in order to decide if their wages are fair or not (Nosenzo, 2013; Charness and Kuhn, 2007). For this reason, a change in the minimum wage policy might affect workers' behaviours or decisions even if they are not directly affected by it. If the companies meet workers' expectations or demands, then the cost of the minimum wage

change increases further. On the other hand, if the firms ignore these wage increase demands, these workers might feel less satisfied with their jobs leading to a performance decrease or an increase in the turnover rates within the companies which might also increase the cost (Abeler *et al.,* 2010; Kacperczyk and Bazzazian, 2015; Wade *et al.* 2006). As a result, each endogenous or exogenous policy change might generate different or side effects which are not considered at first sight. For this reason, understanding how workers react to a new policy from different perspectives is important. If we can understand the mechanisms behind the changes in behaviours or decisions of workers, then any possible negative effects can be eliminated by the firms even before they are generated.

The purpose of this thesis is to study how workers react to new policies in the labour market or within the firm from different perspectives. In Chapter 2, I analyse how workers and employers react to the introduction of a minimum wage in terms of fairness concerns. In particular, there is a focus on how minimum wage introduction affects the reservation wages and wage offers in terms of spillover effects based on the fairness concerns. Chapter 3 deals with analysing whether or not workers change their performance if their fixed wages are increased due to increase in the minimum wage when they are paid both a fixed wage and piece rate. Chapter 4 attempts to disentangle the peer effects based on observing and being observed by the rivals during the tournaments.

Minimum wage is a very common practice in the labour markets in many countries. According to International Labor Organization (ILO, 2015), around 90% of the 186 member States have a minimum wage. Such a policy affects many people and can have many effects on workers and firms. Studies show that introducing or increasing the minimum wage does not only increase the wages of workers who are bound by the minimum wage but it also affects wages of workers who are not bound by it (Neumark *et al.,* 2004; Maloney and Mendez, 2004; Lemos 2009). There are discussions for the possible reasons behind these findings. One such explanation is that firm owners might increase these workers' wages due to their fairness concerns (Neumark and Wascher, 2008; Waltman, 2008; Cunningham, 2007). However, it is not easy to measure fairness in these studies with secondary data. Chapter 2 analyses how employers' wage offers and the wage demands of the workers, who are not bound by the minimum wage introduction, change based on fairness concerns. This is achieved by conducting a lab experiment which allows the exclusion of all possible reasons except fairness.

Fairness is a very important phenomenon affecting people's behaviours and decisions. Workers' evaluations about their wages if they are fair or not are based on other workers' wages (Nosenzo, 2013). They might want to earn higher wages than workers who have lower productivity or they might want to earn similar wages as other workers who have the same productivity levels (Gartenberg and Wulf, 2017; Kacperczyk and Bazzazian, 2015; Abeler *et al.* 2010). The introduction of the minimum wage decreases the difference in wages between workers who are bound by the minimum wage and workers who already earn more than the minimum wage level. If workers consider other workers who have less productivity and earn lower wages, then they may also demand a wage increase with the new minimum wage policy in order to maintain the difference in wages. On the other hand, if the minimum wage is introduced for a certain sector but not another for the workers having similar productivities, then these workers might also demand an increase in their wages. As a result of this, the minimum wage introduction might also affect other workers who are not bound by it. If they increase their wage demands and if their demands are not met by their employers then they may believe that they are treated unfairly by their employers. As a result, workers might have lower job satisfaction and a decreased performance or they may even leave their jobs (Abeler *et al.,* 2010; Kacperczyk and Bazzazian, 2015; Wade *et al.* 2006). This might cause more problems for the companies such as a decrease in productivity or an increase in staff turnover rates so that overall costs increase. For this reason, it is important to understand how workers react to the minimum wage policy changes since firms can also react to workers' demands in order not to have these problems. In fact, this study also covers how employers react with their wage offers to this new policy in the labour market. Employers might consider these possible reactions of workers and might change their wage offers as well.

According to the results of the study, there is evidence that workers who already earn more than the minimum wage level increase their wage demands after the minimum wage is introduced. In addition, employers are also likely to increase these workers' wages. However, when the minimum wage is introduced in one sector and not the other, workers in the sector which is not covered by this policy did not react to the introduction of a minimum wage policy in the other sector.

On the other hand, Chapter 3 examines whether or not increasing the minimum wage has effects on workers' performance if their compensation scheme is based on a fixed wage which is equal to the minimum wage and piece rate together. The key point of this research is the compensation system of workers. There are many

studies comparing fixed wages and piece rate payment schemes in order to see which payment system is better at increasing workers' performance (Smoot and Duncan, 1997; Lazear, 2000; Fernie and Metcalf, 1999). However, both of these payment schemes have some disadvantages. If workers are only paid fixed wages regardless of their performance, then there is no incentive to increase their performance. On the other hand, if they only receive piece rate payments, they may only focus on increasing the quantity of their production in order to increase their income as much as possible (Heywood *et al*., 2013; Prendergast, 1999; Baker *et al*., 1988). This could result in lower productivity for the firm since workers might ignore the quality of their production. For this reason, some companies prefer applying a compensation policy which consists of both fixed wage and piece rate payments together (Lazear, 1986; Dickinson, 2005; Billikopf, 2014).

In the case where employees work under this kind of mixed compensation system and their fixed wage is equal to the minimum wage level, the effect of an increase in the minimum wage becomes more important. An increase in the fixed wage due to a new minimum wage policy might lead workers to decrease their performance since they may become less eager to earn from the piece rate payment scheme (Goette *et al*. 2004). On the other hand, an increase in the minimum wage might trigger these workers to increase their performance also because the value of their job increases with the increase in their fixed wages. Increases in the value of their job might make workers concerned about losing their job and in order not be dismissed, they could work harder (Wolfers and Zilinsky, 2015; Yellen, 1984; Shapiro and Stiglitz, 1984). Increasing the minimum wage also increases the firms' labour costs and in order to compensate for this, firms might have to apply new policies. For this reason, it is important to understand how the performance of workers changes with the minimum wage change to decide what kind of policies they should apply.

For this study, a dataset is obtained from a Turkish company. This company's data is used because workers are paid a fixed wage equal to a minimum wage level regardless of their performance and they are able to increase their income with the piece rate payment. The minimum wage was increased by about 30% by the government in Turkey, on the 1st of January, 2016. The dataset covers three months before and three months after the minimum wage increase. The results show that there are mixed effects of the minimum wage increase on the overall performance of the workers because there are differences depending on the classification of workers. The low-productivity workers increase their performance

with the minimum wage increase whereas the high-productivity workers decrease their performance.

On the contrary to previous chapters, Chapter 4 studies an issue related to the changes in the compensation policy within the firms instead of exogenous changes in the labour market. Companies apply different compensation systems in order to incentivize their workers. One of the most common practices is to organize tournaments among workers for a reward. Employees compete against each other based on their performance and the best worker(s) are rewarded with a monetary or non-monetary gift (Newman and Tavkof, 2014). The main reason for this implementation is to incentivize workers to increase their performance. It is therefore important to understand how workers react to this kind of implementation.

One debate about tournaments in the workplace is whether or not workers are able to learn/observe each other's performance information during the tournament. The reason for these discussions is that negative peer effects might be generated by observing the other workers' performance. As Eriksson *et al*. (2008) state that a worker who notices that he is behind the other workers might feel discouraged and decreases his performance or even quit the race or a worker who is leading the race might feel too confident about winning the reward and this might lead him to decrease his performance. As a result, although the purpose of designing the tournaments in the firms is to increase overall performance, negative peer effects might diminish these incentives. In such a case, one suggestion would be to deny workers the possibility of observing/learning each other's performance during the tournament process. On the other hand, observing the other workers might also generate positive peer effects leading workers to increase their performance, therein providing greater overall benefits (Eriksson *et al.* 2008). In such a case, it would be suggested that workers should be able to observe each other's performance during the tournament.

There are studies about the performance effects of observing rivals. However, in these studies, people who can observe their rivals are also simultaneously observed by their rivals (Eriksson *et al.* 2008; Ludwig and Lünser, 2012). While observing might generate positive or negative peer effects, being observed might also generate these effects. The purpose of the fourth chapter is to disentangle the effect of observing and being observed. If we can understand the behavioural changes that result from these conditions, then tournaments might be more effective in terms of increasing workers' performance.

For the study, a lab experiment was conducted. The results show that neither being observed by the rival nor observing the rival generates negative peer effects. Instead, being observed led underdogs to increase their performance. On the other hand, without distinguishing participants as underdogs or frontrunners, observing the rival or being observed by the rival or both acts at the same time increases the overall performance compared to the case when workers neither observe nor being observed. For this reason, it is suggested that workers should both observe and be observed by their rivals during the tournament process in workplaces.

Chapter 2: Spillover Effects of the Minimum Wage Based On Horizontal Fairness: A Lab Experiment

2.1 Introduction

Experimental studies using games such as the ultimatum game or the gift-exchange game show that workers have strong fairness concerns, in terms of labour market-related issues (Falk and Fischbacher, 2006; Fehr and Schmidt, 2005; Falk *et al.*, 2006; Gächter and Fehr, 2002). Nosenzo (2013) explains that workers consider their co-workers' payoffs as a judgment of the fairness of their own payoffs, which is known as horizontal fairness[1]. On the other hand, Charness and Kuhn (2007:693) 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 in fact compare their wages to others' in the same firm, or in other firms. Based on this comparison, people who feel underpaid experience less job satisfaction and are more likely to leave their jobs (see. Brown, 2001, Wade *et al.,* 2006; Card *et al.*, 2012). In addition, according to the fair-wage hypothesis by Akerlof and Yellen (1990), when a worker makes a decision about his effort level, he does not only care about his wage but also the wages of other workers. Experimental studies based on gift-exchange games show that upon receiving unfair wages in comparison to peers', workers' effort levels decrease (see. Abeler *et al.,* 2010; Gächter and Thöni, 2010).

On the other hand, wage increases induce workers to re-evaluate their wages in terms of their fairness perceptions. Grund and Rubin (2017) explain that workers use other employees' wages as reference points and when there is a wage increase, it is interpreted as a deviation from the reference point. A worker's wage may not be increased while other workers' wages are increased, or a worker is given a

[1] There are two important reference groups for the social comparisons in terms of payoffs. If the referents for a worker are in different places in the vertical hierarchy (such as employer or CEO), then this is a vertical comparison-vertical fairness type of comparison (Gartenberg and Wulf, 2017; Kacperczyk and Bazzazian, 2015). On the other hand, if a worker defines his reference group as his co-workers or generally other workers then this a horizontal comparison-horizontal fairness type of comparison (Abeler *et al.* 2010; Gartenberg and Wulf, 2017).

smaller wage increase compared to other workers. For this reason, a worker who previously believed that his wage was fair, may now think the opposite after the wage increase. For example, if an employer increases a worker's wage, a different worker who is more productive and receives a higher wage, may also demand a wage increase since the difference between these two wages decreases and is perhaps considered as unfairness by this worker. Alternatively, if there are two employees working at the same level of productivity and an employer increases only one of these workers' wages, the other worker may consider this unfair treatment by the employer, despite the fact that he considered this wage to be fair prior to the increase. On the other hand, employers may also consider these potential issues 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 introduction of a minimum wage generates spillover effects on wages and workers' wage demands 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 the employers. Workers may feel frustrated if they think that they are treated unfairly by their employers as evidenced in the studies stated above. However, it is not clear how they may react in the case of similar outcomes caused by the minimum wage regulation which is not under the control of employers. Falk *et al*. (2008) state that people do not only care about fair or unfair outcomes, but they also care about fair or unfair intentions behind the results. Gächter and Thöni (2010) conducted a lab experiment based on a gift-exchange game and found that the intentions behind the wage discrimination is more important than the payoff consequences for the workers. For this reason, if the minimum wage changes perceptions about horizontal fairness in wage differences, then observed effects of wage demands or wage offers may be different to the effects caused by wage increases from employers.

Studies focused on the minimum wage and wage levels show that introducing or increasing the minimum wage indeed does not only affect the wages of people who are bound by wage changes (low-skilled workers), but it also generates spillover effects onto the wages of people who already earn more than minimum wage (high-skilled workers) (see. Neumark and Wascher, 2008; Fajnzylber, 2001). On the other hand, some other studies show that minimum wage also causes spillover effects in

uncovered sectors[2] between similar (low-skilled) workers. Cunnigham (2007) explains that the minimum wage is more binding within the informal sectors compared to the formal sectors in Latin America and the Caribbean. Although there are some papers, which do not find any spillover effects (Hohberg and Lay, 2015), most studies show that introducing or increasing the minimum wage in the covered sectors, increases the wages in the uncovered sectors (see. Lemos, 2009; Jaramillo Baanante, 2004; Fajnzylber, 2001).

However, the issue with these minimum wage studies is that it is not easy to identify causal factors, their relative importance and whether or not the fairness concerns are reasons behind these results. There are different explanations as to why a minimum wage causes spillover effects on the wages of workers who are not bound by the minimum wage. One of them is the substitution effect, meaning that the demand for high-skilled workers increases as low-skilled workers become more expensive due to minimum wage changes (Stewart, 2012; Cahuc and Zylleberg, 2004). This leads to an increase in the wages of high-skilled workers. For the uncovered sectors, one explanation is that introducing or increasing the minimum wage causes an increase in wages of the 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 (Harrison and Leamer, 1997). It also increases the wages of low-skilled workers' in the uncovered sectors due to higher demand. On the other hand, there is one common explanation for both cases; fairness. It is said that employers increase the wages of high-skilled workers in sectors with a minimum wage since they place importance on the difference between high-skilled and low-skilled workers' wages due to fairness concerns (Cunningham, 2007). For the uncovered sectors, Neumark and Wascher (2008) state that the reason why spillover effects occur in uncovered sectors, may be explained by fairness concerns of employers

[2] If the minimum wage is not introduced for a certain group then it is considered as an uncovered sector in the study. There are countries which have a federal minimum wage, however higher minimum wage levels can be observed across different states or industries within these countries. In fact, according to ILO's Working Conditions Laws Report (2012), 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). These different minimum wage levels within a country might be determined as statutory minimum wages and/or thorough a collective bargaining process between the unions and the state institutions and so forth. For example, employers paying the minimum wage to (at least) some of their workers might have companies doing similar businesses in different regions/states where minimum wages are set to different values (e.g. fast food restaurant chains, coffee shop chains, department store branches). This treatment can be evaluated as an example for these cases.

for the workers having similar abilities. Nevertheless, as mentioned above, understanding which of these effects exist or which one outweighs the other, is not easy to distinguish with these studies.

I conducted a laboratory experiment for this study. Due to the advantages of the lab experiment, I can 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 I examine in this study. As in the original design, I focus on the reservation wage decisions of the workers and wage offers of the employers, in order to observe their fairness concerns. The reservation wage is the lowest wage a job seeker accepts to work (Cahuc and Zylleberg, 2004). This can be interpreted as a worker having fairness concerns determines his reservation wage as the least fair offer he will accept and he will reject all wage offers lower than it. For this reason, it is a good measurement of the fairness concerns of workers.

In my experimental design, I had two different treatments. In the first treatment, I had two different worker types based on their productivity levels: low-skilled workers (LSW) and high-skilled workers (HSW). There were also firm owners matched with these workers. Before each period started, one firm owner was re-matched with three low-skilled workers and three high-skilled workers. While firm owners decided wage offers and the number of workers they would like to hire of each type, workers decided on their reservation wage value. After everyone made their respective decisions, the computer accepted or rejected the wage offers based on the reservation wages on behalf of the workers and one period ended with learning the payoffs. The treatment consisted of 30 periods. After the 15th period, the minimum wage was introduced unexpectedly and participants played the same game with the minimum wage for 15 more periods. In the second treatment, I had one type of worker (low-skilled worker), however, all of these low-skilled workers were assigned to one of the two sectors randomly before the experiment started: covered and uncovered sectors. I named the workers Type-1 if they were in the uncovered sector and Type-2 if they were in the covered sector. The game was the same with the first treatment however after the 15th period the minimum wage was introduced only for the Type-2 workers.

Under this experimental design, the main analysis for horizontal fairness in the first treatment is whether or not high-skilled workers' reservation wages are higher

than the low-skilled workers' reservation wages in the absence of the minimum wage and if there is a spillover effect of the introduction of a minimum wage on high-skilled workers' reservation wages after the minimum wage is introduced. On the other hand, for the second treatment based on horizontal fairness, I test whether or not workers in both sectors have similar reservation wages in the absence of the minimum wage and 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, I analyse if the firm owners offer different wages to the low and high-skilled workers due to differences in productivity, and if so, whether or not they increase the wages for high-skilled workers after the minimum wage is introduced although they pay more than the minimum wage in its absence. The same logic is valid for the second treatment; whether or not the firm owners 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 there is evidence of horizontal fairness concerns in the first treatment. High-skilled workers' reservation wages are higher than the low-skilled workers' in the absence of the minimum wage. Firm owners also offered higher wages to the high-skilled workers than the low-skilled workers before the minimum wage was introduced. Firm owners increased the wage offers for the high-skilled workers after the minimum wage was introduced, although their offers were already higher than the minimum wage in its absence and this shows evidence of spillover effect of the minimum wage introduction. The average value of the reservation wages of the high-skilled workers were less than the minimum wage level in the absence of the minimum wage, however, these workers demanded more than the minimum wage level and low-skilled workers, after the minimum wage was introduced. In the second treatment, 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 treatment. Firstly, they may not have considered this case as a violation of horizontal fairness because the reason for the violation was a new regulation in the market, not the employer's decision. Secondly, although it was not the employers' decision, workers may have considered it unfair because employers could have increased their wages. However, they might have preferred not to react to the violation of the horizontal fairness with increasing

their reservation wages. Studies about how workers react to the violation of the horizontal fairness are mostly based on the gift-exchange games and results show that workers react to the violation with decreased effort in the work place. However, decreasing effort and increasing the reservation wages generates different consequences. In a gift-exchange game, decreasing the effort increases the worker's payoff. However, increasing the reservation wage may result in zero earnings for the worker. Therefore, they may have considered it not worthy to take the risk and earn nothing in order to punish the firm owners in the case of a violation of the horizontal fairness. Then, it should be discussed why high-skilled workers in the first treatment did not behave in a similar way. One possible explanation for these results is that people might be more sensitive towards losing an advantage, meaning that 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 although it costs them to earn nothing.

This study proceeds as follows: the next section is the literature review where I mention some studies about the issues discussed so far. In Section 3, I will explain the experimental design and procedure. I will show my results in Section 4 which is followed by the discussion and concluding remarks in the last section.

2.2 Literature Review

2.2.1 Non-Experimental Studies

Kacperczyk and Bazzazian (2015) analysed how both vertical and horizontal fairness concerns of workers affect the cross-firm mobility in Sweden. They found that horizontal wage inequality increases an employee's tendency to make an external move, whereas vertical wage inequality reduces it. In addition, they found that the horizontal-inequality effect is greater for the bottom same-level wage earners and the vertical-inequality effect is greater for top different-level wage earners. Wade *et al.* (2006) also studied vertical fairness concerns based on the comparison of CEO and lower-level manager wages. They found that when CEOs increase their wages, they also increase their subordinates' wages. They also found that lower-level managers use CEO's wages in order to determine whether their wages are fair. In addition, if a lower-level manager thinks that he is underpaid compared to the CEO's wage, he is more likely to leave his job. On the other hand,

Brown (2001) studied if others' earnings are important for a worker's pay level satisfaction based on inequity concerns for different referent groups. The main focus of his study was to examine which of the factors were most important to workers: social referents (family, friends and relatives), financial referents (based on a worker's financial needs), historical referents (based on a workers previous wages), organisational referents (employees working in the same organisation) and market referents (based on pay comparisons with workers from other organisations). He found that all of these referent groups are important for the pay level satisfaction of underpaid and overpaid workers. However, market referents have the greatest impact on a worker's pay level satisfaction, regardless of whether he is overpaid or underpaid. In addition, the effects of referent groups are smaller for overpaid workers than underpaid workers. These studies demonstrate how wage comparisons are important for workers.

On the other hand, Neumark *et al.* (2004) studied to what extent minimum wage changes affect wage levels. They state that for the workers whose wages were at the minimum wage level or just a bit more, the elasticity between wages and minimum wage was about 0.8. It decreased as wages increased but still, for the workers earning between 1.1 and 1.5 times the minimum wage, the elasticities were change from 0.4 to 0.25. According to Maloney and Mendez's (2004) study which focused on the minimum wage and wage effects in Latin American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Honduras, Mexico, and Uruguay), people who earned 0.7-0.9 times the minimum wage , were affected most and as they moved up the income distribution this effect decreased. However, there were significant effects even up to 4 times the minimum wage. Fajnzylber (2001) found similar results for the effect of the minimum wage over the wage distribution for Brazil over 1982-1997. He states that the minimum wage affected the whole wage distribution, not just for people whose wages were around the minimum wage levels. The results of these studies show that the wages of people who were already earning higher than minimum wage increased, which means that there is evidence of spillover effects on the wages of these workers. However, it is not easy to determine whether or not the reason for wage increases is due to fairness concerns, as discussed before.

Examining how a minimum wage affects employers and employees in a sector where the minimum wage is not introduced - an uncovered sector in this study - is a much-debated issue in the literature. However, there are inconsistent results. For example, Lemos (2009) studied minimum wage effects in Brazil from 1982 to 2004.

She found positive effects up to the 90th percentile for the informal market wage distribution and up to the median in the formal sector wage distribution although the minimum wage level was between 5th and 10th (15th and 30th) percentile in the formal (informal) wage distribution. Jaramillo Baanante (2004) conducted similar research on Peru. He states that changes in minimum wage affect people who are at the bottom of the wage distribution in the informal sector. On the other hand, in the formal sector, the minimum wage affects only those who are directly affected between the old and new minimum wage levels. There are also some studies showing that there is no effect of the minimum wage on uncovered sectors. For example, Hohberg and Lay (2015) found that a minimum wage had significant positive effects on the wages in the covered sector, however there were no significant effects on employee earnings in the informal sector in their study, which was conducted in Indonesia between 1997 and 2007. With similar logic, these results may or may not show horizontal fairness concerns.

2.2.2 Experimental Studies

Abeler *et al.* (2010) studied equality and equity concerns with a three-person gift exchange game (one employer and two employees in a group of three) in a lab experiment. In their experiment, contrasting the regular gift-exchange game, firstly workers decide their effort levels and then the employers offer wages to these employees after they see the effort levels of the workers. They had two treatments in their experiment: there was no wage discrimination regardless of the effort levels in the first one and an employer could offer different wages to his employees in the second one. An employee was informed about the wage offered to his peer in the second treatment. They found that effort levels substantially decreased when there was only one wage. They claim that the reason was not the monetary incentives but the violation of the norm of equity. On the other hand, Brandts and Charness (2004) analysed how changes in market conditions affected people's behaviours in a gift-exchange game. They found that a minimum wage affected people's behaviours modestly. Having a minimum wage decreased effort levels for all wage offers and the probability of paying a higher wage. The results show that people not only considered the outcomes, but also considered the intentions behind these outcomes. Although these papers are related to either fairness or the introduction of a minimum wage, one cannot learn how reservation wages are affected, since they did not observe the workers' reservation wage decisions.

On the other hand, as mentioned above, Falk *et al*. (2006) studied the effects of the minimum wage on the reservation wages in the laboratory. They assigned participants into the worker and firm owner roles and they checked to what extent the introduction of the minimum wage affected wage offers, reservation wages and employment levels. They found that the minimum wage had important effects in terms of the fairness concerns on both the workers and employers. Although the reservation wages and wage offers (on average) were less than the minimum wage level before its introduction, workers and firm owners increased wages above the minimum wage level following its introduction. They also checked how removal of the minimum wage affected these parameters. The results show that the minimum wage had asymmetric effects, meaning that effects continued after the minimum wage was removed. Wang (2012) also used the same experimental design in the laboratory and analysed asymmetric information between workers and firm owners in terms of the minimum wage level. He replicated the study and found similar results to the original study. In addition, he also checked whether employers had fairness concerns in terms of being aware that workers did not have the exact information about the minimum wage level. He discovered that if workers did not know the minimum wage level and if employers were aware of this situation, they 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. Although both of these studies analysed the fairness concerns between workers and employers, they had one type of worker (homogenous workers) and a minimum wage was introduced for everyone. 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 by the minimum wage.

2.3 Experimental Design

In this section, I will explain my experimental design, provide information about the treatment procedures and how the experiment was conducted in detail. I will also state the hypotheses in consideration of this certain design. This experiment has two treatments and each treatment consists of a group game. Both treatments were designed 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 firm owner and three homogenous workers in terms of the productivity levels. However, in my experiment, in addition to this group consisting four participants, I added three more workers who either had the

same level of productivity, or higher level of productivity depending on the treatment.

2.3.1 Design of the Game

2.3.1.1 The First Treatment

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 during the session. There were three roles that participants were assigned: firm owner, low-skilled worker (LSW) and high-skilled worker (HSW). Participants were divided into the groups before each period started. One group included seven participants: one firm owner, three low-skilled workers and three high-skilled workers. Each firm owner was assigned to the workers randomly. This means that each participant might be in a different group with different workers or a firm owner in every period – however three of them were always high-skilled workers, three of them were low-skilled workers and one firm owner including himself.

None of the participants' role identities (workers or firm owners) were revealed to other participants. All participants were aware that everybody in the experiment should remain anonymous.

During the experiment, instead of using pounds (GBP), participants used an imaginary currency, called *experimental currency units* (ECU).

When the period started, a firm owner was supposed to submit four different hiring decisions:

(1) Submitting a wage offer to low-skilled workers.
(2) Submitting the amount of low-skilled workers he would like to hire (he may want to hire 0 or 1 or 2 or 3 low-skilled workers).
(3) Submitting a wage offer to high-skilled workers.
(4) Submitting the amount of high-skilled workers he would like to hire (he may want to hire 0 or 1 or 2 or 3 high-skilled workers).

As in the original design, there was no wage discrimination in the same skill group. This meant that the wage a firm owner proposed to the low-skilled workers was valid for all low-skilled workers who received an offer from him. This rule was valid for high-skilled workers as well.

Firm owners entered their wage offers, while workers entered the lowest wage (reservation wage) they were willing to accept in the current period. On the other side, firm owners also decided how many workers they would like to hire as was outlined above. If a firm owner wanted to hire three low-skilled and three high-skilled workers, the computer compared the offers and the reservation wages of the workers that were matched with that firm owner, after both parties entered their decisions. If the reservation wage was equal 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.

If a firm owner wanted to hire less than three workers (let's assume X workers) from either the low-skilled or high-skilled group, the computer chose X workers among 3 workers from that group randomly and only these chosen workers received an offer. Therefore, only these workers' reservation wages were compared to the wage offers by the computer. If a worker did not receive an offer, they were informed of this decision without being told the value of the wage offer.

In the case that a worker received a wage offer, they could view the details of the offer on the screen. If the offer was accepted according to the reservation wage value, the proposed wage would be his earnings for the current period of the session. If the offer was rejected, his earnings for this period would be zero. All workers entered their reservation wages without knowing the decisions of the other participants.

At the end of each round, firm owners were informed of their earnings for each skill group and of the amount of low and high-skilled workers 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 firm owner earned as a result of low- and high-skilled workers.

If a firm owner hired a worker depending on their offer and worker's reservation wage, the owner would enter into an employment contract with the worker. The profit received by the firm owner in each period depended on the wages he or she offered and on the revenue that the workers were providing. Therefore, the firm

owner's profit for a period was determined by the wages that were paid to the workers and the income earnt by them. A firm owner's profit was defined as:

Profit = Income - Cost

Table 1 below shows how much ECU a firm owner earns for each skill category by hiring an additional worker.

Table 1: Firm's Revenue Function in the First Treatment

Number of Workers Hired	Total Revenue-LSW	Total Revenue-HSW
1	400	800
2	750	1500
3	1000	2000

The table above applied to all firm owners and was common knowledge for all participants in the experiment. If a firm owner hired only one low-skilled worker, he received 400 ECU income thanks to his work. If he hired only one high-skilled worker, he would receive 800 ECU income. However, if he hired two low-skilled workers, the income would be 750 ECU as a result of these two low-skilled workers. The same logic was valid for high-skilled workers: if two high-skilled workers were hired, the owner's income would be 1500 for the high-skilled workers.

On the other hand, firm owners should also consider their costs, namely the wages they paid to their workers. The costs should have been subtracted from the income as mentioned above. If the wage was *WL* for the low-skilled workers and *WH* for the high-skilled workers, the payoff function for a firm owner depending on the number of the workers he hired was:

Payoff function of the firm owner for LSW= $\begin{cases} 0 & zero\ worker \\ 400 - WL & one\ worker \\ 750 - 2WL & two\ workers \\ 1000 - 3WL & three\ workers \end{cases}$ (1)

Payoff function of the firm owner for HSW= $\begin{cases} 0 & zero\ worker \\ 800 - WH & one\ worker \\ 1500 - 2WH & two\ workers \\ 2000 - 3WH & three\ workers \end{cases}$ (2)

On the other hand, if the wage offer was *w* for a worker, a worker's payoff function was:

Payoff function of the worker= $\begin{cases} 0 & \text{if he does not get an offer} \\ 0 & \text{if he gets an offer but rejects it} \\ w & \text{if he gets an offer and accepts it} \end{cases}$ (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 unexpected notification of the introduction of minimum wage. They were informed that there was a new rule had been introduced and firm owners 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[3].

At the end of the experiment, 3 of 30 periods were randomly chosen and the **s**ummation of these 3 periods were the amount, participants earnt from the experiment. The same 3 periods were chosen for everybody in the experiment. However, there was an additional lottery for firm owners. A number was chosen between 1 and 2 and when a 1 was drawn, the firm owners earnt profit as a result of the low-skilled workers and if a 2 was drawn, they earnt profit as a result of the high-skilled workers. Thanks to this feature, I was able to exclude all possible effects, such as substitution effect etc. because the payoffs for the different type of workers are independent for the firm owner. On the other hand, this feature might affect the employers in terms of the number of workers they would like to hire based on their risk preferences. They might be induced to hire both type 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 ECU = 1.0 (GBP). After this calculation, the earnings from the experiment were added to the amount of £4 (show-up fee) and this was the money they were given at the end of the experiment.

2.3.1.2 The Second Treatment

The second treatment was similar to the first, aside from two important differences. The first difference was that there were two same skill groups named as Type-1

[3] 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 a firm owner hires only one worker then he 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.

workers and Type-2 workers instead of having two different skill workers (low-skilled and high-skilled)[4]. All the rules which have been explained so far were also valid for this treatment. In each period, firm owners were assigned six employees randomly: three of these workers were Type-1 workers and three of these workers were Type-2 workers. All workers and firm owners were re-matched before each period started and played the game according to the rules explained in the first treatment above. The information shared with the participants after each period was the same as the previous treatment. However the income table appeared as below:

Table 2: Firm's Revenue Function in the Second Treatment

Number of Workers Hired	Total Revenue- Type-1	Total Revenue-Type-2
1	400	400
2	750	750
3	1000	1000

The interpretation of the table is the same as the previous treatment. Firm owners' income depended on the number of workers they hired. If a firm owner hired only one Type-1 workers, he received 400 ECU. If he hired only one Type-2 worker, he received 400 ECU. The payoff functions for a firm owner for both Type-1 and Type-2 workers were the same as the firm's payoff function for the low-skilled workers explained in the first treatment (equation (1)). On the other hand, the payoff function for the Type-1 and Type-2 workers was also the same as a worker's payoff function in the first treatment (equation (3)).

The second important difference was that the minimum wage was introduced only for Type-2 workers. After the 15th period, participants were informed about the

[4] The research was based on the different type of workers in the first phase. 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 treatment. After the pilot sessions were conducted for this treatment, the treatment referring to the covered and uncovered sectors was added to this study as the second treatment. Since there were the same type of workers in terms of skills in the second treatment, the labels were changed to Type-1 and Type-2 workers based on whether or not 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 treatment was added to the experiment, was that the pilot sessions were already conducted for the first treatment. Ultimately, the main purpose of this study was not based on the comparison of these two treatments. For this reason, using different labels in two treatments is not expected to affect the results.

minimum wage introduction and were informed that this new rule covered only Type-2 workers, whilst there was no new rule for Type-1 workers. They were also informed that the information was communicated to all participants in the experiment. Calculation of the payment based on the chosen 3 periods for the workers and the firm owners and chosen group of workers, was the same as the first treatment.

The total amount of ECU the participants earned over the course of the experiment was converted into pounds after completion of the experiment with the exchange rate set at 100 ECU = 1.5 (GBP). After this calculation, 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. The reason for determining the exchange rates differently in two treatments was in order to provide sufficient average earnings for the participants. Since only low-skilled workers featured in the second treatment, the average value of the earnings in this treatment were insufficient for the 75 minute-experiment. For this reason, a higher exchange rate was preferred in this treatment.

For both treatments, the reason for choosing a within-subject design was to observe how an unexpected exogenous change in the market affects the participants. In order to observe the effect of the change, it was preferable to measure participants' decisions before the change for comparisons. Alternatively, a between-subject design based on two treatments could have been selected: one treatment with no minimum wage and no change during the session and one treatment with the minimum wage from the beginning of the treatment until the end. However, this may not have shown the reactions of the participants to an exogenous change in the market since there would not be any change in the reference points (wage intervals) within a treatment. For this reason, within-subject design was the preferable study design for this experiment.

On the other hand, the sequence of the treatments might also be discussed in terms of internal validity. In fact, Falk *et al*. (2006) ran another treatment which started with the implementation of minimum wage which was subsequently removed in the middle of the session, in addition to the main treatment which started with no minimum wage and the introduction of minimum wage by the middle of the session. They compared the existence and absence of the minimum wage with these two treatments. They found asymmetric effect of the minimum wage changes. This means that wage offers and reservation wages did not decrease by a significant amount after the removal of the minimum wage. The authors

explained that being exposed to a minimum wage may encourage participants to get used to higher wages and may create entitlements. In fact, it has been discussed in the literature that workers are more sensitive to wage cuts than wage increases (Kube *et al*., 2013). Since the main purpose of this study was to analyse and find causal effects based on the effect of wage increases due to the minimum wage introduction, no issues related to internal validity were expected. In addition to this issue, learning was also a potential challenge in the lab experiments. In the results section below, possible learning effects are discussed with the regressions which were modelled whilst controlling for the temporal effects.

One of the other common concerns for laboratory experiments is repeated-game effects. In both treatments of the experiment, a worker was re-matched with an employer and the other workers randomly in each period. Random matching protocol helps to cancel out these possible effects. In 7 of 8 sessions of the experiment, there were 4 employers whereas there were 3 employers in 1 session. It is obvious that a worker is re-matched with the same employer in the later periods. However, firstly, it is not possible to learn in which period a worker is matched with which of the employers so that this can decrease the possible repeated-game effects. Secondly, for this experiment which focuses on the workers' reservation wages, repeated-game effects should not be a concern due to reservation wage property explained above. If workers are worried about not being hired by the employer, they would set their reservation wages at the lowest possible value in order to be hired in all periods. However, they do not prefer this according to previous studies (self-interest hypothesis) (Falk *et al*., 2006). For this reason, their decisions in a period are expected to be independent from their decisions in other periods. In addition, workers were aware that their reservation wage values were not shared with employers.

On the other hand, from the employer perspective, it is much more difficult for them to estimate which workers they are matched in a period. In 7 of the 8 sessions, there were 24 workers, whereas there were 21 in 1 session. In addition, if they did not want to make an offer to all workers with whom they were matched in a certain period (such as making an offer to one low-skilled worker among three of them), it is not possible to estimate which worker would be picked by the computer for this offer since this was also a random procedure. On the other hand, as just mentioned above, workers' reservation wage values were not shared with the employers which also helps to cancel out these possible effects in terms of the participants having the employer role. They only knew if their offers were accepted or not. They were

not informed by how much the reservation wages were above or below their offers so that it would not make sense from them to determine their wage offers in a period with consideration for the later periods. Lastly, the payments were calculated based on the periods randomly chosen. As a result, it is expected that all participants would make their decisions in each period independently and these possible repeated-game effects are not supposed to be a problem for this particular experimental design.

2.3.2 Running the Experiment

The experiment was run in the ExpReSS Lab at Royal Holloway, 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. I ran 4 sessions for each treatment. For the first treatment, I had 3 sessions with 28 participants (4 groups in each session) and 1 session with 21 participants (3 groups in the session). The reason for having fewer participants in the last session of the first treatment was the lack of the participants for that day. However, I was able to run 4 sessions with 28 participants in each session for the second treatment.

When the participants arrived at the lab, they picked a number from a bag and sat at the terminal instructed by the number that was chosen. After everyone sat at a terminal, consent forms and participant information sheets were given 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 by the computer aloud. 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 and all participants were asked to solve some quiz questions before they started the experiment. Instructions can be seen in Appendix A.1.

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 get used to the game on the computer and these practice periods would not affect their earnings. After the third practice period, they started the first period of the experiment. They were informed of how they would know that the practice period had finished and the experiment started.

On average, from the moment the consent form and the participant information sheet were distributed, to the end of the 30th period, all sessions ended within 75 minutes. Participants were paid £11.80 on average.

2.3.3 Hypotheses

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

H1: *High-skilled workers' reservation wages will be higher than the low-skilled workers' 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 due to fairness perceptions (Gartenberg and Wulf, 2017; Kacperczyk and Bazzazian, 2015). The high-skilled workers are aware that they provide more revenue to their employers than the low-skilled workers in this experimental design. For this reason, they are expected to demand higher wages than the low-skilled workers before the minimum wage is introduced.

H2: *There will not be difference in Type-1 and Type-2 workers' reservation wages on average in the absence of the minimum wage.*

On the other hand, workers who have the same level of productivity should earn the same wages, in order to be treated fairly (Abeler *et al.* 2010; Gartenberg and Wulf, 2017). For this reason, both types of workers in the second treatment are expected to have similar reservation wages since they provide the same amount of revenues to their employers.

H3- *Firm owners will offer higher wages to the high-skilled workers than the low-skilled workers in the first treatment before the minimum wage introduction.*

Firm owners offer higher wages to the high-skilled workers than the low-skilled workers due to two possible reasons. Firstly, firm owners may want to behave fairly towards workers and as a result of this, they consider the differences between these workers and they may want to provide horizontal fairness between these workers. Secondly, they may be aware of the workers' fairness concerns, in terms of how the workers decide their reservation wages, so in order to hire these workers they have to offer higher wages to the high-skilled workers since these workers' reservation wages are expected to be higher than the low-skilled workers' reservation wages.

H4- *There will not be difference in firm owners' wage offers for both Type-1 and Type-2 workers before the minimum wage introduction.*

Since both type of workers in the second treatment provide the same level of revenue, firm owners would not discriminate the wages between Type-1 and Type-2 workers in the absence of the minimum wage for the same possible reasons: these two types of workers' reservation wages may be similar and this leads firm owners to offer similar wages to these workers, or firm owners offer similar wages due to horizontal fairness concerns, regardless of the workers' reservation wages.

H5: *High-skilled workers increase their reservation wages after the minimum wage introduction.*

If the high-skilled workers' 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 introduction of the minimum wage, due to reservation wage concept. However, the difference between their wages and the low-skilled workers' wages decreases with the minimum wage. Due to their horizontal fairness concerns, high-skilled workers also increase their reservation wages with the minimum wage introduction, since they consider the relative wage changes. On the other hand, if the high-skilled workers' 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, based on the reservation wage concept. However, since the low-skilled workers will earn at least the minimum wage level, high-skilled workers increase their reservation wages above the minimum wage level and keep demanding higher wages than the low-skilled workers.

H6: *Type-1 workers increase their reservation wages after the minimum wage introduction.*

Although the minimum wage is not binding for the Type-1 workers in the second treatment, they also increase their reservation wages with the minimum wage introduction since they think that they should earn similar wages to Type-2 workers who are bound by the minimum wage due to their horizontal fairness concerns.

H7: *Firm owners increase their wage offers for the high-skilled workers after the minimum wage introduction.*

The reasons for the increase in the wage offers are similar to the reasons discussed in H3 above. Even if the firm owners already offer higher wage values to the high-skilled workers than the minimum wage level in absence of it, they still increase their wage offers with the minimum wage introduction due to two possible reasons. Either these workers increase their reservation wages as discussed in H5 and firm owners are supposed increase the wages in order to hire these workers, or they increase the wages in order to provide horizontal fairness between high and low-skilled workers since the minimum wage introduction decreases the difference between the wages of high and low-skilled workers.

H8: *Firm owners increase their wage offers for the Type-1 workers after the minimum wage introduction.*

In the second treatment, although firm owners do not have to increase the wage offers for the Type-1 workers since the minimum wage introduction does not cover them, they also increase the wage offers for Type-1 workers in order to provide horizontal fairness between similar workers or these workers also demand higher wages by increasing their reservation wages as discussed above. For either of the reasons, minimum wage introduction leads firm owners the increase their wage offers for the Type-1 workers.

2.4 Results

I will present the results of the two treatments in this section. The results of each treatment will begin with the firm owners' wage offers, followed by the reservation wages.

2.4.1 The First Treatment

Result.1: Firm owners offered higher wages to the high-skilled workers than the low-skilled workers before the minimum wage introduction. There is evidence of the spillover effect of the minimum wage introduction on the wage offers of the high-skilled workers.

Table 3 below shows the mean values of the wage offers for both worker groups, with and without the minimum wage. As can be seen from the table that wage offers for the HSW are much greater than the LSW in the absence of the minimum wage showing, evidence of offering different wages to workers to provide horizontal fairness based on the differences in productivities as discussed in H3.

The difference is statistically significant with a p-value of 0.000 according to the Mann-Whitney (M-W) test with the null hypothesis claiming the distributions are the same whereas the alternative hypothesis claiming that the distributions are not the same[5]. In terms of the difference between before and after the minimum wage introduction, there is a small increase for the HSW on average, but the increase is not statistically significant according to M-W test result with the p-value of 0.35.

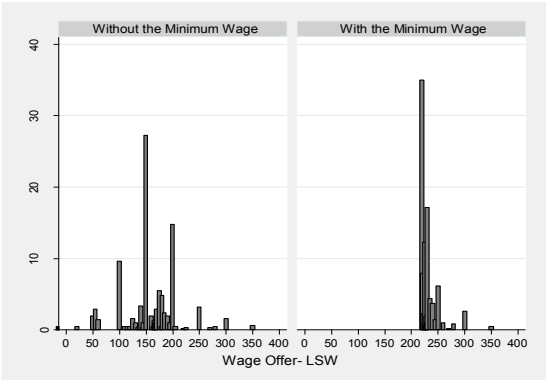
Table 3:Average Values of the Wage Offers

	Wage-LSW	Wage-HSW
Before the Minimum Wage Introduction		
	159.29	304.22
	(50.04)	(95.24)
N/Observations[6]	15/624	15/625
	230.03	306.70
After the Minimum Wage Introduction	(17.52)	(58.54)
N/Observations	15/620	15/630

Note: Standard deviations are in parentheses.

The distribution figures below show the differences of the wage offers before and after the minimum wage introduction for the low-skilled and high-skilled workers.

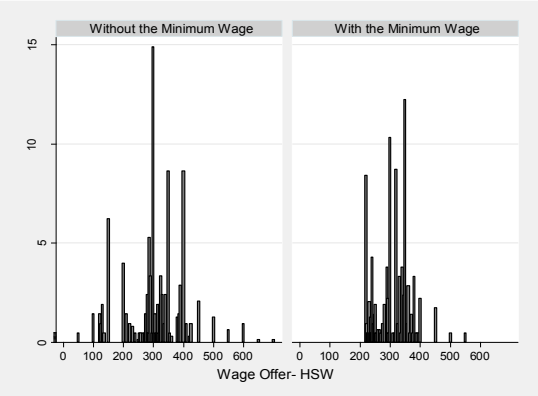
Figure 1: Wage Offer Distributions- LSW



[5] Unless otherwise stated, for all M-W tests applied in this thesis, when comparing two samples, the null hypothesis states that the distributions of the two samples are the same and the alternative hypothesis states that the distributions of the two samples are not the same.

[6] N refers to the number of different individuals in the sample whereas observations refer to the number of total observations. This will be valid in all the summary statistics tables in the rest of the thesis.

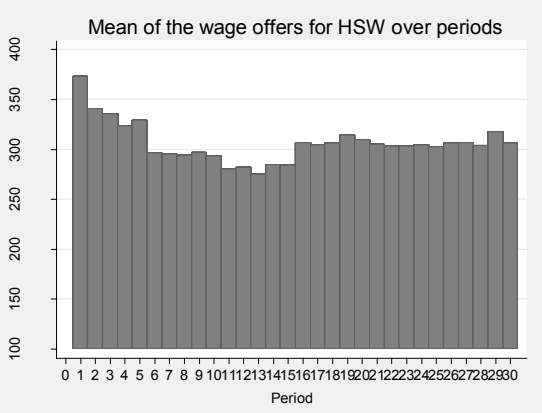
Figure 2: Wage Offer Distributions- HSW



I also checked the average wage offers over the periods to determine if there are any observable differences between the first several periods and the periods which follow, in terms of a possible learning process, which is a common issue in laboratory experiments. Figure 3 and Figure 4 below, show that the first couple of periods and the later periods which follow, 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 offers in in the periods 6-15, with p-values of 0.000 for both LSW and HSW wage offers.

Figure 3: Wage Offers over Periods- LSW

Figure 4: Wage Offers over Periods- HSW



As can be seen from Table 4 below, if the first five periods are omitted (as an example), the average values of the wage offers before the minimum wage introduction, decreases for both LSW and HSW. It increases the differences in the average values of wage offers for LSW and HSW, before and after the minimum wage and the difference (before and after the minimum wage introduction) for the HSW becomes statistically significant according to M-W test result with a p-value of 0.000. For this reason, in order to measure these kinds of possible effects, period variable is added to the regression analysis.

Table 4: Average Values of the Wage Offers without the First Five Periods

	Wage-LSW	Wage-HSW
Before the Minimum Wage Introduction	149.08	287.98
	(39.75)	(81.08)
N/Observations	15/422	15/429
After the Minimum Wage Introduction	230.03	306.70
	(17.52)	(58.54)
N/Observations	15/620	15/630

Notes: Standard deviations are in parentheses.

Regression results in Table 5 shown below provide more precise information about the changes. The dependent variable is the value of the wage offer for LSW (Columns 1 and 2) and HSW (Columns 3 and 4), 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, in order to deal with the period problem as discussed above.

As can be seen in the table, introducing the minimum wage has a significant effect on the LSW wage offers as it is expected (column 1), since the minimum wage is binding on average for these workers. However there is no significant effect of introducing the minimum wage on HSW wage offers (column 3). The coefficient of the minimum wage dummy (for HSW) is small but positive, as it is expected in terms of spillover effect, however it is not statistically significant. Running the regression with the period variable changes results substantially. With the period variable in Columns 2 and 4, coefficients of the minimum wage dummies increase. In addition, the coefficient of the minimum wage dummy variable in the HSW regression

(column 4), becomes significant at the 1% level. These results show that firm owners increased the wage offers for HSW after the minimum wage, although they were already offering wages greater than the minimum wage level. This means that introduction of the minimum wage generated a spillover effect on the high-skilled workers' wages, as discussed in H7.

Table 5:OLS Regression Results for the Wage Offers

Dependent Variable:	W.O.-LSW	W.O.-LSW	W.O.-HSW	W.O.-HSW
	(1)	(2)	(3)	(4)
Constant	166.57***	180.33***	274.76***	297.27***
	(2.08)	(3.16)	(5.36)	(7.25)
Minimum Wage Dummy	70.66***	96.41***	2.13	43.44***
	(1.89)	(3.85)	(4.36)	(8.13)
Period	No	Yes	No	Yes
Including the Session Fixed Effect	Yes	Yes	Yes	Yes
Observations	1244	1244	1255	1255
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.49	0.51	0.06	0.10

Notes: Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01.

Changes in actual wages due to introduction of the minimum wage also show similar results with the wage offers. As is shown in Table 6 below, the average value of the actual wages of LSW was below the minimum wage in the absence of the minimum wage and it increases above the minimum wage after it was introduced. According to the Wilcoxon signed-rank (W-S-R) test results, actual wage values of LSW, after the minimum wage introduction, are significantly different than 220 with

the p-value of 0.000[7]. Regression results for LSW in Table 7 are also consistent with these results. The minimum wage dummy is positive and statistically significant in column 1 and the addition of the period variable does not change the significance (column 2).

On the other hand, the mean value of the actual wages of HSW decreases with the minimum wage introduction as can be seen from Table 6 however this is not statistically significant according to the M-W test result with a p-value of 0.22. According to the regression results for HSW in column 3, there is no statistically significant change with the minimum wage either. In addition, although it is not significant, there is a decrease in actual wages (sign of the coefficient of the minimum wage dummy is negative as can be seen from Table 7 column 3). However, if the regression for HSW is run with the period variable, the coefficient of the minimum wage dummy becomes positive and statistically significant at the 1% level (column 4). These results also show evidence of the spillover effect on the actual wages of the high-skilled workers, due to minimum wage introduction.

Table 6: Average Values of the Actual Wages

	Actual Wage-LSW	Actual Wage-HSW
Before the Minimum Wage Introduction	164.97	311.81
	(48.70)	(91.69)
Observations	536	570
After the Minimum Wage Introduction	230.61	308.4
	(18.03)	(59.77)
Observations	575	570

Notes: Standard deviations are in parentheses.

[7] Unless otherwise stated, for all W-S-R tests applied in this thesis, if a sample is compared to a constant value, the null hypothesis states that the median of the sample is equal to that constant value whereas the alternative hypothesis states that the median of the sample is not equal to that constant value (such as 220 in this case). However, if W-S-R test is applied when comparing two samples, the null hypothesis states that the medians of the two samples are equal and the alternative hypothesis states that the medians of the two samples are not equal.

Table 7: OLS Regression Results for the Actual Wages

Dependent Variable:	A.W.-LSW (1)	A.W.-LSW (2)	A.W.-HSW (3)	A.W.-HSW (4)
Constant	170.56***	186.97***	280.15***	304.71***
	(1.95)	(3.17)	(5.42)	(7.24)
Minimum Wage Dummy	65.71***	96.38***	-4.1	41.67***
	(2.22)	(4.03)	(4.42)	(8.36)
Period	No	Yes	No	Yes
Including the Session Fixed Effect	Yes	Yes	Yes	Yes
Observations	1111	1111	1140	1140
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.46	0.50	0.08	0.11

Notes: Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01.

Table 8 and Table 9 show both average actual wages and the optimal average wage offers[8] over the sessions for LSW and HSW, respectively. The optimal wage values are calculated based on the reservation wage decision discussed below. As can be seen from the tables, actual wages are greater than the optimal wages and it can be interpreted as firm owners offered more than they were supposed to offer in terms of the profit-maximization values. Actual wages are statistically different from the optimal wage values for all sessions according to the W-S-R test results with all the p-values at 0.000 for both LSW and HSW. The results in terms of statistical significance do not change if the Holm-Bonferroni method is applied for all the session-level comparisons for both treatments.

[8] Optimal wage offers were calculated based on the reservation wages of the workers that the firm owners were matched in each period. For example, let's assume that a firm owner wanted to hire three LSW for the second period and he 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 firm owner would know the reservation wages, offering 150 was going to be the optimal value since he could still hire three workers but also increase his payoff as decreasing the costs. As a result, the optimal wage would be 150.

Table 8: Profit Maximization Wage Offers for LSW

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

Notes: Standard deviations are in parentheses.

Table 9: Profit Maximization Wage Offers for HSW

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

Notes: Standard deviations are in parentheses.

On the other hand, for the aggregate level data including all the sessions, the average actual wage for the low-skilled workers is 164.97 whereas the average optimal wage value is 89.23 before the minimum wage introduction. The difference is statistically significant according to W-S-R test with a p-value of 0.000. In addition, the average actual wage is 230.61 and the average optimal wage is 221.41 for these workers after the minimum wage introduction. The difference is also significant with a p-value of 0.000 based on the W-S-R test. For the high-skilled workers, the aggregate level data including all the sessions shows that the average value of actual wages is 311.81 and the average optimal wage value is 137.67 before the minimum wage introduction whereas the average value of actual wage

value is 308.40 and the average optimal wage value is 255.21 after the minimum wage introduction. The average actual wages are statistically different then the optimal wages before and after the minimum wage introduction with the p-values of 0.000 according to W-S-R test results.

Result.2: High-skilled workers' reservation wage value on average, is greater than the value for the low-skilled workers', with and without the minimum wage. There is evidence of the spillover effect of the minimum wage introduction on the high-skilled workers' reservation wages.

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

Table 10: Average Values of the Reservation Wages

	Reservation Wage-LSW	Reservation Wage-HSW
Before the Minimum Wage Introduction	80.27	118.69
	(70.63)	(117.19)
N/Observations	45/675	45/675
After the Minimum Wage Introduction	221.8	246.04
	(7.67)	(46.25)
N/Observations	45/675	45/675

Notes: Standard deviations are in parentheses.

As can be seen from Table 10, the high-skilled workers' reservation wages are greater than the low-skilled workers' in the absence of the minimum wage. The difference is statistically significant according to the M-W test with a p-value of 0.000. It means that high-skilled workers demanded more than the low-skilled workers as is expected by the hypothesis based on horizontal comparisons, as discussed in H1. After the minimum wage introduction, average value of the low-skilled workers' reservation wages increases to 221.8 whereas the high-skilled workers' reservation wages increases to 246.04, as shown in Table 10. The difference between these types of workers' reservation wages after the minimum wage introduction is still significantly different according to M-W test results with a p-value of 0.000.

According to reservation wage concept, workers are supposed to accept all the offers equal or greater than their reservation wage values. In this case, high-skilled workers were supposed to be willing to accept 220 on average after the minimum wage introduction, since the average value of the reservation wage of the high-skilled workers was 118.69 in the absence of the minimum wage. However, since the minimum wage provided at least 220 ECU to the low-skilled workers, high-skilled workers demanded more than 220 in average. As mentioned above, this is evidence of high-skilled workers having horizontal fairness concerns. They wanted to keep earning more than the low-skilled workers after the minimum wage was introduced as well as discussed in H5.

The interesting point is that the difference between high and low-skilled workers' average reservation wages decreases after the minimum wage introduction from 38.4 to 24.2. This means that the increase in reservation wages of the low-skilled workers is higher than the increase in the high-skilled workers' reservation wages after the minimum wage introduction. However, the difference in these increases between two types of workers reservation wages is not statistically significant according to M-W test with a p-value of 0.61.

For both low-skilled and high-skilled workers, reservation wage distributions can be seen from the figures below. Figure 5 shows the distributions for the reservation wages of LSW, with and without the minimum wage, whereas Figure 6 shows the same for the HSW.

Figure 5: Distributions of the Reservation Wages- LSW

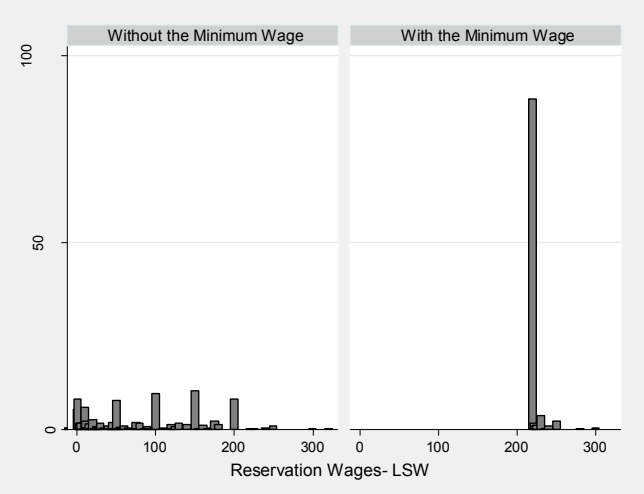
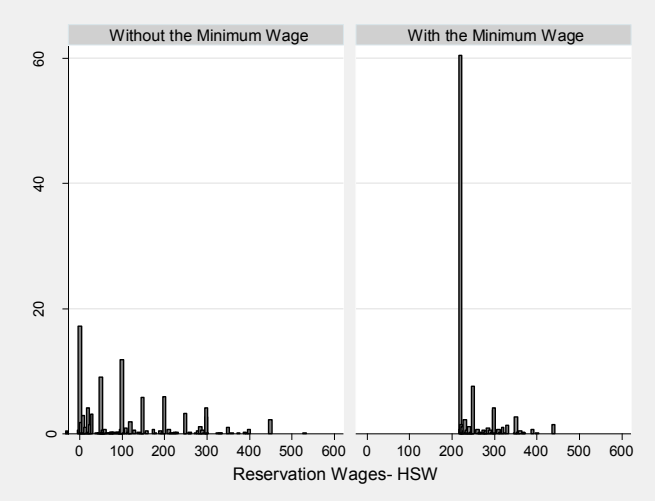


Figure 6: Distributions of the Reservation Wages- HSW



Average values over the periods were also checked in case there was any learning process, as it was for the firm owners. However, there were no significant differences between the first several (5 or less) periods and the remaining periods, according to M-W test results, with all p-values greater than 0.10. The reason for their being less change or lack of a learning process for the workers compared to firm owners, is perhaps due to the fact that workers adapted to the game faster than firm owners which makes sense. While a worker only decides his or her own reservation wage which determines how much share he or she wants to receive from the firm owner, a firm owner has to make four different decisions (wage offer for each group and how many workers he would like to hire from each group). Therefore, it might be said that a firm owner requires more practise or experience to adapt to the experiment-game.

Table 11 below shows the regression results for the reservation wages with and without the period variable for both LSW and HSW. Coefficients of the minimum wage dummies are statistically significant at the 1% level in all regressions, with or without the period variable for both LSW and HSW regressions.

2.4.2 The Second Treatment

Result.1: There is no evidence of spillover effect of the minimum wage introduction on the wage offers for the Type-1 workers.

Table 11: OLS Regression Results for the Reservation Wages

Dependent Variable:	R.W.-LSW	R.W.-LSW	R.W.-HSW	R.W.-HSW
	(1)	(2)	(3)	(4)
Constant	81.60***	77.54***	81.72***	163.23***
	(3.58)	(4.37)	(4.00)	(8.57)
Minimum Wage Dummy	141.52***	148.90***	127.34***	128.00***
	(2.71)	(5.27)	(4.53)	(8.96)
Period	No	Yes	No	Yes
Including the Session Fixed Effect	Yes	Yes	Yes	Yes
Observations	1350	1350	1350	1350
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.67	0.67	0.42	0.42

Notes: Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01.

Table 12 below shows the average values of the wage offers for both worker groups with and without the minimum wage. According to these average values, the interesting point is the wage offer difference between Type-1 and Type-2 workers in the absence of the minimum wage. According to the M-W result, the difference is statistically significant with a p-value of 0.002. This result is not consistent with the expectation based on horizontal fairness discussed in H4[9]. On the other hand, For the Type-1 workers, there is a small increase in the average value of the wage

[9] In case there were some framing problems which led firm owners to think that Type-1 workers were more valuable, I checked the average wage offers for each session and for each type of worker in the absence of the minimum wage. According to the averages in Table A.2 in the appendix, there is no regular differences in wage offers between two types. For example, in the first session, firm owners offered higher wages to Type-1 workers whereas other firm owners offered higher wages to the Type-2 workers 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 firm owners faced. As discussed in the reservation wage section below, there are two outliers having the role of Type-1 workers in this treatment.

offers after the minimum wage is introduced. However, M-W test result shows that this difference is not statistically significant with a p-value of 0.14. There is an increase in the average values of the wage offers for the Type-2 workers as is expected, and the increase is statistically significant according to M-W test with a p-value of 0.000.

Table 12: Average Values of the Wage Offers

	Wage-Offers Type-1 Workers	Wage-Offers Type-2 Workers
Before the Minimum Wage Introduction	124.42	116.47
	(59.48)	(55.48)
N/Observations	16/685	16/695
After the Minimum Wage Introduction	126.93	226.47
	(61.68)	(12.89)
N/Observations	16/706	16/687

Notes: Standard deviations are in parentheses.

The figures below show the distributions of the wage offers. Figure 7 shows the distributions for the Type-1 workers, whereas Figure 8 shows for the Type-2 workers, before and after the minimum wage introduction.

Figure 7: Distributions of the Wage Offers- Type-1

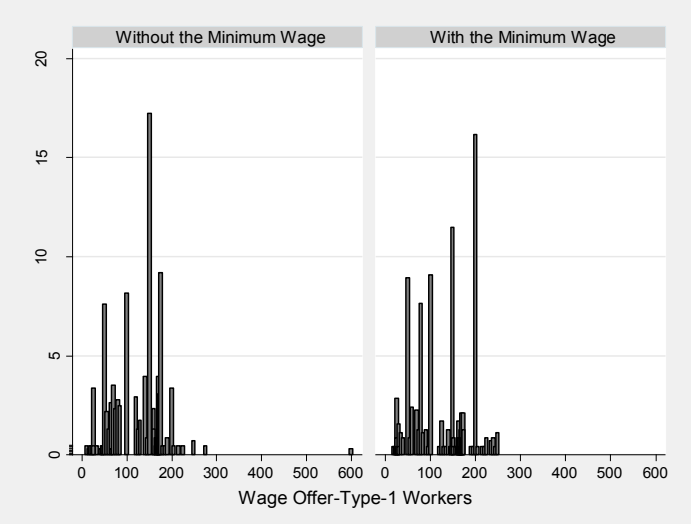


Figure 8: Distributions of the Wage Offers- Type-2

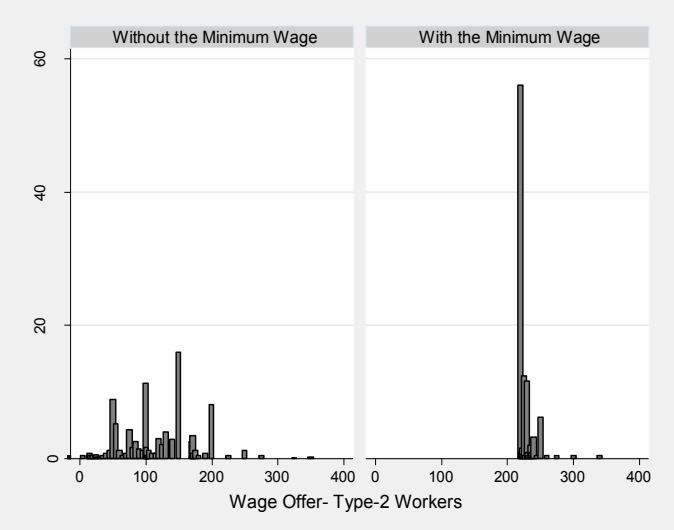


Table 13: OLS Regression Results for the Wage Offers

Dependent Variable:	W.O.-Type-1	W.O.-Type-1	W.O.-Type-2	W.O.-Type-2
	(1)	(2)	(3)	(4)
Constant	148.03***	150.04***	118.88***	128.92***
	(2.35)	(4.31)	(1.79)	(2.78)
Minimum Wage Dummy	2.87	4.28	109.90***	128.64***
	(2.45)	(4.95)	(1.90)	(3.74)
Period	No	Yes	No	Yes
Including the Session-Fixed Effect	Yes	Yes	Yes	Yes
Observations	1391	1391	1382	1382
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.43	0.44	0.72	0.73

Notes: Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***<0.01.

Table 13 above shows the regression results for the wage offers of two types of workers. As can be seen from the table, the coefficient of the minimum wage dummy for the Type-2 workers is positive and significant at the 1% level as is expected, since the minimum wage is binding for these workers, with and without

the period variable (column 4 and 3). On the other hand, the coefficient of the minimum wage dummy for the Type-1 workers is not statistically significant, although it is positive with and without the period variable (columns 2 and 1). This shows that there is no effect of the minimum wage introduction on the wage offers for the Type-1 workers in contrast to H8.

Introduction of the minimum wage caused similar changes in actual wages with the wage offers. As can be seen in Table 14, although there is a small increase in the average actual wages for the Type-1 workers with the minimum wage introduction, this difference is not statistically significant according to M-W test result with a p-value of 0.15. However, for the Type-2 workers, the difference between the average values before and after the minimum wage introduction is statistically significant according to M-W test result with a p-value of 0.000.

Table 14: Average Values of the Actual Wages

	Actual Wage Type-1 Workers	Actual Wage Type-2 Workers
Before the Minimum Wage Introduction	132.33	121.71
	(59.16)	(55.69)
Observations	539	592
After the Minimum Wage Introduction	133.93	226.62
	(60.39)	(13.11)
Observations	579	657

Notes: Standard deviations are in parentheses.

According to the regression results presented in Table 15, introducing the minimum wage increases the actual wages for the Type-1 workers, however the coefficient is not statistically significant (column 1). On the other hand, the actual wages of the Type-2 workers increase above the minimum wage level after the minimum wage introduction, as can be seen in column 3 and the coefficient of the minimum wage dummy is significant at the 1% level. Including the period variable into the models does not change anything in terms of statistical significance, for both Type-1 and Type-2 workers (columns 2 and 4).

Table 15 : OLS Regression Results for the Actual Wages

Dependent Variable:	A.W.-Type-1	A.W.-Type-1	A.W.-Type-2	A.W.-Type-2
	(1)	(2)	(3)	(4)
Constant	151.93***	152.04***	123.00***	134.13***
	(2.47)	(3.43)	(1.89)	(2.84)
Minimum Wage Dummy	1.4	1.61	104.62***	125.52***
	(2.6)	(5.35)	(2.03)	(3.94)
Period	No	Yes	No	Yes
Including the Session-Fixed Effect	Yes	Yes	Yes	Yes
Observations	1118	1118	1249	1249
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.47	0.47	0.79	0.72

Notes: Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***<0.01.

All these results show that introducing the minimum wage in one sector only, did not generate any spillover effect on the wages of the workers in the other sector, among whom the minimum wage is not introduced. Based on these results, we can conclude that there is no evidence that firm owners considered the horizontal fairness between workers who were homogenous in terms of the revenue they provided to the firm owners, as discussed in H8.

Table 16 and Table 17 both show average actual wages and the average optimal wage offers over the sessions for Type-1 and Type-2 workers, respectively. As can be seen from the tables, actual wages are greater than the optimal wages and it can be interpreted as firm owners offered more than they were supposed to offer in terms of the profit-maximization values. Actual wages are statistically different than the optimal wage values for all sessions, with or without the minimum wage according to the W-S-R test results, with p-values of 0.000 for both Type-1 and Type-2 workers. The results in terms of statistical significance do not change if the Holm-Bonferroni method is applied for all the session-level comparisons for both treatments.

Table 16: Profit Maximization Wage Offers for Type-1 Workers

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

Notes: Standard deviations are in parentheses.

Table 17: Profit Maximization Wage Offers for Type-2 Workers

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

Notes: Standard deviations are in parentheses.

On the other hand, for the aggregate level data including all the sessions, the average actual wage for the Type-1 workers is 132.33 whereas the average optimal wage value is 72.00 before the minimum wage introduction. The difference is statistically significant according to W-S-R test with a p-value of 0.000. The average actual wage is 133.93 and the average optimal wage is 76.72 for these workers after the minimum wage introduction. The difference is also significant with a p-value of 0.000 based on the W-S-R test. For the Type-2 workers, the average value of actual wages is 121.71 and the average optimal wage value is 75.80 before the minimum wage introduction whereas the average value of actual wage value is 226.62 and the average optimal wage value is 220.72 after the minimum wage introduction. The differences between the actual wages and the optimal wages

before and after the minimum wage introduction are statistically significant with the p-values of 0.000 according to W-S-R test.

Result.2: There is no evidence of spillover effect of the minimum wage introduction on the Type-1 workers' reservation wages.

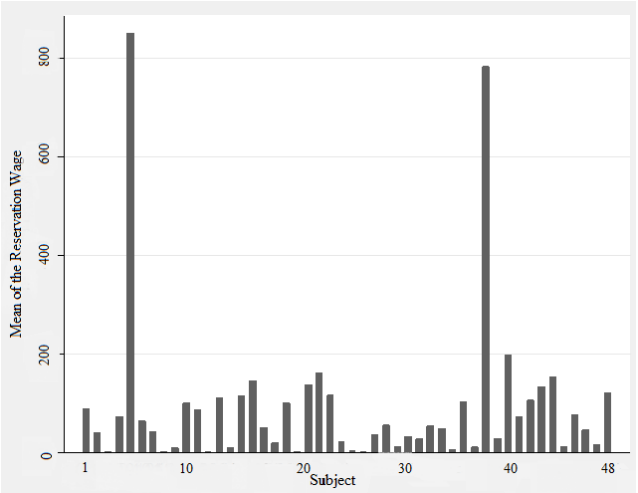
As can be seen in Table 18, surprisingly, the average reservation wage of the Type-1 workers decreased after the minimum wage was introduced. However, there is no significant difference between the reservation wages of these workers before and after the minimum wage introduction according to the M-W test result with a p-value of 0.80. There is also another interesting result in terms of the reservation wage averages in the absence of the minimum wage. The average value of the Type-1 workers' reservation wages are much higher than the Type-2 workers' reservation wages before the minimum wage introduction although the difference is not statistically significant according M-W test with a p-value of 0.23. Figure 9 below, shows the average reservation wages over the subjects for Type-1 workers. Two outliers can be easily identified in the figure. These two outliers' represent average reservation wages which are significantly higher, which could in fact increase the average of all Type-1 workers significantly.

Table 18: Average Values of the Reservation Wages

	Reservation Wage-Type-1	Reservation Wage-Type-2
Before the Minimum Wage Introduction	96.01	62.7
	(168.66)	(57.14)
N/Observations	48/720	48/720
After the Minimum Wage Introduction	93.45	221.1
	(164.687)	(5.82)
N/Observations	48/720	48/720

Notes: Standard deviations are in parentheses.

Figure 9: Reservation Wages of the Type-1 Workers over Subjects



If these two outliers are excluded, then the remainder of the Type-1 workers' reservation wages becomes 64.66 on average, which is so close to the Type-2 workers' average reservation wages. Without these two subjects, there is no significant difference between the Type-1 and Type-2 workers' reservation wage values according to the M-W test result (with a p-value of 0.84) in the absence of the minimum wage as it was expected based on the horizontal fairness discussed in H2. In addition, if these two outliers are excluded, the average value of the reservation wages of the Type-1 workers 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 0.79. However, these two outliers are not excluded for the further analysis explained below.

Figure 10: Distributions of the Reservation Wages-Type-1

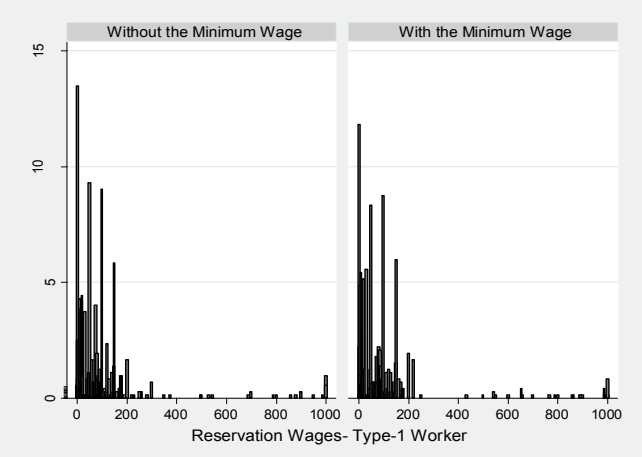
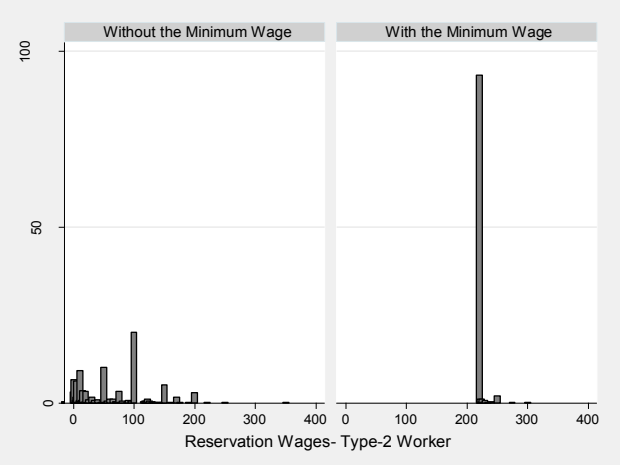


Figure 11: Distributions of the Reservation Wages-Type-2



Distributions of the reservation wages for both types, with and without the minimum wage, can also be seen from the figures above. Figure 10 shows the reservation wage distributions for the Type-1 workers before and after the minimum wage introduction whereas Figure 11 shows the distributions for the Type-2 workers' reservation wages.

Table 19: OLS Regression Results for the Reservation Wages

Dependent Variable:	R.W.-Type-1	R.W.-Type-1	R.W.-Type-2	R.W.-Type-2
	(1)	(2)	(3)	(4)
Constant	115.68***	116.06***	64.54***	68.72***
	(12.93)	(14.37)	(2.11)	(3.02)
Minimum Wage Dummy	-2.55	-1.83	158.4***	166.23***
	(8.51)	(18.38)	(2.05)	(3.89)
Period	Yes	No	Yes	No
Including the Session Fixed Effect	Yes	Yes	Yes	Yes
Observations	1440	1440	1440	1440
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.06	0.06	0.80	0.80

Notes: Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***<0.01.

On the other hand, regression results in Table 19 above show similar findings to those explained before. With and without the period variable, reservation wages of the Type-2 workers increased above the minimum wage level and the coefficient of the minimum wage dummy is significant at the 1% level (columns 3 and 4). However, although there is a decrease for the Type-1 workers, the coefficient is not statistically significant with and without the period variable (columns 1 and 2). This can be interpreted as, there is no evidence that the Type-1 workers were affected by the minimum wage introduction for similar workers in the other sector, since they did not change their reservation wages with the introduction of the minimum wage in contrast to H6.

2.4.3 Comparison of the Treatments

The low-skilled workers in the first treatment and the Type-2 workers in the second treatment are identical in terms of their productivities and being bounded by the minimum wage. However, the two type of workers have different peers; low-skilled workers in the first treatment have peers with higher productivity, whereas Type-2 workers in the second treatment 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 low-skilled workers' reservation wages are higher than the Type-2 workers' reservation wages and the difference is statistically significant according to the M-W test with a p-value of 0.000. After the minimum wage is introduced, the low-skilled workers' reservation wages are still greater than the Type-2 workers' reservation wages, and this difference is also significant according to the M-W test with a p-value of 0.002.

The reason for the low-skilled workers having greater reservation wages is perhaps related to the existence of the high-skilled workers. This means that these workers' reservation wage decisions might be affected by the fact that high-skilled workers get higher wage offers. This perhaps causes an increase in their reservation wages and higher reservation wages compared to the Type-2 workers, whose peers are similar in terms of productivities.

On the other hand, the wage offers for LSW are also higher than the wage offers for Type-2 workers before and after the minimum wage introduction and the differences are statistically significant according to the M-W test results with p-values of 0.000.

These results can be interpreted with two possible explanations. Firstly, firm owners decide the high-skilled workers' wage offers to begin with, and then they use these workers' wage offers' as reference points to determine the low-skilled workers' wage offers. For this reason, this perhaps leads them to offer higher wages to the low-skilled workers, compared to the Type-2 workers' wage offers. Secondly, due to higher reservation wages of the low-skilled workers in the first treatment, they could be triggered to offer higher wages to be able to hire these workers.

However, if we consider the difference in exchange rates across the treatments, these results change. As mentioned in the experimental design, 100 ECU is equal to £1 in the first treatment, whereas 100 ECU is equal to £1.5 in the second treatment. For this reason, 1 ECU is more valuable for the workers in the second treatment. If the values are multiplied by 1.5 in the second treatment, the average wage offers and reservation wages in the second treatment, are greater than the first treatment, and the differences are statistically significant with p-values of 0.000 for the M-W tests, before and after the minimum wage introduction. However, the previous results might be considered as more realistic because the wage offer and reservation wage intervals are the same in both treatments. Finally, one of the main issues is how much firm owners wish to share with the workers, between 0 and 1000 ECU and how much share workers demand for the same interval. For this reason, different exchange rates may be ignored for the comparison of the treatments.

2.5 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 horizontal fairness. I conducted a lab experiment for the research.

The design and the results of the experiment may introduce speculation over whether or not they really 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. In fact, these types of random role assignments for the different productivity levels and/or treating participants differently in the experiments have been used in previous

studies (see. Charness and Kuhn, 2007; Ohana, 2011; Nosenzo[10], 2013). 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 treatment, 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.

On the other hand, the design of this experiment can be considered as a form of an ultimatum game. In the literature, there are many papers related to the fairness considerations based on the ultimatum game designs. For example, Ho and Su (2009) studied peer-induced fairness considerations based on the ultimatum game. Each group in the game consisted of three participants: proposer, the first responder and the second responder. The first responder received the offer at first and then the second responder was offered a wage in addition to a signal about the wage offered to the first responder. Each of the participants were assigned to

[10] 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 treatments, 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.

their roles completely randomly. They found that the second responder's decisions were highly related to the signal of the offer received by the first responder and the results were explained with the fairness considerations. As a result, random role assignment does not prevent triggering the fairness considerations of the participants in ultimatum games according to previous studies.

According to the results, both high-skilled workers' reservation wages and firm owners' wage offers for the high-skilled workers show that horizontal fairness concern is an important issue for the agents in the absence of the minimum wage. The reason is that high-skilled workers' reservation wages are higher than the low-skilled workers' reservation wages and the wage offers for these workers are also higher than the wage offers for the low-skilled workers. After the minimum wage was introduced, high-skilled workers increased their reservation wages above the minimum wage level and the average value is still greater than the low-skilled workers' reservation wages. This also shows that high-skilled workers wanted to keep earning more than the low-skilled workers due to their fairness concerns. Firm owners also increased their wage offers to the high-skilled workers 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 firm owners 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 Type-1 workers in the uncovered sector, firm owners perhaps did not increase the wage offers. Therefore, focus should be on why workers did not increase their reservation wages.

There may be two reasons to explain why workers did not react to the violation of the horizontal fairness in the second treatment. Firstly, they may not have accepted the violation of the horizontal fairness as an unfair situation because the reason for the violation was 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 greedy

behaviours of the proposers (Fehr and Schmidt, 1999; Blount, 1995). For this reason, workers in the uncovered sector perhaps did not consider that the violation was the firm owners' decision, so they didn't 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 the 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. However, there may be differences between decreasing effort levels and increasing the reservation wages. When a worker reduces their effort level in a gift-exchange game, his payoff 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 unhappy 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 firm owners.

On the other hand, then, it is important to discuss why high-skilled workers in the first treatment did not behave similarly and react to the minimum wage introduction. Perhaps high-skilled workers felt that they were more valuable and had advantage over the low-skilled workers, since they were providing more revenue to the firm owners. 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 it was unfair to decrease the differences in the wages. Basically, the results show that the horizontal fairness concerns were more important for the workers having 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.

These results may further understanding about how an exogenous regulation change in the market affects workers' and employers' behaviours, in terms of the horizontal fairness concerns. For future research, it might be interesting to study whether or not horizontal fairness concerns have more or less effects on the agents in different exogenous changes in the market. In addition, obviously, this research

is not just a contribution in the fairness literature but also in 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.

Chapter 3: Minimum Wage Increase and Worker Performance: Firm-Level Evidence

3.1 Introduction

Firms practice different payment schemes in order to increase their workers' performance, one of the most important concerns for companies. Studies about how different payment schemes affect performance are mostly based on comparing fixed wage and piece rate payment (or generally pay for performance) and the general finding in these studies is workers tend to increase their performance under piece-rate payment (Smoot and Duncan, 1997; Lazear, 2000; Fernie and Metcalf, 1999). On the other hand, if the workers are paid based just on the piece rate, they may just focus on the quantity in order to increase their income and they may take risks to increase the quantity which may cause decrease in quality (Heywood *et al*., 2013; Prendergast, 1999; Baker *et al*., 1988). Due to advantages and disadvantages of these different payment schemes, in most jobs, employees work under a mixture of these payment schemes meaning that they are paid a fixed wage and they are able to increase their income based on their performance (Lazear, 1986; Dickinson, 2005; Billikopf, 2014)[11].

The purpose of this study is to analyse how increase in fixed wages due to an exogenous change in the labour market affects workers' performance when the workers are both paid fixed wage and piece rate. Studies show that increases in the fixed wages or piece rates by the employer might lead workers to increase their performance due to reciprocity behaviour of the workers (gift-exchange phenomenon)[12] (Charness and Kuhn, 2011; Bellemare and Shearer, 2009; Gilchrist

[11] Although it is common to practice combination of both piece rate and fixed wage together, there is no enough study related to this type of payment scheme. To my knowledge, there are only few experimental studies about the performance changes when the workers are paid both fixed wage and piece rate. These studies are based on how the percentage of piece rate payment to base wage or total payment affects workers' performance (see. Frisch and Dickinson, 1990; Dickinson and Gillette, 1993; Oah and Lee, 2011).

[12] In the studies about the gift-exchange concept, except Non (2012), workers are just paid either fixed wages or piece rates. As far as I am aware, there is no study how workers react to increase in one of these payment types when they are paid both. In Non's (2012) theoretical work, workers are paid fixed wage and piece rate together however his main focus was not this kind of compensation system. Although there is no study in the case when the employees are paid both type of payment, we can assume that there will be similar results with the previous gift-exchange studies. The reason for that is because the main reason for the increase in efforts is the reciprocity behaviour of the workers. If the fixed

et al., 2016[13]). This means that employees accept these wage increases as a gift and they increase their performance in return to appreciate the employer's kind behaviour. However, workers might react differently to the increases in the wages by an exogenous change which, in this case, is an increase in the national minimum wage. The reason is that workers might not evaluate this type of increase as a gift or a kind behaviour of the employer since the employers are forced to increase the wages by the government. Falk *et al*. (2008) explain that outcomes are not the only concerns' of the people but also they consider the reasons behind these outcomes. As a result, they may have different reactions to the two same outcomes if there are different reasons behind them. For this reason, it is important to understand how workers react to the exogenous changes such as minimum wage increase in the labour market, since this is a very common practice in the labour market which affects many people.

In fact, there are two studies showing how introducing a minimum wage affects the effort levels in a gift exchange game. Brandts and Charness (2004) analysed how existence of a minimum wage affect the wage and effort levels if there are more workers than firms with a lab experiment. Put simply, they considered an excess supply of workers and the minimum wage rule together. They found that there was 30% decrease in the average effort and 5% increase in the average wage offers compared to the same case with no minimum wage. Owens and Kagel (2010) also studied the effect of introducing a minimum wage in a gift-exchange game with a lab experiment. However, they introduced the minimum wage in an ongoing labour market (within-subject design) whereas Brandts and Charness' experiment was based on comparing the minimum wage across treatments with and without the minimum wage (between-subject design). Owens and Kagel also found that there was a decrease in the efforts for the wage offers around the minimum wage level; however, they did not find significant difference for the high wage offers when they compared with and without the minimum wage cases. At least for some degree, these results show that workers evaluated the wage increases because of the minimum wage introduction different from the wage increases by the employer. However, there are two important differences with these studies and the present

wage or piece rate increases by the employers are accepted as a gift and workers increase their performance in return, then it should not make difference if the workers are paid just one of these or both together in terms of accepting the increase as a gift. It should still trigger their positive reciprocity behaviours.

[13] For example, Bellemare and Shearer (2009) found that a "monetary gift" lead workers to increase their productivities by about 10% whereas Gilchrist *et al*., (2016) found 20% increase in the productivity.

study. In these studies, workers were just paid fixed wages and they were not able to increase their income by increasing their effort levels. In addition, workers' payoffs decrease as they increase their effort levels in these studies whereas increasing the performance also increases the payoffs or income of the workers in this research. Secondly, the workers had no concerns about being dismissed in these studies, whilst it is a possibility for this paper's case. It means that choosing less effort does not affect employment status in these studies, whereas workers can get fired if they do not work well so that it can be an important effect on the performance in the present study.

There are also discussions in the literature on how firms react to the minimum wage increase in order to compensate the increase in the cost of labour due to minimum wage increase. These studies focused on the firms' productivities with the aggregate data instead of individual performance changes. For example, it is claimed that minimum wage increase also increases the cost of labour so that firms substitute the labour with more capital-intensive forms of production and this increases the firms' productivities (Riley and Bondibene, 2017). In addition, it is argued that increases in the minimum wage affects the productivity with employment-related issues. Increase in the cost of labour due to higher minimum wage leads firms' to replace the low-ability workers with high-ability workers which also increases the firms' productivity (Neumark and Wascher, 2008). One more important issue about changes in the firms with the minimum wage increase is organizational changes. Firms might increase training, monitoring or practice more strict human resource and better management practices in order to increase the productivity and compensate the increase in labour cost (Riley and Bondibene, 2017). Although these discussions are related to the reactions of the firm side, these changes might also be the possible reasons behind the workers' performance changes. For this reason, these issues should also be considered in the analysis even if the studies are based on the individual worker reaction to the minimum wage increase.

The analysis for this research is based on a dataset received from a Turkish company producing ceramic based products. The minimum wage was increased by 30% in Turkey on the 1st of January, 2016 and the dataset covers the 6-month period from 1.10.2015 to 31.3.2016. The reason for getting the data from this company is that workers in this company earn fixed wage which is equal to minimum wage and also piece rate per product if they exceed their monthly target. The dataset includes the daily information for the number of total products and the number of

faulty products produced by each worker. Performance is defined as a ratio calculated based on the number of net products (total product-faulty product) divided by the total products for each day, for each worker. Due to defining the performance with this ratio, I am able to consider the performance with including the quality as well as the quantity. There are more than 300 different products produced in this company. The most produced product was determined as the baseline product by the company. Each other product has a rate to convert the production values to the baseline product because piece rate payments are calculated in terms of the baseline product. These rates are determined with more than 50 years' experience of the company based on the difficulty of producing each product and how many of these products can be produced on a day by a worker compared to the baseline product. All of this information is recorded by a computerized system every day. In addition to these details, age, sex and experience information related to the workers was provided by the human resources department based on the ID numbers of the workers.

Due to the features of the company and the dataset, none of the arguments related to firms' reactions to the minimum wage increase mentioned above are valid for this analysis, which makes it easier to understand the mechanisms behind the performance changes of the workers. First of all, in order to exclude all employment-related issues, workers who worked before and after the minimum wage increase were included in the analysis. It means that workers who left the job or who were dismissed or workers who were hired within this six month time period were excluded from the analysis. In addition, based on the information received from the factory management and human resources department, there was no substituting of labour with the capital or increase in capital for any reason, and no organisational change during this time.

Apart from these issues, two hypotheses are tested in this study. The first hypothesis is that an increase in the minimum wage also increases the cost of losing the job, so workers increase their performance in order not to lose their jobs (Wolfers and Zilinsky, 2015; Yellen, 1984; Shapiro and Stiglitz, 1984). In addition, there are also discussions about whether increases in the minimum wage also increase unemployment, as finding a job becomes more difficult (Neumark and Wascher, 2008). As a result, workers may become more anxious about losing their jobs after the minimum wage increase and this leads them to increase their performance.

The second hypothesis is that the minimum wage increase decreases the workers' performance due to income targeting. Camerer *et al.* (1997: 428) state that "judgments and decisions depend on a comparison of potential outcomes against some aspiration level or reference point." In terms of income targeting, it means that people define a level of income as a reference point and they become less sensitive to earning more income due to the decrease in the marginal valuation of another unit as they exceed the reference point more and more (Goette *et al*. 2004). For this reason, an increase in the minimum wage might decrease the value of the piece rate payment because workers are able to achieve their income target with earning less piece rate payment and this may lead workers to decrease their performance.

The analysis is based on comparing the performance three months, two months and one month before and after the minimum wage increase to see more immediate reactions to the change. The results show that the overall performance decreases when the analysis time period is three months before and three months after the minimum wage increase whereas it becomes insignificant if the time period is shorten to two months before and after the minimum wage increase. However, the overall performance increases when the analysis time period is one month before and after the change. The reason for these changes comes from the different effect of the minimum wage increase on the different type of workers in terms of productivity. If the workers are divided as low-productivity and high-productivity based on the median of the performance values before the wage increase, different effects are observed for these two type of workers. High-productivity workers decrease their performance with the minimum wage increase when the analysis time period is three months or two months before and after the change. When the time period is shortened to one month before and after the increase, the statistical significance disappears. On the other hand, low-productivity workers increase their performance after the minimum wage increase when the analysis time period is one month or two months before and after the increase. There is no statistically significant effect on the low-productivity workers' performance when the analysis is based on the three months before and after the change.

We can interpret these results as the minimum wage increase having heterogeneous effects on the workers based on whether they are low or high-productivity workers. Basically, there is an increase in low-productivity workers' performance. This shows that the hypothesis about being worried for getting fired

and increase in the value of the losing the job is valid for these workers. In fact, it might be understandable for these workers to feel and react this way and why the high-productivity workers do not feel this way. If a worker is aware of that he or she is one of the best or at least one of the good workers in the workplace, he or she feels less insecure about losing the job since he or she is more valuable for the company. However, low-productivity workers can indeed feel more insecure about losing their jobs. In addition, since these workers are worse in terms of performance compared to the others, they may also feel that it is even more difficult to find another job for themselves and this may also lead them to work harder. On the other hand, the results show that high-productivity workers decrease their performance with the minimum wage increase meaning that income targeting hypothesis is valid for these workers. Since these workers are more likely to exceed their target and able to increase their income with earnings from the piece rate payment, this might not be a surprising result either. However, the significance of the effect disappears when the time period is shortened to one month before and after the increase. These workers are paid after they work. It means that, in order to get their higher wages, they had to work one month. For this reason, realizing the wage increase might take time for them until they received their first new wages[14].

This study proceeds as follows: the next section consists of the related literature review and I will explain the dataset in the third section. I will show my results in Section 4, which is followed by the discussion and concluding remarks in the final part.

3.2 Literature Review

As discussed before, agents do not only consider the results but also they consider the intentions behind the outcomes. The wage increase by the employer and a wage increase which is not the employer's decision might not be evaluated the same way by the workers. For example, Charness (2004) studied attribution and reciprocity with the gift-exchange game. He hired undergraduate students as participants for the experiment and before the experiment started they were divided into two groups as employers and employees equally. The interesting point about this

[14] These workers are supposed to work and get their wages at the end of the month. Although the new minimum wage was valid after the 1st of January, 2016, these workers got their first high wages on the 1st of February.

experiment was how the wage offers were made. There were three options: a wage offer could be made by the employer, or by the experimenter or it could be determined randomly according to the bingo cage results. After the wages were accepted, workers chose the effort levels as is standard in a gift-exchange game. They wanted to see if participants were interested only in increases or whether or not they also considered the reasons behind the wage changes. Their results show that there was no statistically significant difference in the effort levels for different wages determined by the two exogenous wage assignments (either from the experimenter or the bingo cage). On the other hand, workers reacted more to the wage increases if it was offered by the employer. These results support the argument that workers are not only interested in the outcomes but also reasons behind it.

On the other hand, there is a large number of literature on the effects of minimum wage on labour outcomes. Probably, most of these studies focus on the effects of the minimum wage on employment since there are controversial results in these studies about how changes in minimum wages affect employment. For example, Neumark and Wascher (2008) analysed around 100 empirical papers (which were published after 1990) about minimum wage and employment and they state that one of the third of these papers found no significant effect or found even positive employment effects with the introduction (or increase) of the minimum wage whereas the two of the third of the studies showed that introducing or increasing the minimum wage decrease employment. Currie and Fallick (1996) analysed the federal minimum wage increases from 1979 to 1980 and 1980 to 1981 ($2.90 to $3.10 and $3.10 to $3.35, respectively) in the US. They found that employed people whose wages were below the second increase were 3 to 4% less likely to be employed a year later. Campolieti *et al*. (2005) focused on the youth (16-24 years old) employment transitions and minimum wage increases in Canada. As they state that there were 24 minimum wage increases in different times and different regions in Canada between 1993 and 1999. They found that people whose wages were around the minimum wage levels (as they define at risk-group) became unemployed by about 4 to 8%. On the other hand, there are also studies showing positive effects of the minimum wage on employment as was mentioned. For example, Katz and Krueger (1992) researched the increases in the federal minimum wage for fast-food industry in Texas ($3.35 to $3.80 on April 1, 1990, $3.80 to $4.25 on April 1, 1991). Overall, they found positive employment effects of the minimum wage increases with different elasticities from 1.70 to 1.85. Another study showing positive employment effects is the one written by Card and Krueger (1994). They

conducted a similar research to previous one in New Jersey. They analysed the state minimum wage increase in New Jersey (from $4.25 to $5.05). Basically, they compared the changes in fast-food industry in New Jersey and Pennsylvania where the minimum wage was not increased. They found positive effect of the increase on the employment level with the 0.7 elasticity.

In addition to employment discussions, how much the minimum wage affects the wages for the people who earn at or less than the minimum wage level and people who earn already more than the minimum wage level has been argued by labour economists. Studies about the minimum wage and wage levels show us introducing or increasing the minimum wages causes spillover effects on people who are not bound by the minimum wage level (Neumark and Wascher, 2008; Neumark *et al*., 2004). For example, Neumark *et al*. (2004) studied the effects of the minimum wages on the wages and some other economic outcomes. They state that for the workers whose wages were around the minimum wage level, the elasticity between minimum wage and wages was about 0.8 whereas it was 0.4 and 0.25 for the workers earning 1.1 and 1.5 times to minimum wage. On the other hand, Draca *et al.,* (2011) analysed the effect of the introduction of a national minimum wage on firm profitability. They focused on the minimum wage introduction in the UK (1999) and found that there was a reduction in profit margins of 8% to 15% after the minimum wage was introduced.

Another important subject which is discussed in this paper is the mixed compensation systems. Changes in the wages when employees work under combination of fixed wages and piece-rate payment system might generate different result. Although it is very common to practice combination of both piece rate and fixed wage together, there are only few experimental studies and these are related to how the percentage of piece rate payment to fixed wage or total payment affects workers' performance. For example, Frisch and Dickinson (1990) compared five different percentages of piece rate to base pay with a lab experiment. The percentages changing across the treatments were 0% which is just a fixed wage, 10%, 30%, 60%, and 100% which is an entirely piece rate payment scheme. Participants received a base pay and piece rate per task if they completed it above a target determined before the experiment was started. They found that workers' performance were better in all cases other than 0% however they could not find any significant difference between the 10%, 30%, 60%, and 100% cases. Similarly, Dickinson and Gillette (1993), using a within-subject design, compared the effects of 30% and 100% of piece rate payment to total pay with a lab

experiment. They could not find any significant differences in productivity either. On the other hand, Oah and Lee (2011) also conducted a similar lab experiment but with a longer experiment time although the number of participants was low. Participants were also able take breaks during the work time. They compared 0%, 10% and 100% of the piece rate payment to base wage. In the first case, there was no piece rate and the last one was based on completely piece rate payment. However, in the 10% case, workers received some amount of hourly wage and piece per task correctly they perform. The productivity was the highest when it was only piece rate however only some participants' performance were higher in the 10% case compared to 0% case. In addition, they found that workers took less breaks when they are paid piece rates compared to just fixed wage case. However, in these experimental studies, base wages and piece rates were changed together across treatments. For this reason, it is not possible to distinguish how changes in just fixed wages or just piece rates affect the performance.

Lastly, this study is also related to income targeting literature. There are studies showing that people determine some level of income in their mind as a reference point and their decisions are based on whether or not they achieve this target or how much they are below or above the target. Camerer *et al.* (1997) analysed labour supply decisions based on the transitory wage increases for cabdrivers in New York City. Although the price per mile is determined by the law, drivers were able to find customers with less searching based on the weather, subway breakdowns, day-of-the-week effects, holidays, conventions, etc. and this causes increases in their hourly wage. They found that workers tend to work more hours on the days they could find less customers and work less if it is easier to find customers meaning that when they have higher hourly wages. They explain the results as the drivers determining a level of daily income, and they stop working when they achieve this target. On the other hand, Fehr and Goette (2007), conducted a randomized field experiment at a bicycle messenger service in Switzerland. The workers' wages were based on the share of the revenue they generate in each five-hour shift, without any base wage. The percentage of the share that workers were paid was increased by 25% temporarily during the experiment. Workers were able to choose how many shift they would like to work. They found that workers increased the number of shifts they worked after the increase with the elasticity 0.8. On the other hand, they also found that workers decreased their efforts in a shift with generating less revenue with the elasticity -0.3. They also explain their results with daily reference income level. Workers are less sensitive to increasing their income after they exceed their target. For this reason, although they increased the number of shifts

they work, they decreased their efforts in their shifts. These studies are not directly related to my study since workers for this research are not able to arrange their labour supply. Regardless of their performance they are supposed to work for a fixed time in the factory every working day. However, these studies show that reference levels/income targeting is in fact an issue for the workers.

3.3 Data

The data for the research was provided by a Turkish company producing ceramic-based products (such as washbasins, toilets etc.). There are more than 300 products manufactured in this company. Although there are about 500 workers in total, the dataset only covers some of the employees working in the production department. The reason for this is that only these workers' performance information has been recorded by the company since other workers' performance are not easy to measure or to observe.

The dataset covers the six-month time period from 1.10.2015 to 31.03.2016. There were 112 different employees that worked in this production department in this time period. However, some of them were excluded from the analysis. Firstly, there were workers who were basically working in the other parts of the production department and they were substituting the workers who mainly work in this production department in their absence. For this reason, their performance might be lower than the other workers since their main job is not this kind of work, so their performance might be misleading for the analysis. The other group of workers who were excluded were the ones who left or got fired, or workers who started working before or after the minimum wage increase. There are two reasons for excluding these workers. Firstly, there is no observation of these workers either before or after the minimum wage increase and the main analysis of this research is based on the panel data analysis. Secondly, the workers who were about to leave the job might not care their performance and this may lead them to decrease their performance. On the other hand, workers who just started to work might try to show off to their supervisors and they may try to perform at their highest level. These two cases might be misleading in terms of measuring the effect of the minimum wage increase. Lastly, there were some workers who worked very few days in this six-month time period (such as 1 day before the minimum wage increase and 1 day after the minimum wage increase due to health issues or changing department within the factory). It is not possible to distinguish why a worker worked less than the other workers. For this reason, I had to make a limit

in order to decide whether or not to include a worker in the analysis based on the number of days. For this reason, I excluded the workers who worked less than 30 days before and after the minimum wage increase. As a result, there are 79 workers in the dataset who worked both before and after the minimum wage increase in this time period[15].

The recording system of the production is a computerized system. Workers put a barcode on each product they produce and it is possible to follow each product at each stage. After the worker produces a product, the faulty parts of the products are checked and this is called as first stage control process. After this control process, the faulty parts of the products are recorded on the system and the product is sent to the next stage of the production which is firing process. There are some faults which cannot be understood before the product is fired. For this reason, there is another quality control check stage after this firing process and this is called as second stage control process. After the two stages, the total amount of the faults are recorded on the system as the total number of faulty products for each worker.

The dataset includes the number of products each worker produced on each day, how many of them were faulty and the number of products missing. In addition, there is a rate for each product to convert that product to the baseline product. In order to measure the performance or, in other words, to calculate the piece rate payments, the company chose a baseline product which is produced the most in the factory among more than 300 products. All other products except the baseline product has a rate to convert the value of the production into the baseline product. This rate is based on the difficulty of producing the product and how many items of this product can be produced on a day.

In addition to performance data, some extra information was received from the human resource department. This information includes age of the workers, experience, gender and the minimum living allowance[16]. Each worker was assigned

[15] 13 workers got fired or left the job whereas 12 new workers were hired within this 6-month time period. On the other hand there were 3 employees actually working in the other departments and 5 employees worked less than 30 days before and after the minimum wage increase.

[16] The income tax for the workers are decreased based on their marital status and the number of kids they have. For example, a married man whose wife is not working pay less income tax than a worker who is single. Or, a married man with three children pay less income tax than a married man with one child. Basically, paying less income tax means being paid higher minimum living allowance in this case. In the dataset, I have this information (how much money each worker is paid for the minimum living allowance). In

to an ID number in the dataset. Thanks to these ID numbers, I was able get more information about the workers although they were anonymous in the dataset.

3.3.1 Payment Scheme and Minimum Wage Increase

The employees working in the production department are paid minimum wage and piece rate if they exceed their target. The piece rate payment is calculated based on the target, the number of total net product of baseline product and the piece rate of the baseline product which is 0.77 Turkish Lira. The formula of the total net product is:

Total Net Product= Total Number of Products Produced-The Number of Faulty Products Produced-The Number of Missing Products[17].

The daily target of the workers is 60 baseline total net product. The monthly target is determined by the number of days each worker works in one month. If an employee worked 30 days in the last month, he is expected to produce 1800 baseline total net product for the last month. In this case, if the worker produced more than 1800 total net product then he is paid for each product above this amount with a piece rate 0.77 Turkish Lira. For example, in the previous month a worker worked 20 days and he produced 2010 products. He was supposed to produce 1200 total net products for 20 days in order to achieve the monthly target. Let's assume that the number of the faulty products was 300 and there were 10 products were missing. This worker's total net product value was 1700 (2010-300-10). As a result, this worker produced 500 more products (1700-1200) above his target for the last month. Since he is paid 0.77 Turkish Lira for each product above the target, he is paid 385 Turkish Lira for the last month in addition to his base wage which is equal to minimum wage. Calculating the target for the piece rate payment on a monthly basis will lead workers to try and reach their best performance all the time since producing less than the daily target on one day will be compensated from another day which the worker produced more than his daily target. On the other hand, there is no penalty for the workers if they produce less

terms of this analysis, this information refers that how many people each worker is responsible to take care of and this might affect the workers' performance since more responsibility means more income requirement.

[17] Workers are responsible if a product is missed. However, this does not actually refer to performance of the workers since even if a product is missed by another worker in the other stage, the worker who produced it at the first place is responsible for that. Since it is not completely under control of these workers, I do not consider the missing products when I define the performance.

than their target. In the case of their total net product being less than their target or even if it is 0, they are still paid their monthly minimum wage as long as they are not fired.

As mentioned above, workers are paid base wage which is equal to national minimum wage level regardless of their performance. The minimum wage was increased about 30% on 1.1.2016 by the government in Turkey[18]. The reason for saying about 30% is that the minimum wage value varies between workers due to minimum living allowance as mentioned above. The minimum wage without the minimum living allowance was increased to 1177.46 from 910.44 (around 29% increase)[19]. On the other hand the lowest value of the minimum wage with the minimum living allowance which is valid for the single workers was increased from 1000.54 to 1300.99 and the highest value was increased to 1387.45 from 1063.63 which is valid for the workers whose wife or husband does not work and when they have three or more children. This highest value is the upper limit for the minimum living allowance since workers are not paid more money if they have more than 3 kids when their spouse does not work.

There are also some regulations in the company related to the base wage. Workers are paid monthly minimum wage and can take sick leave up to two days per month. If it exceeds two days, their base wage is also cut based on the number of days they are absent. The monthly minimum wage is based on 30 days and if a worker takes 4 days sick leave than his wage is cut (monthly minimum wage/30)*2. It is also valid if a worker takes off time based on hours. Workers in this company are supposed to work 7.5 hours on each day. For example, if a worker takes 2 days and 4 hours sick leave than his wage cut is (monthly minimum wage/225)*4.

The dataset does not cover information about absenteeism for the reason that it is not possible to take into account how much their base wage is cut per month. In addition, the piece rate payment information is also considered as private information by the company and was not shared for the study and it is also not

[18] In the last 15 years, the minimum wage was increased on the first day of each year in Turkey. In most of these years, it was also increased on the first day of July however there were some years workers received only one raise within a year. For this reason, workers were expecting the wage raise however the amount of the raise was not clear until October, 2015. There were general elections in Turkey on the 1st of November, 2015 and almost all parties declared that there would be a big raise in the national minimum wage. The reason for 30% increase was also related to these promises.

[19] The annual inflation rate between January, 2015 and January, 2016 was 9.58%. The monthly inflation rates from October, 2015 to March, 2016 were 1.55%, 0.67%, 0.21%, 1.82%, - 0.02% , -0.04%, respectively (TurkStat, 2018).

possible to calculate the exact values. The reason is that if a worker produced 30 baseline product for a day, I am not able to understand the reason behind producing less products. He may have taken sick leave for a half-day, the machines on the production line he is working at might have been broken, or he might have worked in the other part of the production department some hours on that day. For example, if there was a problem with a machine and the worker had to stop producing after he produced 30 then his daily target is decreased or there may not have been even a target for that day. Unfortunately, the dataset does not cover any information about these cases. For this reason, it is not possible to calculate exact amount of the piece-rate payments for each worker for each month.

3.3.2 Variables

The performance, which is the main, dependent variable in this study, is defined as a ratio of which the formula is;

Performance = (Total Products-Faulty Products)/Total Products

This ratio is a good measurement of the performance which also considers the quality. Measuring the performance with just total product or just net product might be misleading because as mentioned above there are some cases which workers had to produce less due to some issues which are not under their control (machine problems or working in different parts of the production department etc.) However, even if there is a machine broken on one day, the worker still tries to minimize his faulty products in order to increase his piece rate payment until he has problems with the equipment. Or, even if he works in the other departments for some days of a month, he again tries to minimize producing faulty products on the days he works in this department with the same motivation. For this reason, regardless of the amount of the total production, this ratio will give a good information for the performance changes.

The second variable which explains the changes in performance is a dummy which is equal to 0 before the minimum wage increase and 1 after the minimum wage increase. In addition, I generated an index which shows the difficulty of producing the products. As mentioned above, each product except the one determined as baseline product by the company has a rate to convert to the baseline product for the calculations of the piece rate payments. This rate is based on the difficulty of producing a certain product and how many of them can be produced on a working day. These rates are determined based on the company's years of experience.

Basically, a higher rate means it is more likely to produce faulty products for that type of product. The index formula is;

$Index_{i,t} = (\Sigma(X_{it} * R_i)) / \ \Sigma Y_{it}$

where i refers to the worker and t stands for the time. X shows the number of products produced of each type and R shows the rate for that certain product. On the other hand, Y refers to the total number of products which was produced by the worker i at time t. Since it is very common to produce different products on one day for a worker in this company, this value takes into account of this issue.

In addition to these variables, the minimum living allowance information is also included in the analysis. This shows how many people a worker is responsible for taking care of (such as children). An increase in this value might make an employee work harder since he needs more income. The minimum living allowance values are used as categorical variables in the analysis. There are also control variables for the analysis such as gender, age and experience in this factory. These control variables and the minimum living allowance values are accepted as fixed in order to measure the individual fixed effects in the analysis. For this reason, the values on the first day of the dataset is fixed throughout the six-month time period. For example, if a worker's experience is 2500 days on 1st of October, 2015 which is the first day for the dataset covers, then this worker's experience information is fixed as 2500 for the analysis before or after the minimum wage increase.

3.3.3 Hypotheses

For this specific dataset under the company's policies and changes in the labour market, there are two hypotheses tested in this study.

H1: *Workers increase their performance after the minimum wage increase since they are more sensitive about losing their jobs due to increase in the value of the job loss.*

Apart from the discussions how the minimum wage increases affect unemployment levels in the market, the value of the job increases for these workers with the minimum wage increase since they are bound by the minimum wage. It is claimed that shirking or absenteeism or disciplinary problems decrease with the wage increases since these raises also increase the cost of the job loss so that workers are more sensitive about losing their jobs (Wolfers and Zilinsky, 2015; Pfeifer, 2010; Yellen, 1984). Although, these issues are not the concern of this paper, for

the same reasons, it can be claimed that workers increase their performance since they do not want to lose their jobs due to higher cost of job loss and they may be more worried about losing their jobs (Wolfers and Zilinsky, 2015; Yellen, 1984). This might be valid especially for the low-productivity workers. Since increases in the minimum wage increases the cost of the labour, firms might replace the low-productivity workers with the more productive workers in the market, because working with the low-productivity employees might not be profitable anymore.

In addition, there are also discussions about whether or not an increase in minimum wage also increases unemployment (see. Neumark and Wascher, 2008). As mentioned above, firms might prefer substituting the workforce with capital or try to hire better workers in order to compensate the increase in the cost of labour and this may cause more unemployment in the labour market. On the other hand, people who are not actively looking for a job might start searching jobs again due to increase in minimum wage which means that unemployment might also increase for this reason. Johannson and Palme (1996) explain that workers shirk less and absenteeism decreases if unemployment is high. The reason for this is that the potential cost of losing the job is also higher since it is more difficult to find a job. As a result, in addition to increase in the value of the job due to wage increase, the threat of being unemployed for a while because of the higher unemployment in the market might also lead workers to increase their performance.

On the other hand, it can be questioned that the value of the other jobs paying the minimum wage also increases due to increases in the national minimum wage, so that there should not be increases in the value of the job. It is true that the outside options are also increasing for these workers who are bound by the minimum wage. However, it may not be possible to find another job immediately after being dismissed. The unemployment rates in Turkey between October, 2015 to March, 2016 varied from 10.1 to 10.4 (TurkStat, 2018). If the agriculture sector is excluded, then the rates varied between 12.0 and 12.5 (TurkStat, 2018). The rates are similar in the region. However, the rates for the region are calculated based on three provinces. For this reason, unfortunately, it is not possible to learn the exact unemployment rates for the county where the factory resides in. However, I learned from the workers that there were not many other options in the market where they could easily find another job which paid at least the minimum wage. They had to explore options in the bigger counties or in the centre of the province which could lead to relocation to a place where rents are higher or enduring the transportation costs. Most of these workers live in the villages which are very close to the factory

and so they do not need to be concerned about transportation costs since the company provides free shuttles for the workers. For this reason, even if they can find another minimum wage job in another place in the province, there may be an overall decrease in their income compared to the case which they work in this company. Secondly, if they are fired and do not want to work in another town, they most likely work on a day by day basis jobs or within the agriculture sector. Approximately 35% of the employees worked in the agricultural sector in the region (including three provinces) in 2015 (TurkStat, 2018) and it is most likely to be higher in rural areas as this is where the agricultural sector is based. In addition, according to the estimations, approximately 45% of the workers in the region worked in the informal market in 2015 and 2016 (SSI, 2018). Since these workers are sometimes employed seasonally or only on certain days every week and their premiums are not paid, it is more likely that they work with a lower wage value compared to those working in the formal market with a minimum wage. As a result, being fired and being unemployed for a while or working on a day by day basis or in the agriculture sector, is associated with lower wages compared to their current job.

H.2: *Workers decrease their performance because of income targeting behaviour.*

Camerer *et al*. (1997: 428) state that "judgments and decisions depend on a comparison of potential outcomes against some aspiration level or reference point". They analysed the cabdrivers' labour supply behaviours in New York City. They found that workers tend to work more hours on the days they could find less customers and work less if it is easier to find customers meaning that when they have higher hourly wages. They explain the results by arguing that drivers determine a level of daily income target and then stop working when they achieve this target. In addition, Goette *et al*. (2004) explain that the marginal value of another unit decreases if the reference point is exceeded more and more due to diminishing sensitivity. In terms of income targeting, this can be interpreted as: if workers are able to earn more than the income level that they determine as the reference point, they are less sensitive to increasing their income. Since an increase in the minimum wage increases these workers' fixed wages, they can achieve their income target with earning less piece rate payment. If there are workers who cannot earn any piece rate before the minimum wage increase, we may still observe this effect on these workers. If a worker does not produce enough to earn piece rate, then this worker might not even try anymore and lose his all motivation to earn some extra income from the piece rate payment due to increase in the fixed wages.

As a result, increase in the fixed wages because of the increase in the minimum wage might lead workers to decreasing their performance.

3.4 Results

3.4.1 Descriptive Statistics

There are 79 workers who worked at least 30 days before and after the minimum wage increase. Table 20 below shows the descriptive information about these workers. The mean value of the age is 33.07 with a standard deviation of 7.00. The oldest worker is 48 years old whereas the youngest is 22. The average experience based on the number of days is 2547.10. The least experienced worker in the sample had 89 days of experience in this company whereas the most experienced one worked 7153 days. 3 of the 79 workers are females. The number of working days in a month shows the average value of how many days a worker worked in one month within the 6-month time period. The mean of the minimum living allowance is 118.68 Turkish Lira before the minimum wage change and it increased to 164.96 Turkish Lira with the minimum wage increase.

As mentioned above, unfortunately, the information about the piece rate payment values were not shared by the company due to their privacy rules. In addition, with the information in the dataset, it is not possible to calculate the exact values. For example, let's assume that a worker produced 30 products with zero faulty and missing products on one day according to the dataset. If this employee worked a full working day then it means that he did not produce enough in terms of firm's daily expectation, which is 60. If he wants to earn from the piece rate payment, he is supposed to compensate this low number of products on the other days. However, the problem is, it is not possible to understand what the main reason for producing less on that day is. If he worked only half of the day and took time off work, then the firm's expectation for that day is not 60 but 30 since he worked only half of the day. Then this worker produced at least enough in terms of the firm's daily expectation. He does not need to compensate this on the other days. In addition, the machine he was using might have been broken on that day which might be another reason for this worker to produce less. Then, the firm's expectation from this worker for that day is not 60 either. They calculate the daily target for that certain day if there is any unusual issue. However, at least, approximate values can be calculated by ignoring these possible issues. This means that regardless of the number of products a worker produced, I assume that

the employee worked all day and he could only produce that number of products on that day without having any problems. Although this may not be the best way for the piece rate payment calculations, it will at least give some information about changes before and after the minimum wage increase since these issues mostly occur randomly.

Table 20: Summary Statistics

	Mean	Min-Max
Age	33.07	22-48
	(7.00)	
Experience (Days)	2547.1	89-7153
	(1838.89)	
Female	3/79	-
Number of Working Days In a Month	23.59	8-28
	(3.96)	
Minimum Living Allowance-Before	118.68	90.11-153.19
	(20.40)	
Minimum Living Allowance-After	164.96	123.53-209.99
	(28.49)	
N=79	Number of Observations: 10398	

Notes: Standard deviations are in parentheses.

Figure 12 below shows the distributions of the net monthly production based on the monthly target before and after the minimum wage increase. For example, if the worker worked 20 days in one month and produced 1100 with 100 faulty products then his net product for this month is 1000. If we consider his target which is 1200 for 20 days of work, then this worker produced 200 less than he was supposed to achieve given his monthly target. Then, this number would be -200 in the distribution figure. Basically it shows how much workers are above or below their monthly target. The distributions for the time period before and after the

minimum wage increase are statistically different according to Kolmogorov-Smirnov (K-S) test with a p-value of 0.001[20].

Figure 12: Distributions of the Monthly Net Production Based on Monthly Target-3 Months

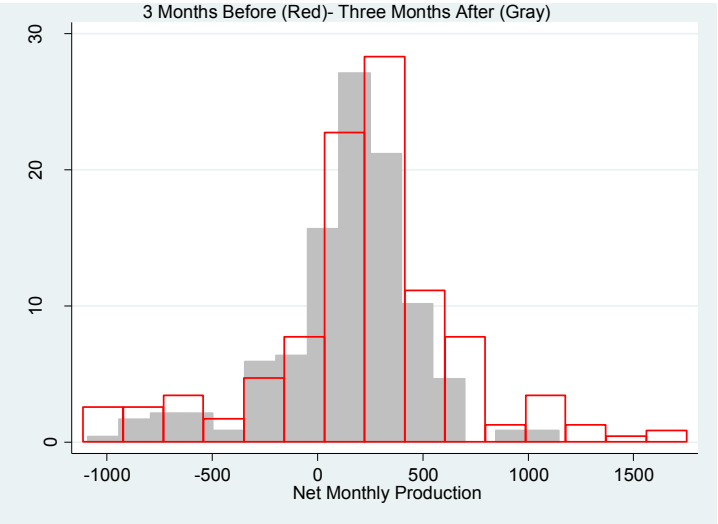


Figure 13: Distributions of the Monthly Piece Rate Earnings- 3 Months

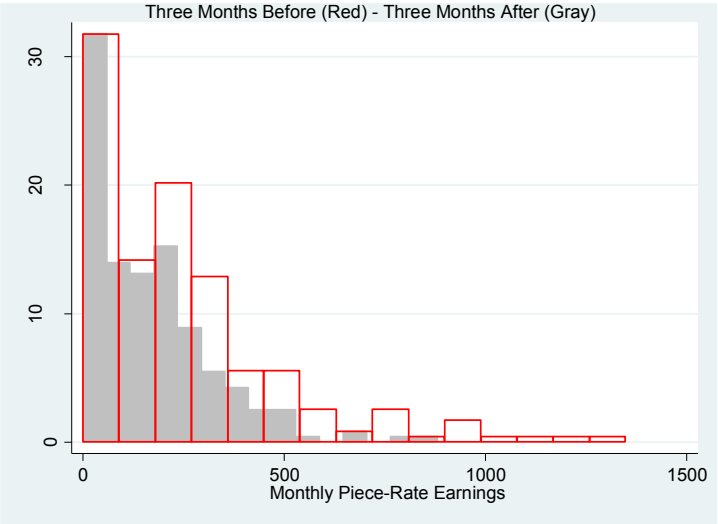


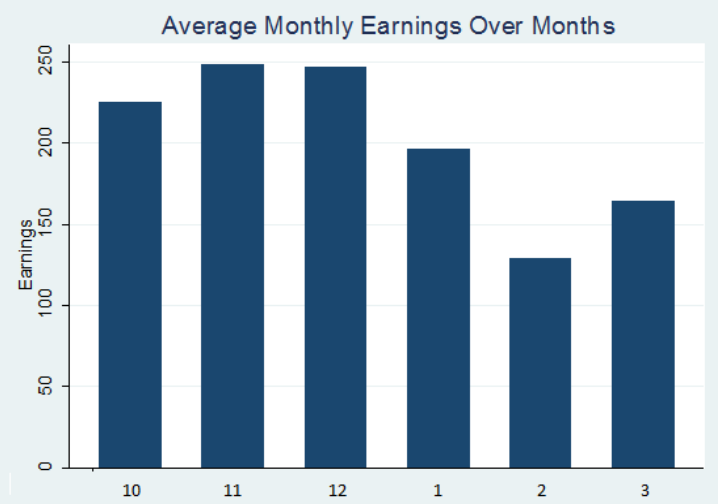
Figure 13 above shows the distributions of the monthly piece-rate earnings before and after the minimum wage increase. Since there is no punishment for producing less than the firm's expectation, all negative values are accepted as 0 for this figure. As can be seen from the figure, around 70% of the workers earned some piece rate payment before and after the minimum wage increase. The number of observation which the piece rate payment is equal to 0 is 49 in 233 before the minimum wage

[20] Unless otherwise stated, for all K-S tests applied in this thesis, the null hypothesis states that the distributions of the two samples are the same and the alternative hypothesis states that the distributions of the two samples are not the same.

increase whereas it is 55 in 236 after the increase. However, the difference in the ratios of the 0 in the piece rate payments before and after the minimum wage is not statistically significant according to the proportion test with a p-value of 0.55 with the null hypothesis is the two ratios are equal whereas the alternative hypothesis claims that the two ratios are not equal. On the other hand, these two distributions are statistically different according to K-S test with a p-value of 0.001.

On the other hand, Figure 14 shows the monthly average piece rate earnings from October 2015 to March 2016. As can be seen from the figure, after December 2015 there is a decrease in the average earnings. It kept decreasing in February 2016 as well. In fact, the average value of the monthly piece rate earnings for three month time period before the minimum wage increase is 240.040 Turkish Lira and it decreases to 163.034 Turkish Lira after the wage increase. The difference is statistically significant with a p-value of 0.000 according to both t-test[21] and M-W test.

Figure 14: Average Monthly Piece Rate Earnings over Months



However, these comparisons do not give too much information about how the performance changed after the minimum wage increase. For example, let's consider just two workers: worker A and B, and one month before and after the minimum wage increase, December and January. If worker A, whose net production based on his monthly target was -100 in December, increased his net production to -25 in January and if worker B, whose net production based on his monthly target

[21] Unless otherwise stated, for all t-tests applied in this thesis, the null hypothesis states that the means of the two samples are equal and the alternative hypothesis states that the means of the two samples are not equal.

was 100 in December, and decreased to 50 in January then this can be interpreted as being an increase in the performance since the magnitude of increase in A's net production is greater than the decrease in B's net production. However, worker A could not earn any piece rate payment in both December and January whereas worker B decreased his piece rate payment from December to January. For this reason, although there was in increase in the performance in total of these two workers, there was a decrease in the piece rate earnings.

3.4.2 Main Analysis

Table 21 below shows the average values for the daily production and faulty products for a worker before and after the minimum wage increase. The average value of the daily production for a worker before the minimum wage increase is 87.581 and decreases to 85.874 after the increase. The difference is statistically significant with a p-value of 0.000 for the t-test and 0.053 for the M-W test. On the other hand, the average value for the daily faulty product for a worker is 18.337, and it increases to 19.114 after the minimum wage increase and the difference is statistically significant with p-values 0.017 and 0.000 for the t-test and M-W test results, respectively. These result show that the number of faulty products increased although the workers produced less after the minimum wage increase. On the other hand when the time period is shorten to two months before and two months after the minimum wage increase then the average daily product for a worker becomes 87.390 and 85.344, respectively. The decrease is statistically significant with a p-value of 0.001 for the t-test and 0.09 for the M-W test. However, the average daily faulty product value is 17.529 before the increase and 17.119 after the increase and the difference is not statistically significant according to both tests. Lastly, if the time period is shortened to one month before and one month after the increase then the average daily production for a worker decreases from 87.266 to 85.391 and the difference is statistically significant according to the t-test with a p-value of 0.016 but not significant according to the M-W test with a p-value of 0.121. The average daily faulty products also decreases this time from 17.730 to 16.300 and the decrease is statistically significant based on the t-test with a p-value of 0.011 whereas it is not significant with a p-value of 0.171 for the M-W test.

Table 21: Average Daily Values Related to the Production for a Worker

	Number of Total Products	Number of Faulty Products
3 Months Before	87.581	18.337
	(28.102)	(19.169)
3 Months After	85.874	19.114
	(25.618)	(18.085)
2 Months Before	87.390	17.529
	(28.373)	(18.988)
2 Months After	85.344	17.119
	(26.065)	(17.492)
1 Month Before	87.266	17.730
	(27.407)	(19.737)
1 Month After	85.391	16.300
	(24.313)	(17.419)

Notes: Standard deviations are in the parentheses.

On the other hand, Figure 15 below show the distributions of workers' daily production three months before and after the minimum wage increase. The distributions are statistically different according to K-S test with a p-value of 0.000. Figure 16 shows the distributions for the same variable for the two months before and after the minimum wage increase whereas Figure 17 shows for one month before and after the change. In both cases, the distributions are statistically different according to K-S test with the p-values are less than 0.05.

Figure 15: Distributions of Workers' Daily Production- 3 Months

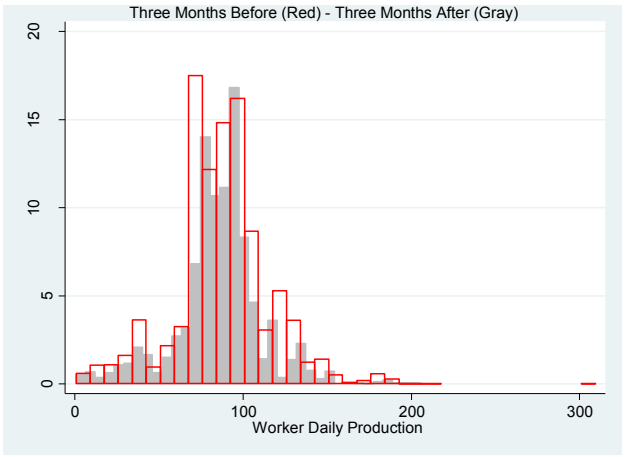


Figure 16: Distributions of Workers' Daily Production- 2 Months

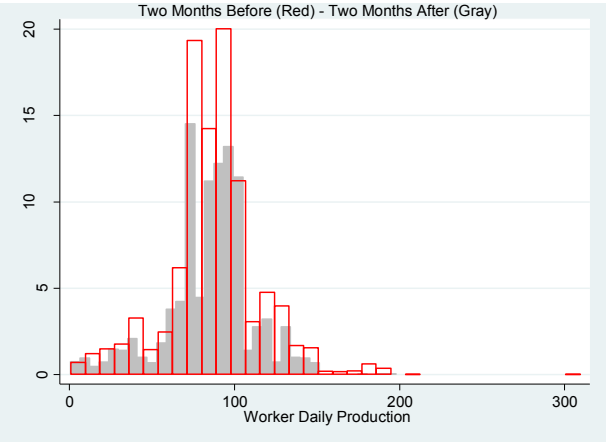
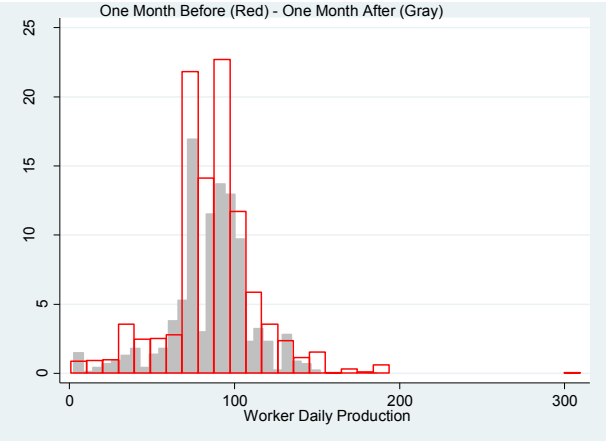


Figure 17: Distributions of Workers' Daily Production- 1 Month



However, as mentioned above, the main focus of the analysis is based on the performance which is defined as the ratio of the net product to total product in this study. Focusing on just net production values to measure the performance changes might be misleading. For example, before the minimum wage increase, if the average value of the total production of a worker is 100 and the average value of the faulty products is 10 then the average value of the net production for this worker is 90 for this time period. On the other hand, if the average value of his total production is 90 and the average value of the faulty products is 5 after the minimum wage increase then the value of his net production is 85 for this time period. If we define the performance as the net production then there is a decrease in the performance for this worker after the minimum wage increase. However, for this example, the worker produced less faulty products considering the total production, after the minimum wage increase. If the total production values would be constant before and after the minimum wage we could compare the faulty products or net production for the performance changes however the total production values change over the time. In addition, differences in total production might not be related to the workers but the problems with the machines or

company's decisions about the amount of production. For this reason the main variable for the performance is defined as the ratio of these two variables.

As can be seen from Table 22 below, the average daily value of the performance for the three months before the minimum wage increase is 0.807 and it decreases to 0.795 after the increase. The difference is statistically significant with a p-value of 0.000 for both t-test and M-W test results. If the time is shorten to two months before and two months after the minimum wage increase, the average daily value of the performance for a worker becomes 0.816 before the increase and it increases to 0.818 and this small increase is not statistically significant according to t-test with a p-value of 0.322 whereas it is statistically significant with a p-value of 0.048 for the M-W test. On the other hand, for the one month before and after the minimum wage increase, the average value of daily performance increases from 0.814 to 0.826 which is statistically insignificant based on the M-W test with a p-value of 0.276 however it is significant according to t-test with a p-value of 0.010.

Table 22: Average Daily Values of the Performance for a Worker

	Performance
3 Months Before	0.807
	(0.173)
3 Months After	0.795
	(0.159)
2 Months Before	0.816
	(0.168)
2 Months After	0.818
	(0.150)
1 Month Before	0.814
	(0.172)
1 Month After	0.826
	(0.150)

Notes: Standard deviations are in the parentheses.

Figure 18 below shows the distributions of workers' daily performance three months before and three months after the minimum wage increase. The distributions are different according to K-S test with a p-value of 0.000. Figure 19 shows the same distributions for two months before and after the minimum wage and these distributions are also statistically different with a p-value of 0.027 according the K-

S test. On the other hand, Figure 20 shows the distributions for the month before and month after the minimum wage increase; however, these two distributions are not statistically different with a p-value of 0.390 based on the K-S test.

Figure 18: Distributions of Workers' Daily Performance- 3 Months

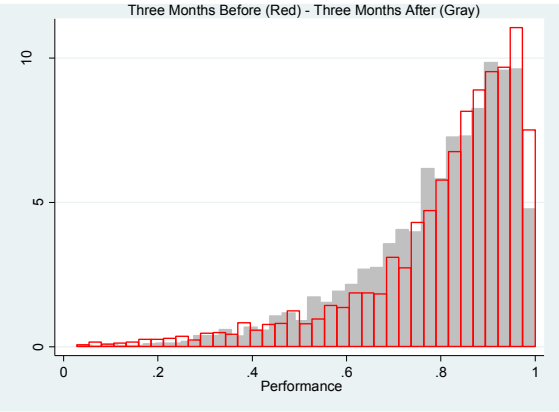


Figure 19: Distributions of Workers' Daily Performance- 2 Months

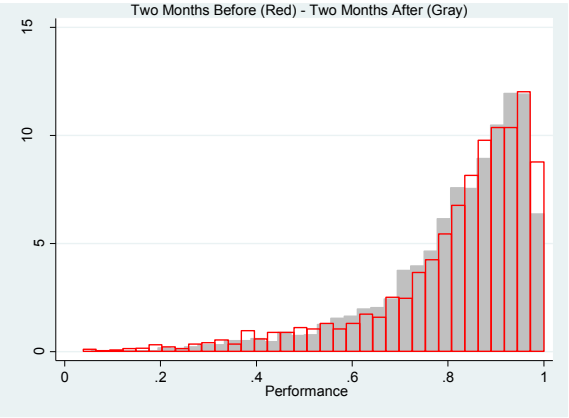


Figure 20: Distributions of Workers' Daily Performance- 1 Month

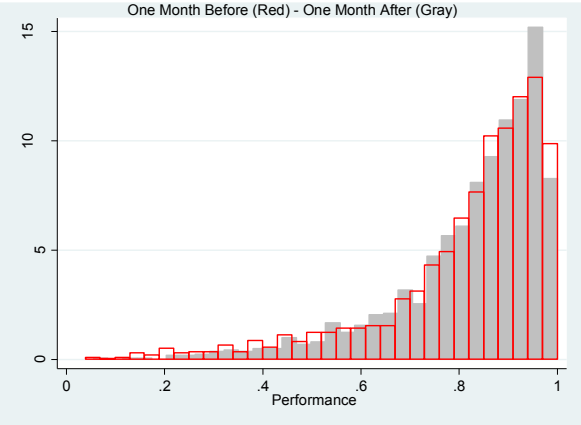


Table 23 below shows the individual fixed effect and pooled cross-sectional model results of which the model is written below in the equation (1). The dependent

variable P is the performance[22]. The main independent variable is MWI which is a dummy for the minimum wage increase. It is 0 for the time before the increase and equals 1 after the increase. The second independent variable is Index which shows the difficulty of producing the products for a worker for a certain time. The other independent variable MLA refers to minimum living allowance. Lastly, X' includes the control variables which are age, sex, experience, age-squared and experience-squared.

$$P_{i,t} = a_0 + \beta_1 MWI_{i,t} + \beta_2 Index_{i,t} + \beta_3 MLA_{i,t} + X'_{i,t} + \varepsilon_{i,t} \quad (1)$$

Table 23: Fixed Effect and Pooled Cross-Sectional Model Results- 3 Months Before and 3 Months After

	Fixed-Effect Model	Pooled-Cross Sectional Model	Pooled-Cross Sectional Model
Dependent Variable:	Performance	Performance	Performance
	(1)	(2)	(3)
MWI Dummy	-0.006**	-0.006**	-0.006**
	(0.002)	(0.002)	(0.002)
Index	-0.057***	-0.057***	-0.055***
	(0.001)	(0.001)	(0.001)
Constant	0.957***	0.943***	0.497*
	(0.005)	(0.002)	(0.027)
MLA	No	Yes	Yes
Control Variables	No	No	Yes
Observation	10398	10398	10398
R-squared	0.54	0.29	0.32

Notes: Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. MWI dummy equals 0 before the minimum wage increase and 1after the increase. Index variable refers to difficulty of producing the products. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

[22] As can be seen from the distribution of the performance figures, they are skewed. Although log transformation for the performance variable was applied, it did not change the skewness of the distributions. In addition, it did not affect the results either. For this reason, the log of the variable was not preferred.

As can be seen from the column 1 in Table 23, which shows the individual fixed effect model results, the coefficient of the minimum wage increase dummy is negative meaning that there is a decrease in the performance and it is statistically significant at the 5% level. In addition, the value and the significance of the coefficient of the minimum wage dummy is the same for the pooled cross-sectional results in column 2 and this does not change when the control variables are included in column 3. On the other hand, the index variable is negative and statistically significant in all three model results as expected. As explained before, the index value shows the difficulty in producing a product, so a higher index value means it is more difficult to produce. For this reason, it is expected to observe a negative relation between this variable and the performance since, as the index value gets higher, employees are more likely to produce faulty products for these products.

In order to observe the workers' shorter-term reactions to the minimum wage change, the same analysis is conducted with a shortened time period to two months before and after the minimum wage increase (November and December are compared to January and February) and also one month before and after the increase (December is compared to January). The reason for this type of analysis is to check whether or not the effects change as the time prolongs. There may be an increase in the performance just after the minimum wage increase whereas the effect may not be observed after a while. Conversely, there might not be any effect of the minimum wage increase immediately after the increase, however there may be observed increases or decreases in the performance after the time prolongs.

The model written in equation (1) above is the same for these analyses as well. Table 24 below shows the same fixed effect and pooled cross-sectional model results for the two months before and after the minimum wage increase. As can be seen from the table, the coefficient for the minimum wage increase dummy is positive meaning that there is an increase in the performance with the minimum wage change, in fixed effect (column 1) and pooled cross-sectional model results with and without the control variables (column 3 and 2, respectively). However, all of them are statistically insignificant. Again, the coefficients of the index variable are all negative and statistically significant as is expected in the three models and consistent with the previous results.

Table 24: Fixed Effect and Pooled Cross-Sectional Model Results- 2 Months Before and 2 Months After

	Fixed-Effect Model	Pooled Cross-Sectional Model	Pooled Cross-Sectional Model
Dependent Variable:	Performance	Performance	Performance
	(1)	(2)	(3)
MWI Dummy	0.003	0.005	0.004
	(0.003)	(0.003)	(0.003)
Index	- 0.044***	-0.053***	-0.050***
	(0.003)	(0.001)	(0.001)
Constant	0.986***	0.948***	0.590***
	(0.003)	(0.004)	(0.027)
MLA	No	Yes	Yes
Control Variables	No	No	Yes
Observation	6487	6487	6487
R-squared	0.58	0.28	0.31

Notes: Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. MWI dummy equals 0 before the minimum wage increase and 1after the increase. Index variable refers to difficulty of producing the products. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

On the other hand, Table 25 below shows the same models' results for one month before and after the minimum wage increase. The coefficient of the minimum wage increase dummy is positive in three columns, and three of them are statistically significant. The coefficients of the index variable are consistent with the previous results. As a result, based on these results, it can be concluded that there are mixed results of the minimum wage increase on the workers' overall performance for different time periods.

3.4.2.1 Low and High Productivity Workers

Workers might react differently to the policy changes within the firm or labour market based on their productivity levels. For this reason, for further analysis, workers are divided into two groups: low-productivity and high-productivity workers. In order to distinguish the workers, their average performance values in

the three months before the minimum wage increase are calculated and they are ranked based on these values. Workers who are below the median are defined as low-productivity workers and the ones equal and above the median are defined as high-productivity workers. After this differentiation, there are 39 workers defined as low-productivity and 40 as high-productivity[23].

Table 25: Fixed Effect and Pooled Cross-Sectional Model Results- 1 Month Before and 1 Month After

	Fixed-Effect Model	Pooled Cross-Sectional Model	Pooled Cross-Sectional Model
Dependent Variable:	Performance	Performance	Performance
	(1)	(2)	(3)
MWI Dummy	0.011**	0.014***	0.014***
	(0.003)	(0.003)	(0.003)
Index	-0.036***	-0.052***	-0.049***
	(0.009)	(0.001)	(0.001)
Constant	0.973***	0.941***	0.479***
	(0.012)	(0.004)	(0.037)
MLA	No	Yes	Yes
Control Variables	No	No	Yes
Observation	3554	3554	3554
R-squared	0.62	0.26	0.30

Notes: Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. MWI dummy equals 0 before the minimum wage increase and 1after the increase. Index variable refers to difficulty of producing the products. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

[23] The worker whose performance is equal to the median value is included in the high-productivity group. For this reason there are 39 low and 40 high-productivity workers. However, including this worker in the low-productivity worker and doing the analysis with 40 workers in the low and 39 workers in the high-productivity group, does not change the results.

3.4.2.1.1 Descriptive Statistics for Low and High-Productivity Workers

As mentioned above, there are 79 workers in total and 39 of them are defined as low-productivity and 40 of them are accepted as high-productivity workers. There are two females in the low-productivity group whereas there is one female in the high-productivity group. Table 26 below show descriptive information for the same variables showed in Table 20 above but for the low and high-productivity workers separately. The mean values for each variable are close for both type of groups. In fact, according to the t-test and M-W test results, there is no significant difference between two type of groups for any variable values on Table 26 with all p-values greater than 0.10.

Table 26: Summary Statistics for Low and High-Productivity Workers

	Low-Productivity Workers		High-Productivity Workers	
	Mean	Min-Max	Mean	Min-Max
Age	32.76	23-45	33.37	22-48
	(7.15)		(6.92)	
Experience	2288.56	89-6757	2799.17	185-7153
	(1889.70)		(1775.28)	
Female	2/39	-	1/40	-
Number of Working Days In a Month	23.15	9-28	24.02	8-28
	(3.84)		(4.08)	
Minimum Living Allowance-Before	120.611	90.11-153.19	116.80	90.11-153.19
	(20.32)		(20.56)	
Minimum Living Allowance-After	168.819	123.53-209.99	161.20	123.53-209.99
	(28.41)		(28.41)	
Number of Observation for the Low-Productivity Workers: 5053				
Number of Observation for the High-Productivity Workers: 5345				

Notes: Standard deviations are in parentheses.

3.4.2.1.2 Low-Productivity Workers

Table 27 shows the average of the daily production for a low-productivity worker. The mean of the daily production for the three month period before the minimum wage increase is 94.878 and decreases to 92.949 after the increase. The difference is statistically significant with a p-value of 0.008 according to the t-test and 0.022 for the M-W test. If the time period is shortened to two months before and after the increase, the average values are very close to previous result, and the decrease is also statistically significant according to the t-test and M-W test with p values of 0.022 and 0.078, respectively. There is also a decrease for the one month before

and after; however this change is not statistically significant according to both tests with the both p-values are greater than 0.10. On the other hand, there are also decreases in the average values of the daily faulty products in the three time periods. However, the decrease is not statistically significant when the time period is three month before and after the minimum wage increase according to the both test results with the p-values greater than 0.10. On the other hand, the decreases for the two months and one month before and after cases are statistically significant according to the both test results with all the p-values less than 0.03. However, since both the average value of the daily production and daily faulty products decreases together, it does not give much information about the performance changes.

Table 27: Average Daily Values Related to the Production for a Low-Productivity Worker

	Number of Total Products	Number of Faulty Products
3 Months Before	94.878	28.604
	(29.224)	(21.859)
3 Months After	92.949	27.921
	(28.402)	(20.385)
2 Months Before	94.777	27.739
	(29.641)	(21.992)
2 Months After	92.625	25.699
	(29.905)	(20.357)
1 Month Before	94.234	27.854
	(29.288)	(23.253)
1 Month After	92.543	24.982
	(29.077)	(20.568)

Notes: Standard deviations are in the parentheses.

Figure 21 below shows the distributions of workers' daily production for three months before the minimum wage increase and three months after for the low-productivity workers. The distributions are statistically different according to K-S test with a p-value of 0.000. In addition, Figure 22 shows the same distributions for the two months before and after whereas the Figure 23 shows one month before and after the minimum wage increase. In both cases, distributions for before and after the change are statistically different according to K-S test with p-values less than 0.05.

Figure 21: Distributions of Workers' Daily Production- Low-Productivity Workers- 3 Months

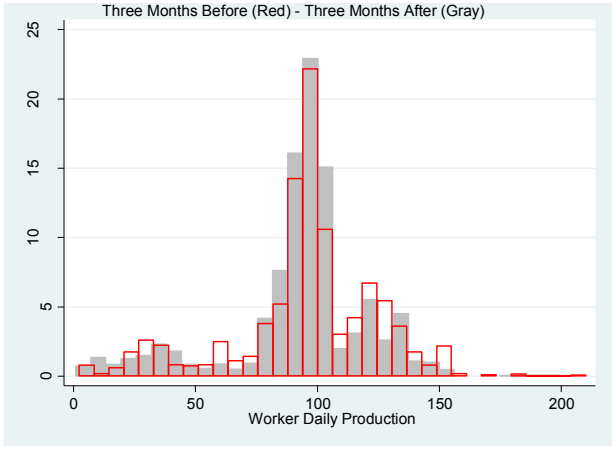
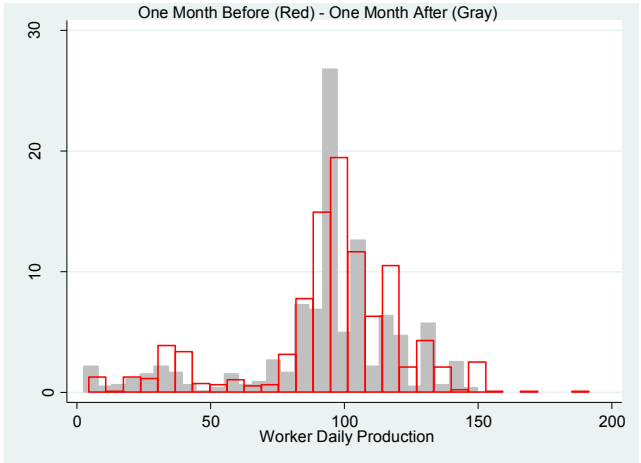


Figure 22: Distributions of Workers' Daily Production- Low-Productivity Workers- 2 Months

Figure 23: Distributions of Workers' Daily Production- Low-Productivity Workers - 1 Month



On the other hand, Table 28 below shows the average daily performance values for the low productivity workers. The average value increases from 0.708 to 0.717 from the three months before to three months after with the minimum wage

increase. Although this change is statistically significant according to t-test with a p-value of 0.041, it is not significant according to the M-W test result with a p-value of 0.977. On the other hand, the difference in the average performance value between the two months before and after the minimum wage increase is statistically significant according to the both test results with p-values less than 0.01. There is also an increase in the performance of the low-productivity workers if the time period is restricted with just one month before and after the minimum wage change. This increase is also statistically significant according to both test results with the p-values less than 0.005.

Table 28: Average Daily Values of the Performance for a Low-Productivity Worker

	Performance
3 Months Before	0.708
	(0.191)
3 Months After	0.717
	(0.171)
2 Months Before	0.719
	(0.187)
2 Months After	0.742
	(0.167)
1 Month Before	0.719
	(0.192)
1 Month After	0.748
	(0.168)

Notes: Standard deviations are in the parentheses.

Distributions of low-productivity workers' performance for the three months, two months and one month before and after the minimum wage increase can be seen from Figure 24, Figure 25 and Figure 26, respectively. The K-S test results show that the distributions for before and after the increase are statistically different in each time period with p-values 0.081, 0.015 and 0.070, respectively.

Figure 24: Distributions of Workers' Daily Performance- Low-Productivity Workers- 3 Months

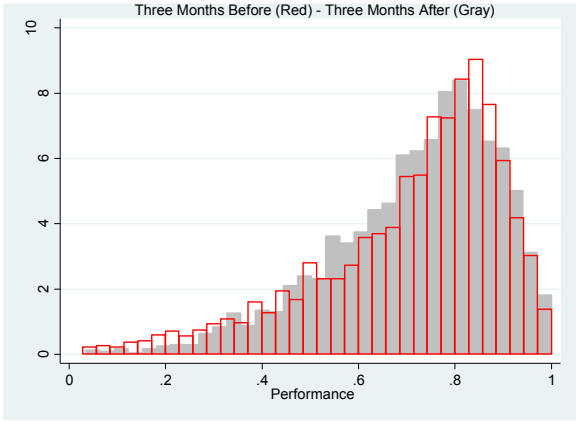


Figure 25: Distributions of Workers' Daily Performance- Low-Productivity Workers- 2 Months

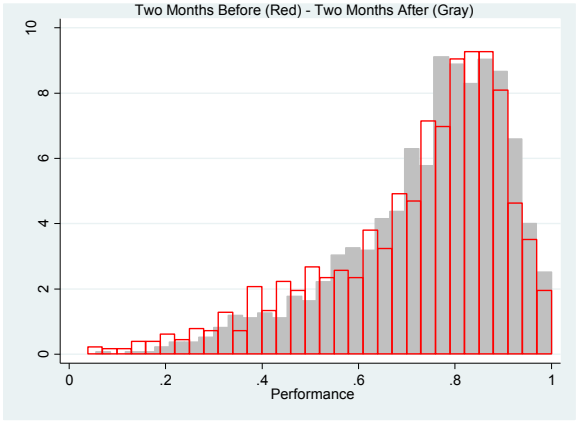
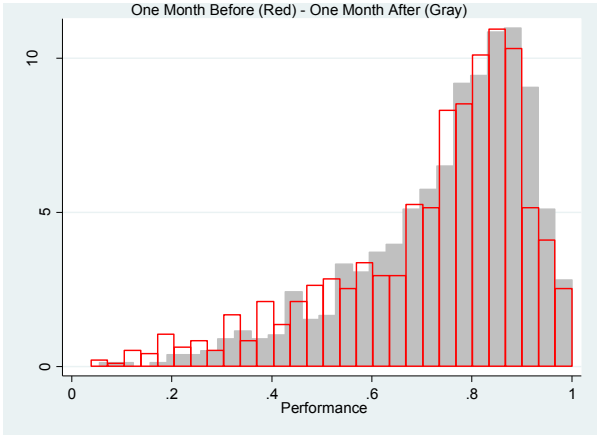


Figure 26: Distributions of Workers' Daily Performance- Low-Productivity Workers- 1 Month



3.4.2.1.3 High-Productivity Workers

Table 29 below shows the average values for the number of daily production and faulty products for a high-productivity worker for the three cases.

Table 29: Average Daily Values Related to the Production for a High-Productivity Worker

	Number of Products	Number of Faulty Products
3 Months Before	80.715	8.675
	(25.144)	(8.435)
3 Months After	79.151	10.744
	(20.515)	(9.963)
2 Months Before	80.428	7.904
	(25.222)	(7.325)
2 Months After	78.546	9.109
	(19.580)	(8.487)
1 Month Before	80.612	8.063
	(23.651)	(7.357)
1 Month After	78.578	8.029
	(15.947)	(7.032)

Notes: Standard deviations are in the parentheses.

The average value of the daily production for three months before the minimum wage increase is 80.715 and it decreases to 79.151 after the minimum wage was increased. The change is statistically significant according to the t-test with a p-value of 0.006 and 0.053 for the M-W test. On the other hand, the average value of the daily faulty products for a high-productivity worker increased after the minimum wage change from 8.675 to 10.744. This change is also statistically significant with a p-value of 0.000 for both tests. If the time period is shortened to the two months before and after the minimum wage increase, the changes in the average values are similar to previous results. Although the average daily production decreases, the average number of faulty products increases after the minimum wage change. The change in the average number of faulty products is statistically significant with a p-value of 0.000 for both tests. However, the difference in the average value of the daily production is not statistically significant according to the M-W test with a p-value of 0.176 whereas the t-test result shows that it is significant with a p-value of 0.009. Lastly, if we focus on just one month before and after the minimum increase, there is still a decrease in the average value of the daily production however there is also a very small decrease in the average

value of the faulty products. The difference in the number of faulty products is not statistically significant according to the both tests with the p-values greater than 0.40. The difference in the average daily production is statistically significant according to the t-test with a p-value of 0.017 whereas it is not according to the M-W test result with a p-value greater than 0.20.

Figure 27 shows the distributions of workers' daily production for three months before the minimum wage increase and three months after for the high-productivity workers whereas Figure 28 shows the same distributions for two months before and two months after. In both cases, the distributions for the time period before the minimum wage increase are statistically different from the distributions for the time period after the change according to K-S test results with p-values of 0.001. On the other hand, Figure 29 shows the same distributions for one month before and after the minimum wage change however there is no statistically difference according to K-S test with a p-value of 0.186.

Figure 27: Distributions of Workers' Daily Production- High-Productivity Workers- 3 Months

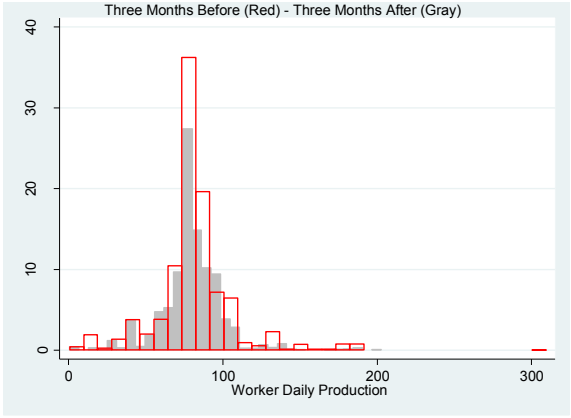


Figure 28: Distributions of Workers' Daily Production- High-Productivity Workers- 2 Months

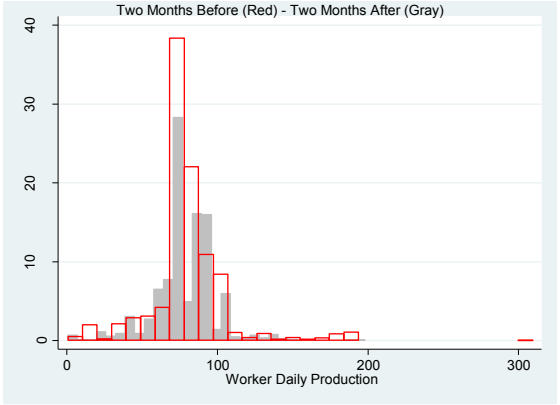


Figure 29: Distributions of Workers' Daily Production- High-Productivity Workers - 1 Month

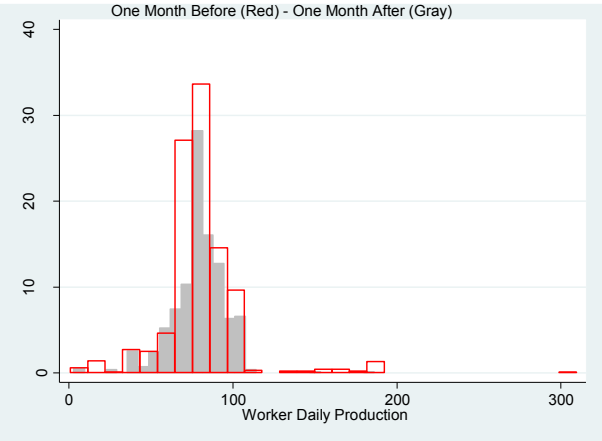


Table 30 below shows the average daily performance values for the high-productivity workers for different time periods as before. In three different time period cases, as can be seen from the table, the average value of the performance decreases after the minimum wage increase. These changes are statistically significant with p-values of 0.000 for both tests except the one month before and after time period. The difference in performance between one month before and one month after the minimum wage change is not statistically significant according to the t-test with a p-value of 0.142 and 0.442 for the M-W test.

Table 30: Average Daily Values of the Performance for a High-Productivity Worker

	Performance
3 Months Before	0.899
	(0.078)
3 Months After	0.870
	(0.103)
2 Months Before	0.906
	(0.071)
2 Months After	0.888
	(0.087)
1 Month Before	0.904
	(0.074)
1 Month After	0.900
	(0.077)

Notes: Standard deviations are in the parentheses.

On the other hand, Figure 30 shows the distributions of high-productivity workers' daily performance for the three months before and after the minimum wage increase whereas the same distributions for the two months and one month time periods can be seen from Figure 31 and Figure 32, respectively. K-S test results show that both distributions of the performance for three months and two months before the minimum wage increase are statistically different than the distributions covering three and two months after the minimum wage increase with p-values of 0.000. However, the distribution for the one month before the increase is not statistically different than the distribution for the one month after the minimum wage change according to K-S test with a p-value of 0.655.

Figure 30: Distributions of Workers' Daily Performance- High-Productivity Workers- 3 Months

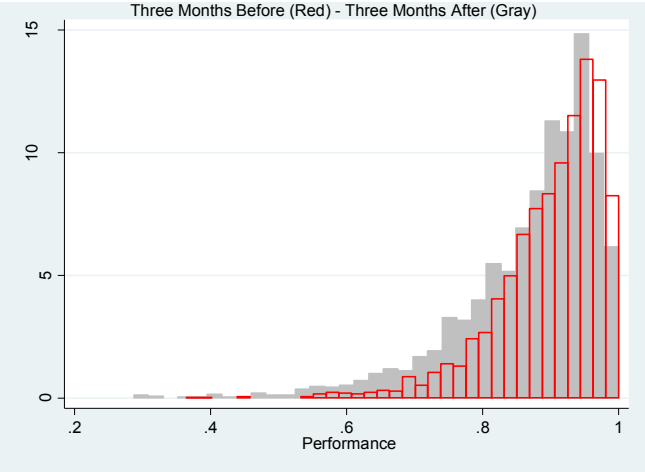


Figure 31: Distributions of Workers' Daily Performance- High-Productivity Workers- 2 Months

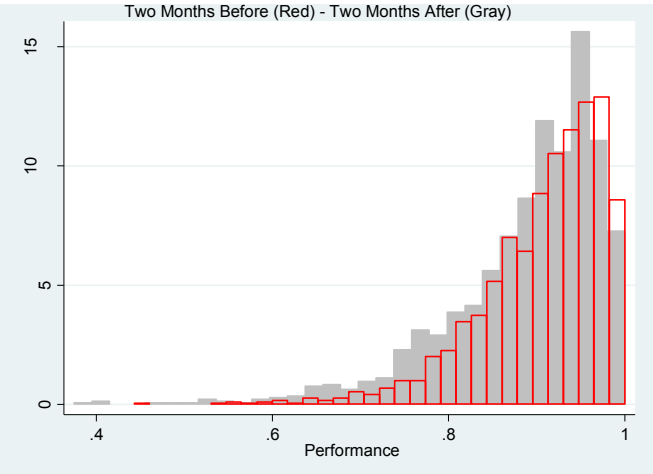
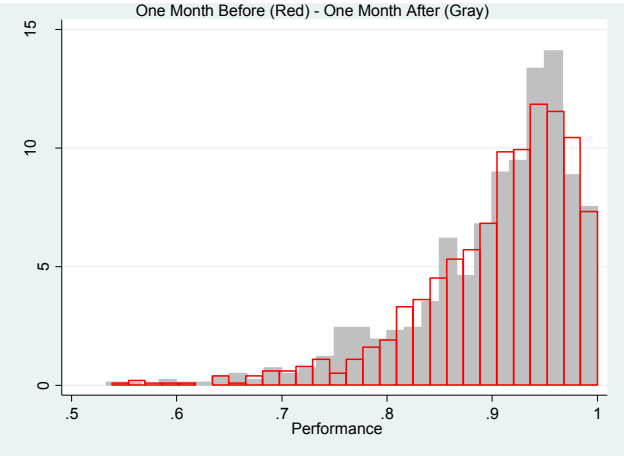


Figure 32: Distributions of Workers' Daily Performance- High-Productivity Workers- 1 Month



3.4.2.1.4 Regression Analysis for the Low and High- Productivity Workers

The model below is run for the analysis of the effects of the minimum wage increase on the low and high-productivity workers. The dependent variable P is the performance. The first independent variable is MWI which is a dummy for the minimum wage increase. It is 0 for the time before the increase and equals 1 after the increase. The second independent variable is Index which shows the difficulty of producing the products for a worker for a certain time as it is in the previous model. The other independent variable is Type which is a dummy. It is 0 for the low-productivity workers and 1 for the high-productivity workers. MWI*Type is an interaction of the MWI and Type whereas Index*Type is an interaction of Index and Type. On the other hand, MLA refers to minimum living allowance whereas X' includes the control variables which are age, sex, experience, age-squared and experience-squared as in the previous model.

$$P_{i,t} = a_0 + \beta_1 MWI_{i,t} + \beta_2 Index_{i,t} + \beta_3 Type_i + \beta_4 (MWI_{i,t} * Type_i) + \beta_5 (Index_{i,t} * Type_i) + \beta_6 MLA_{i,t} + X'_{i,t} + \varepsilon_{i,t} \quad (2)$$

Table 31 below show the fixed-effect and pooled cross-sectional results for the low and high-productivity workers for three months before and after the minimum wage increase based on the model shown above. As can be seen in the first column, the coefficient of the minimum wage dummy which shows the effect of the minimum wage increase on the low-productivity workers is positive meaning that there is an increase in the performance, though this is not statistically significant. There are similar results for the cross-sectional model as shown in column 2 and 3. The coefficients for the minimum wage increase dummy is also positive in these

models however these are not statistically significant in either cases (with and without the control groups).

Table 31: Fixed Effect and Pooled Cross-Sectional Model Results-
3 Months Before and After

	F-E Model	P-C-S Model	P-C-S Model
Dependent Variable:	Performance	Performance	Performance
	(1)	(2)	(3)
MWI Dummy	0.006	0.006	0.006
	(0.004)	(0.004)	(0.004)
MWI*Type	-0.027***	-0.029***	-0.028***
	(0.004)	(0.004)	(0.004)
Index	-0.072***	-0.048***	-0.045***
	(0.003)	(0.001)	(0.001)
Index*Type	0.038***	0.016***	0.012***
	(0.006)	(0.001)	(0.001)
Type	0.144***	0.085***	0.095***
	(0.021)	(0.004)	(0.006)
Constant	0.838***	0.859***	0.484***
	(0.022)	(0.006)	(0.003)
MLA	No	Yes	Yes
Control Variables	No	No	Yes
Observation	10398	10398	10398
R-squared	0.54	0.38	0.39

Notes: Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. MWI dummy equals 0 before the minimum wage increase and 1 after the increase. Index variable refers to difficulty of producing the products. Type is a dummy which is 0 for the low-productivity workers whereas 1 for the high-productivity workers. MWI*Type variable is an interaction term of MWI and Type variables. Index*Type is an interaction term of Index and Type variables. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

On the other hand, the addition of the two coefficients (coefficient of the MWI dummy and the coefficient of the MWI*Type) shows the effect of the minimum wage increase on the high productivity workers' performance. As can be seen in column 1, the addition of these two coefficients yields a negative number and this is statistically different from 0 with a p-value of 0.000 according to the Wald test where the null hypothesis claims that the addition of these two coefficients is equal to 0 and the alternative hypothesis states that it is not equal to 0. The minimum wage increase leads a 2.5% decrease in the high-productivity workers' performance according to the fixed-effect results in the column 1. Pooled cross-sectional model results, with or without the control variables, also show similar results as can be seen in column 3 and column 2, respectively. The decrease in the high skilled

workers' performance with the minimum wage change is 2.9% according to the both results. Lastly, the coefficient of the Index variable shows the relation between Index and performance for the low-productivity workers whereas the addition of the two coefficients which are Index and Index*Type shows the effect of the Index on the high-productivity workers. The results show that there is a negative relationship between Index and performance for both type of workers which both results are statistically significant.

Table 32: Fixed Effect and Pooled Cross-Sectional Model Results-
2 Months Before and After

	F-E Model	P-C-S Model	P-C-S Model
Dependent Variable:	Performance	Performance	Performance
	(1)	(2)	(3)
MWI Dummy	0.017***	0.020***	0.019**
	(0.005)	(0.005)	(0.005)
MWI*Type	-0.031***	-0.035***	-0.033***
	(0.005)	(0.004)	(0.004)
Index	-0.072***	-0.045***	-0.041***
	(0.006)	(0.001)	(0.001)
Index*Type	0.051***	0.020***	0.015***
	(0.007)	(0.002)	(0.001)
Type	0.158***	0.073***	0.084***
	(0.015)	(0.003)	(0.004)
Constant	0.812***	0.871***	0.597***
	(0.043)	(0.005)	(0.029)
MLA	No	Yes	Yes
Control Variables	No	No	Yes
Observation	6487	6487	6487
R-squared	0.59	0.37	0.39

Notes: Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. MWI dummy equals 0 before the minimum wage increase and 1 after the increase. Index variable refers to difficulty of producing the products. Type is a dummy which is 0 for the low-productivity workers whereas 1 for the high-productivity workers. MWI*Type variable is an interaction term of MWI and Type variables. Index*Type is an interaction term of Index and Type variables. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

Table 32 above shows the same models' results but for two months before and after the minimum wage increase. As can be seen from the three columns, the coefficient of the minimum wage increase dummy is positive and statistically

significant at the 1% level in the first two columns and 5% in the third column. According to the fixed effect model, increasing the minimum wage led low-productivity workers to increase their performance by 4.1% in the two months after the change. On the other hand, according to the pooled cross-sectional results in column 2, the results are consistent with the fixed-effect model results and workers increased their performance 4.3% with the minimum wage change and this change is statistically significant at the 1% level as well. If the control variables are included in column 3, the value of the coefficient changes and the change in the performance value decreases to 4.2%.

On the other hand, for the high-productivity workers, the results are consistent with the three-month time period as can be seen in three columns. According to the fixed effect model of which the results are in column 1, addition of the two coefficients (MWI and MWI*Type) yields a negative number and it is statistically different from 0 according to the Wald test with a p-value of 0.000. This means that there is a decrease in the high-productivity workers' performance after the minimum wage increase. Pooled cross-sectional results also show that the minimum wage increase leads to a decrease in the performance of high-productivity workers and addition of the two coefficients are also statistically different than 0 according to the Wald test results with the p-values of 0.000 for both results. Based on the fixed effect model results, an increase in the minimum wage led high-productivity workers to decrease their performance by 1.6%, and 1.8% for both pooled cross-sectional results in column 2 and 3.

Repeating the analysis with just one month before and after the minimum wage increase also provides similar results for the low-productivity workers. As can be seen from Table 33 below, the coefficient of the MWI dummy is positive and statistically significant in all three columns. This also shows that the low-productivity workers increased their performance just after the minimum wage increase. According to the fixed-effect model results in column 1, workers increased their performance by 4.6% in the first month after minimum wage change whereas it is 5.8% according to the pooled cross-sectional results in column 2. If the control variables are included into the model, the change in the performance becomes 5.4%. Coefficients of the index variable are statistically significant and there is a negative relation with the performance as is expected in all three different time period analysis as can be seen on the tables.

On the other hand, for the high-productivity workers, the results change in terms of significance compared to the previous results. Addition of the two coefficients

(MWI and MWI*Type) still yields a negative value in each column however these are not statistically different than 0 according to Wald test results with the p-values greater than 0.50 for the fixed-effect and pooled cross-sectional model results with or without the control variables. This means that there is no change in the high-productivity workers' performance just after the minimum wage was increased.

Table 33: Fixed Effect and Pooled Cross-Sectional Model Results-
1 Month Before and After

	F-E Model	P-C-S Model	P-C-S Model
Dependent Variable:	Performance	Performance	Performance
	(1)	(2)	(3)
MWI Dummy	0.021**	0.028***	0.027***
	(0.006)	(0.005)	(0.005)
MWI*Type	-0.023***	-0.030***	-0.028***
	(0.006)	(0.005)	(0.005)
Index	-0.084***	-0.041***	-0.036***
	(0.025)	(0.002)	(0.001)
Index*Type	0.070***	0.015***	0.008***
	(0.026)	(0.002)	(0.001)
Type	0.175*	0.093***	0.110***
	(0.082)	(0.005)	(0.004)
Constant	0.780***	0.851***	0.461***
	(0.085)	(0.005)	(0.038)
MLA	No	Yes	Yes
Control Variables	No	No	Yes
Observation	3554	3554	3554
R-squared	0.63	0.36	0.38

Notes: Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. MWI dummy equals 0 before the minimum wage increase and 1 after the increase. Index variable refers to difficulty of producing the products. Type is a dummy which is 0 for the low-productivity workers whereas 1 for the high-productivity workers. MWI*Type variable is an interaction term of MWI and Type variables. Index*Type is an interaction term of Index and Type variables. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

To conclude, these results show that low-productivity workers increased their performance one and two months after the minimum wage increase, though this effect disappears by three months after the increase. This shows that the income

targeting effect is not valid for these workers, but rather they were triggered by being worried for losing their jobs and decided to increase their performance. However, they became less sensitive to increase in the value of the job and the job loss as the time prolongs. On the other hand, for the high-productivity workers, these results show that high-productivity workers decreased their performance after the minimum wage increase suggesting that the income targeting hypothesis is valid for these workers. However, the effect is not observed just after the minimum wage increase and instead workers reacted to the change a bit later than the minimum wage increase. The possible reasons for observing different effects on these workers as the time period changes is discussed in the discussion part.

3.4.3 Robustness Check

In addition to the previous analyses of which the results were presented above, other model specifications were run in order to check how robust the previous results were. The first model was run to check whether or not to use different time periods as widening or shortening the time periods symmetrically before and after the minimum wage increase is useful. Instead of changing the time interval symmetrically, the month immediately prior to the wage increase which was December was compared to each of the subsequent months separately. The model below for the overall effect is the same as shown above in equation (1).

$$P_{i,t} = a_0 + \beta_1 MWI_{i,t} + \beta_2 Index_{i,t} + \beta_3 MLA_{i,t} + X'_{i,t} + \varepsilon_{i,t} \quad (3)$$

However, the model is run for three time periods; (i) December vs. January, (ii) December vs. February, (iii) December vs. March. The results can be seen in Appendix B, Table B.1. The first column of the table shows the results of the fixed-effect model comparing December to January, whereas the second column shows the same analysis with pooled cross-sectional model results. In fact, the results presented in the first two columns are the same as the analysis for one month before and after the minimum wage increase explained above. On the other hand, the third and the fourth columns show the same models' results for the comparison of December to February whereas the fifth and the sixth columns show the same models' results for comparing December to March. As can be seen from the table, the results are consistent with the previous results. For the overall effect, the level of performance increases just after the minimum wage increase in January, however there is no significant effect in February just like the results two months before and two months after the minimum wage increase analysis. Lastly, the performance

decreased in March compared to December which is also consistent with three months before and after analysis.

On the other hand, the model below is run for the same analysis whilst also classifying the workers as low and high-productivity workers, similar to the model shown in equation (2). December is compared to January, February and March separately for this specification as well.

$$P_{i,t} = a_0 + \beta_1 MWI_{i,t} + \beta_2 Index_{i,t} + \beta_3 Type_i + \beta_4 (MWI_{i,t} * Type_i) + \beta_5 (Index_{i,t} * Type_i) + \beta_6 MLA_{i,t} + X'_{i,t} + \varepsilon_{i,t} \quad (4)$$

The results of the model are presented in Appendix B, Table B.2. The order of the results presented in columns are the same as the previous table (Table B.1). The first two columns are also the same with the analysis based on one month before and after the minimum wage increase for low and high-productivity workers as discussed before. As can be seen in the first two columns, the coefficient of the MWI dummy showing the effect of the minimum wage increase on the low-productivity worker, is positive and statistically significant. This means that the performance of the low-productivity workers' increased with the minimum wage introduction in January compared to December. On the other hand, as the time prolongs to March, the effect disappears and these workers start decreasing their performance. These results are consistent for the low-productivity workers as explained in the previous section in terms of there is an increase just after the minimum wage increase however this effect disappears as the time prolongs.

On the other hand, the effect of the minimum wage increase on the high-productivity workers can be seen with addition of β_1 and β_4 meaning that the coefficients of MWI and (MWI*Type). The results for the high-productivity workers in the first two columns are the same as the previous results based on one month before and after the minimum wage increase. Addition of these two coefficients gives a negative value, however it is not statistically different than 0 with a p-value of 0.641, according to a Wald test where the null hypothesis claims that the addition of these two coefficients is equal to 0 and the alternative hypothesis states that it is not equal to 0. In the third and fourth columns, the value of the addition of these two coefficients yields a negative value and the Wald test result shows that addition of these two coefficients is statistically different than 0 with a p-value of 0.000 with the same null and alternative hypotheses as just stated. Lastly, in the last two columns on the table, the coefficients are both negative and addition of these coefficients is statistically different than 0 with a p-value of 0.000 with the

same test and the same hypotheses. These results show that high-productivity workers decrease their performance in February and March compared to December and these are also consistent with the previous results for the high-productivity workers since there is no effect just after the minimum wage increase, whereas these workers start decreasing their performance as the time period prolongs.

In addition to the model run above, the model shown in equation (5) below was also run as robustness check and the results are presented in Appendix B, Table B.3. MWI refers to minimum wage increase dummy which is 1 after the increase whereas it is 0 before the increase. Index, MLA and X' which includes control variables are the same as the previous model. Month variable refers to the months starting from 1 for the first month (October) of the dataset covers. On the other hand, MWI*Month is an interaction of the month variable and minimum wage increase dummy. The first two columns of the table show the fixed effect and pooled cross-sectional model results, respectively for the overall effect. On the other hand, the third and the fourth columns show the same model results for the low-productivity workers whereas the fifth and the sixth columns show the same model results for the high-productivity workers. Instead of running different regressions for the low and high-productivity workers, one regression model could be run with the interaction terms as in the previous models however this would make the tables extensive and difficult to follow the results. For this reason, the models were run separately for these workers.

$$P_{i,t} = a_0 + \beta_1 MWI_{i,t} + \beta_2 Index_{i,t} + \beta_3 Month_{i,t} + \beta_4 (MWI_{i,t} * Month_{i,t}) + \beta_5 MLA_{i,t} + X'_{i,t} + \varepsilon_{i,t} \quad (5)$$

As can be seen from the first two columns, for both models, the coefficient of the interaction term is negative and statistically significant meaning that there was a decrease in the performance after the minimum wage increase. It is consistent with the results for three months before and three months after the minimum wage increase model results discussed above. On the other hand, high-productivity workers also decrease their performance according to the results in the last two columns. Based on the previous results, although there was no effect observed just after the minimum wage increase, high-productivity workers tend to decrease their performance in the later months. In terms of this perspective, it can be said that these results are also consistent with the previous ones. However, although the low-productivity workers increase their performance according to the previous models' results, there is evidence of a decrease in the performance according to these model's results as can be seen in the third and the fourth columns.

Lastly, the model shown in equation (6) below was also run for the non-linear effects as robustness check.

$$P_{i,t} = a_0 + T'_{i,t} + \beta_2 Index_{i,t} + \beta_3 MLA_{i,t} + X'_{i,t} + \varepsilon_{i,t} \quad (6)$$

The dependent variable in this model is P which is also the performance. Instead of a dummy for the minimum wage increase, there is a vector of time periods (T) referring to a dummy for each month except October which is excluded as the reference category. The Index variable shows the difficulty of producing the products for a worker for a certain time as in the previous models. On the other hand, MLA refers to minimum living allowance and X' includes the control variables which are age, sex, experience, age-squared and experience-squared like the previous models. The results are presented in Appendix B, Table B.4.

The first column of the table shows the results of the fixed-effect model, whereas the second column shows the same analysis with pooled cross-sectional model results for the overall effects. On the other hand, the third and the fourth columns show the same model results as the first two columns but for the low-productivity workers. The last two columns show the results of the same model for the high-productivity workers. The effects might be different for low and high-productivity workers in different time periods and there are five time periods. Creating interaction terms and running one model for both type of workers would make the results complicated to follow. For this reason, this model was also run separately for these workers.

According to the results in the first two columns, in November, December, January and February the performance increased compared to October, since the coefficients of these variables are statistically significant with p-values less than 0.01. However, according to the Wald test results shown in Appendix B, Table B.5, coefficients for November and December are not statistically different. In addition, the value of the coefficient of January is greater than December and these two coefficients are statistically different according to the Wald test results as can be seen in Table B.5. This means that there is an increase in overall performance just after the minimum wage increase. On the other hand, the overall performance decreased in March according to November. These results are consistent with the previous results in terms of overall performance increasing after the minimum wage increase but this effect reversed after a longer period following the minimum wage increase. According to the results in the third and the fourth columns, low-productivity workers increased their performance in November, December, January

and February compared to October. All of these coefficients are statistically significant at the 1% level in both fixed-effect and pooled cross-sectional results. In addition, the value of the coefficient for January is greater than November and December and it is statistically different from both coefficients according to Wald test results presented in Table B.5. On the other hand, the coefficient of March is not statistically significant. These results are also consistent with the previous results and the argument that low-productivity workers increase their performance just after the minimum wage increase. Lastly, the last two columns show the same model results for high-productivity workers. It can be concluded that these results are also consistent with the previous results. The first finding for the high-productivity workers was that they did not increase their performance just after the minimum wage increase according to the results in the main analysis section above. As can be seen in Table B.4, the coefficients of December and January are positive and statistically significant at the 1% level. This means that the performance of these workers was greater in these months than it was in October. However, the values of these two coefficients is almost the same. In fact, according to Wald test results in Table B.5, these two coefficients are not statistically different with p-values of 0.831 and 0.586 for fixed effect and pooled cross-sectional models, respectively. This can be interpreted as: there is no increase in the high-productivity workers' performance in January compared to December. On the other hand, the values of the coefficients of February and March are negative, referring to a decrease in performance in these months compared to October, although the coefficient of February is not statistically significant. However, these coefficients are both statistically different than January. This can be interpreted as there was a decrease in performance after January as the time prolongs like the previous results in the main analysis.

3.5 Discussion and Concluding Remarks

The purpose of this paper is to analyse how an exogenous change such as a minimum wage increase affects workers' performance when they are paid both fixed wage and piece rate. The minimum wage was increased by 30% in Turkey on the 1st of January, 2016. For the study, a dataset was provided by a Turkish company which pays their workers both fixed wage and piece rate together if the workers exceed some target. The dataset covers the three months before and three months after this minimum wage increase. Two hypotheses are tested in the analysis. The first one is to claim that workers increase their performance with

increase in the minimum wage because increase in the wage also increases the value of the losing the job. For this reason, workers might feel more concerned about losing their jobs and this may lead them to increase their performance. On the other hand, the second hypothesis argues that a minimum wage increase might cause a decrease in the performance because of income targeting. This refers to the fact that that workers have some kind of reference level of income in their mind and since they are able to achieve this level with less piece rate payment due to increase in their fixed wages, this may lead them to decrease their performance.

This study has two contributions to the literature. Firstly, there are only a few studies in which the workers are paid both fixed wage and piece rate together. Although this kind of mixed payment scheme is a common practice in the companies, it is not clear how changes in one of these payments affects workers' performance. Secondly, although there are gift-exchange studies about how workers react to the wage increase by their employer, the wage increases due to changes in the labour market when they are working under this kind of mixed payment scheme is not clear since it might affect workers differently to an increase by the employer. Studies show that the reasons behind the outcomes are also important for people. They may react differently to the same outcomes if the intentions behind the outcomes are different. For this reason, understanding the effects of exogenous changes like a minimum wage increase is also important.

The results show that there are mixed effects of the minimum wage increase on the workers' overall performance. Although it is not significant, there is a decrease in the performance when analysis is based on the time period three months before and after the minimum wage increase. On the other hand, if the time periods are shortened to two months or one month before and after the minimum wage increase, the performance increases. The reason for this change is that there are opposite effects of the wage increase on the low-productivity and high-productivity workers' performance. In further analysis, the workers are divided into low and high-productivity workers based on whether their performance is below or above the median. The main reason for a change from a decrease to an increase for overall performance when the time period is shortened is that the magnitude of the effect on the low-productivity and high-productivity workers also changes with shortening the time.

According to the results, the low-productivity workers increase their performance with the minimum wage increase. Although the effect is not statistically significant when the analysis covers three month before and after the minimum wage change,

it becomes significant when the time is shortened to the two months or one month before and after the new policy. On the other hand, the high-productivity workers decrease their performance after the wage increase. The change in the performance is statistically significant if the time period three or two months before and after the minimum wage increase however it is not if the time period is just one month before and after change.

These results can be interpreted as the hypothesis of being more worried about losing the job being valid for the low-productivity workers whereas it is not for the high-productivity workers. Actually, this might not be a surprising result. It is understandable that low-productivity workers can be more sensitive about losing their jobs compared to the high-skilled workers. If the employer decides to fire some workers in order to compensate the increase in cost of labour due to a minimum wage change, low-productivity workers would be the first ones who would be considered to be dismissed. On the other hand, high-productivity workers might feel more secure about their jobs because they are aware that they are valuable workers for the company. For this reason, this kind of fear might have no effect on these workers. In addition, low-productivity workers might be more worried about finding another job compared to the high-productivity workers since they might not be in a good position compared to other unemployed people in the market.

Another issue with the results for the low-productivity workers is that the effect is greater when the time period is restricted to one month before and after the minimum wage increase, and the effect disappears if the time period is extended to three months before and after the minimum wage change. This may suggest that workers' concerns of losing the job might be the highest just after the wage increase, but that they might feel more secure as the time prolongs and as they notice that no one is dismissed. After they observe that they are not in danger of losing their jobs they may become less sensitive about this concern and the effect might be no longer observable.

On the other hand, the income targeting hypothesis is valid for the high-productivity workers and this led a decrease in the performance whereas we cannot claim this for low-productivity workers since they increased their performance. This result might not be surprising either, since high-productivity workers are more likely to exceed their monthly targets and earn piece rate payment. For this reason they are able to arrange their income with changing their performance. On the other hand, some of the low- productivity workers might not even be able to exceed

their monthly target so that they could not earn piece rate payment before the increase. However, although they were not earning any from the piece-rate payment before the minimum wage increase, there could still be some workers at least close to the monthly target and they keep trying to exceed that. If the income targeting effect was valid for these workers, they could at least not try that much to exceed their target so that we could still observe the income targeting effect for the workers who were not earning piece rate at all. However, the results show that this effect is not valid for the low-productivity workers or at least the effect of being worried for the job loss outweighs the income targeting effect for these workers.

On the other hand, the effect of the income targeting for the high-productivity workers is not observed just after the minimum wage increase (one month before and one month after the minimum wage increase). The reason for this result might be related to the payment system in this company. Although the new minimum wage was valid after the 1st of January, 2016, these workers got their first new wage on the 1st of February. For this reason, they might not be affected until they begin receiving their higher wages.

Based on these results, it can be argued that an increase in the minimum wage might cause a decrease in the overall performance based on the magnitude of the changes of high and low-productivity workers. Since the low-productivity workers increase their performance, companies can focus on how to prevent decreases in high-productivity workers' performance. One of the suggestions might be to practice non-monetary incentives, which is also a common practice by the human resource departments in the company. Since the decrease in performance of these high-productivity workers' is related to monetary issues, non-monetary incentives might be useful for these workers in order not to decrease their performance.

On the other hand, analysis based on this kind of data has its own limitations to measure the effects or interpreting the reasons behind the results might be difficult. For the further research, it can be extended with a different data collection process such as experimental approaches. As a result, more research is required in this area in order to understand the mechanisms behind the performance changes after an exogenous changes in the labour market such as a minimum wage increase.

Chapter 4: Peer Effects in Tournaments: A Lab Experiment

4.1 Introduction

Tournament incentives are common practices in order to increase the performance of employees in the workplaces. Workers compete against each other in these tournaments for different benefits such as bonuses or rewards (vacations, gifts etc.)[24]. How to design a tournament to incentivise workers in the workplace has been discussed in the literature. One issue with tournament designs discussed is whether or not the relative performance information should be revealed to the participants during the tournament period since it might generate some peer effects. Eriksson *et al.* (2008:4) explain these peer effects as "the consequences of observing others' performance on their own effort due to non-monetary reasons"[25].

It is an important issue because revealing the relative performance information might generate negative peer effects, decreasing the performance of the workers even though the purpose of the tournament is to increase their performance. The reason for these negative peer effects is that observing a rival's performance might make an underdog participant discouraged, causing him to decrease his performance or make a frontrunner participant slack off (Fershtman and Gneezy 2011; Ludwig and Lünser, 2012). On the other hand, observing a rival's performance might also generate positive peer effects, leading participants to increase their performance (or at least prevent them decreasing) and allowing companies to more benefit from the tournaments because of the increasingly incentivised workers. In this case, underdogs increase or at least do not decrease their performance in order to prevent the feeling of shame (self-esteem) they

[24] There are different types of tournaments in terms of the rewards, for example those with only one prize, where only the best performer is rewarded or those with multiple prizes where multiple best performers may receive the rewards. Different designs might affect the workers' behaviours differently as can be seen in the studies about tournament designs (see. Newman and Tavkof, 2014; Dechenaux *et al*., 2015). A tournament in this study means that people compete against each other to win a reward and only the best performer is rewarded and the other(s) earn nothing.

[25] Observing the rival does not mean actual observation during the working process. Rather, it means being able to observe the performance of the rival (getting feedback). Actual observation might include other effects such as learning, monitoring. In order to exclude these possible effects and focus only on performance, revealing the performance information is accepted as observation in the previous studies. For the same reasons, this logic has been applied in this study.

associate with being an underdog (Eriksson *et al*., 2008). On the other hand, being a frontrunner increases a sense of pride (self-esteem) as people enjoy outperforming others, such that the frontrunner continues attempting to increase their superior position relative to the underdog (Charness *et al*., 2014; Eriksson *et al*., 2008). Additionally, even if revealing the relative performance information does not generate any peer effects, there may still be a decrease in performance. As the probability of winning decreases (increases) for the underdog (frontrunner), maintaining the level of effort might be unnecessary such that it is rational to intentionally decrease one's performance or quit the race (Eriksson *et al*., 2008). For this reason, if there is no decrease in the performance, it is accepted as positive peer effects exist since the decrease in performance due to rational decisions is at least eliminated. As Eriksson *et al*. (2008) state, it is not possible to distinguish whether the decrease is generated by the negative peer effects or the rational decisions. However, whatever the reason is, if being able to observe the participants in the tournaments causes a decrease in performance, it is better not to reveal the relative performance information to the tournament participants.

There are several papers, mostly based on experimental data, studying these peer effects and observing the rival's performance during the tournament period. Although previous studies related to peer effects and tournaments have focused on observing and explaining the results based on the effects of observing, participants who can observe a rival's performance are simultaneously being observed by the rival in most studies. While the act of observing might affect a participant's performance, being observed by the rival might also affect the performance of that participant either negatively or positively because people care what other people think about them, although some people are more sensitive about this than others (Fershtman and Weiss, 1998). Ellingsen and Johannesson (2008:991) state that "there is ample evidence that people's performance is affected by the presence of others, and that much of the effect is due to concern about being evaluated by them". If people feel that they are being evaluated by someone else they may experience evaluation anxiety causing a decrease in performance (Zeidner and Matthews, 2005). For this reason, being observed by the rival might trigger stress because of evaluation anxiety, which may be considered negative peer effects (Heimberg *et al*., 1992; Donaldson *et al*., 2002). This might be valid for both frontrunners and underdogs. Therefore, if the results show that the performance for both underdogs and frontrunners are lower when they are being observed compared to the case when they are not, this could be the result of evaluation anxiety triggered by being observed. On the other hand, being

observed might also generate positive peer effects. Concerns about the social-esteem generated by being observed as people consider what others think about their performance might lead participants to increase their performance (Ellingsen and Johannesson, 2007; Cottrell *et al*., 1968). For example, as mentioned above, although an underdog thinks that it is more likely that he will lose the tournament, he does not stop trying since there is a social norm that "one should never quit" as one does not want others to think that he is a "quitter" (Eriksson *et al*., 2008; Fershtman and Gneezy, 2011). Alternatively, a frontrunner might also increase his performance when being observed in order to show his rival how good he is at performing the task. Feeling pride due to one's good performance is greater if it is known by others (Tavkof, 2013). Overall, being observed may motivate people to work harder in the tournament as well. As a result, in terms of the performance, the definition of the peer effects mentioned above can be extended to *the consequences of observing others' performance* or *having one's performance observed by others* on one's own effort due to non-monetary reasons.

The purpose of this study is to disentangle the effects of observing rivals and being observed by rivals. This issue is important because if we can understand the mechanisms behind the peer effects generated by the relative performance information, then we can further increase the performance of participants. For example, if observing generates positive peer effects and being observed generates negative peer effects then the positive effect of observing might be diminished by the effect of being observed. Therefore, it can be suggested not to reveal the performance information publicly so that the negative effect of being observed can be eliminated. On the other hand, as another example, observing might make underdogs feel discouraged and they want to quit but they do not give up because the "one should never quit" social norm is particularly intensely felt if they are observed by someone (Eriksson *et al*., 2008; Fershtman and Gneezy, 2011). However, although they do not give up, they might still decrease their performance if the effect of discouragement outweighs the effect of being observed. Then, it can be suggested to practice different type of tournaments which might prevent the feeling of discouragement, such as tournaments with multiple prizes. Therefore, it is important to differentiate these effects to get greater benefit from the tournaments in terms of increasing the performance.

In order to study peer effects and differentiate them into being observed by the rival and observing the rival, I conducted a laboratory experiment[26]. The experiment is based on a real-effort task called word encryption, introduced by Erkal *et al,* (2011) and changed by Benndorf *et al.*, (2014). This experiment has three treatments, each consisting of two stages. The first stage was based on the piece-rate scheme in order to measure baseline performance without competitive behaviour. This was the same in all treatments. However, there were differences in the second stages of the treatments. In the second stage of the first treatment - NFT (No Feedback Treatment) - each participant was matched with a different participant prior to the period starting and no-one was able to get any feedback about their rivals. In the second stage of the second treatment - CFT (Continuous Feedback Treatment) - each participant was matched with another participant as in the first treatment. However, every participant was observed by their rival and was also able to observe the rival's performance on their screen. In the second stage of the third treatment, participants were assigned one of the two roles at the beginning of the second stage: either as the observer – OR (Observer Role) or being observed- BOR (Being Observed Role). Each participant undertaking the role of the observer was matched with another participant with the role of the observed. Participants undertaking the observer role were able to observe their rivals' performance and they were not observed by their rivals whereas participants undertaking the being observed role were not able to see their rivals' performance but were observed by their rivals.

Under this experimental design, I analyse the extent to which being or not being observed by the rival and/or observing the rival have effects on workers' performance. For the effect of being observed on underdogs and frontrunners, CFT in which people both observe and are being observed is compared with OR in which people only observed their rivals. As mentioned above, being observed might generate negative peer effects due to evaluation anxiety that should lead participants in CFT to have lower performance compared to the participants in OR. On the other hand being observed might also generate positive peer effects due to effects of social esteem which causes higher performance in CFT. For the effect of

[26] One might question whether or not being observed by an anonymous person in a lab experiment generates any effects on a participant. Studies show that even if people are completely anonymous in the lab, people are still affected by the existence of others. For example, Georganas *et al.*, (2015) found some evidence of peer pressure in their lab experiment if the participants were observed by anonymous other participants without any interaction. Ellingson and Johannesson (2007: 139) also state that "many people care about the judgment of others, even when they are completely anonymous".

the observing on the underdogs and frontrunners, OR is compared with NFT. Observing the rival might generate negative peer effects since the underdogs get discouraged and frontrunners slack off or it might also cause positive peer effects due to self-esteem which prevents underdogs and frontrunners from decreasing their performance. Lastly, in order to analyse the overall effect of observing or being observed or both observing and being observed together, each treatment (OR, BOR and CFT) is compared to the NFT. These comparisons will show the overall effects on participants without distinguishing them as underdogs and frontrunners.

The results show that regardless of whether or not the individual is an underdog or frontrunner, if they observe or are being observed, or indeed both, this causes an increase in performance compared to the case in which people neither can observe nor be observed. This is an evidence of positive peer effects generated by both observing and being observed. On the other hand, being observed resulted in underdogs increasing their performance. However, frontrunners do not increase their performance when they are observed compared to when they are unobserved. For this reason, it can be concluded that being observed generates positive peer effects on the underdogs although there is no effect on the frontrunners. In addition, observing the rival does not cause an increase in the performance of underdogs. However, since there is no decrease in the performance either, it can be still interpreted that observing the rival generates positive peer effects on the underdogs. For the frontrunners, there is evidence of an increase in performance when observing the rival. However, this result is not robust when the control variables are included in the analysis. Since there is also no evidence of a decrease in the performance, it can be claimed that observing the rival also generates positive peer effects on the frontrunners.

These results are consistent with the arguments related to the positive peer effects discussed above. As Eriksson *et al*. (2008) state that falling behind rivals leads underdogs to suffer disutility, due to feelings of shame, so they do not decrease their performance in order to prevent these feelings, whether or not they are observed. On the other hand, they also claim that frontrunners gain utility from outperforming others due to feelings of pride so that they also maintain or increase their performance, although they think that they are more likely to win (Eriksson *et al*., 2008). According to the results which are explained above, indeed, neither underdogs nor frontrunners decrease their performance when they observe others but not when observed by others. It can be said that these effects are strong enough to maintain the performance however it does not cause increase in

performance. Since they are only observing and they are not observed, keeping the distance with the rival might satisfy their concerns in terms of these feelings. On the other hand, being observed led underdogs to increase their performance whereas there is no effect on the frontrunners. These results show that people who are underdogs consider what others think about them. It can therefore be understood that underdogs are more sensitive to the importance of leaving a good impression on others compared to the frontrunners. Frontrunners might think that winning the tournament or being ahead is already enough to leave a good impression on the observers. However, underdogs might think that even if they lose the tournament, they should lose with their best performance.

Results are mostly consistent with the previous studies. For example, Eriksson *et al.* (2008) conducted a lab experiment and found that both observing rivals' performance and being observed by rivals generated positive peer effects because underdogs hardly ever became discouraged or quit and the frontrunners did not slack off. Ludwig and Lünser, (2012) also conducted an experiment to study how interim feedback affects underdogs' and frontrunners' performance with a two-stage laboratory experiment. They found that participants who learnt that they were underdogs before the second stage began, increased their efforts in the second stage. However, participants who learnt that they were ahead decreased their efforts in the second stage in comparison to their first stage effort levels. Therefore, their results indicate that observing the rival generates positive peer effects for the underdogs but has no positive peer effects on the frontrunners.

This study proceeds as follows: the next section is the literature review where I mention some studies of the issues discussed so far. In Section 3, I will explain the experimental design and procedure. I will show my results in Section 4 which is followed by the discussion and concluding remarks in the last section.

4.2 Literature Review

In addition to the studies mentioned in the introduction by Eriksson *et al*. (2008) and Ludwig and Lünser, (2012), there are other studies about the effects of observing the rivals on the performance during the tournament. For example, Straub *et al*. (2014) ran an online experiment including a real effort task (slider task). There were three treatments and all treatments were based on a tournament payment scheme. In the first treatment, no-one received any feedback about their peers. In the second treatment, each participant was supposed to perform better

than a 'good' rival. The good rival means a person whose performance score was 66 sliders. However, participants were not aware that it was not a real person. In the last treatment, participants were competing against a 'bad' rival, defined as those with a score of 27 sliders. In the second and third treatments, participants were told that their rival's score is either 66 or 27 and they accepted this as their peer's performance. This is akin to observing a peer but subtly, there is no-one being observed in this experiment. The authors found, overall, giving feedback about the competitors decreases the performance. In addition, when a person competes against a strong competitor, he is more likely to quit the competition. When the competitors are weak, workers tend to complete the task but with reduced effort. On the other hand, Delfgaauw *et al*. (2014) conducted a field experiment, among 189 stores of a retail chain selling computer games, music, and movies. The study had one control and one treatment group, with stores assigned to one of these two groups. Each store in the treatment group was assigned three stores from the control group. If a store in the treatment group could pass (in sales), the three stores which were assigned, then this store won the tournament and workers in this store were awarded with bonuses (money). The stores in the control group could not win anything and they were not aware of the tournament. The experiment took 8 weeks and at the end of each week, stores in the treatment group were informed about the sales / performance in the three stores (control group) with which they were matched. The study focused on observing peers, although workers who were observed were not aware that they were being observed. They found that treatment stores which were far behind did not respond to the incentives, while the responsiveness of treatment stores which were close to winning a bonus increased in relative performance. However, their results show that the introduction of the relative performance pay scheme does not lead to higher performance on average. Both of these studies show that just observing the rivals' performance does not lead workers to increase their performance.

There are also some studies which look at how being observed affects performance or economic decisions. For example, Gerhards and Gravert (2016) studied how observing or being observed affect people's perseverance to complete a task with a laboratory experiment based on a real-effort task (an anagram word-play task). In the experiment, there were simple and hard anagrams and participants were able to skip an anagram if they could not solve it. There were two type of roles; observers and peers. The difference is observers were able to see how many difficult anagrams their peers skipped whereas peers could not get any information

about their observers, although they were aware that they were being observed by the observer they were matched with. The results show that peers significantly increase their observer's perseverance, however being observed does not significantly affect behaviour. On the other hand, Alevy *et al*. (2014) analysed how being observed affects people's economic decisions in a dictator game with a laboratory experiment. They analysed both the effects of being observed and the effects of different frames of the dictator game. In terms of framing, either the dictator can transfer some amount of money which was given to him or he could get some amount of money from the other participant. They varied these two treatments with being observed by someone else or not. If there was no audience observation, the game was played like a regular dictator game. However, if the treatment was based on the audience, then every participant having the dictator role was called in front of the laboratory and the transfer they made was announced to everybody in the room. They found that when the transfers were announced to the audience, people were more willing to give and less willing to take.

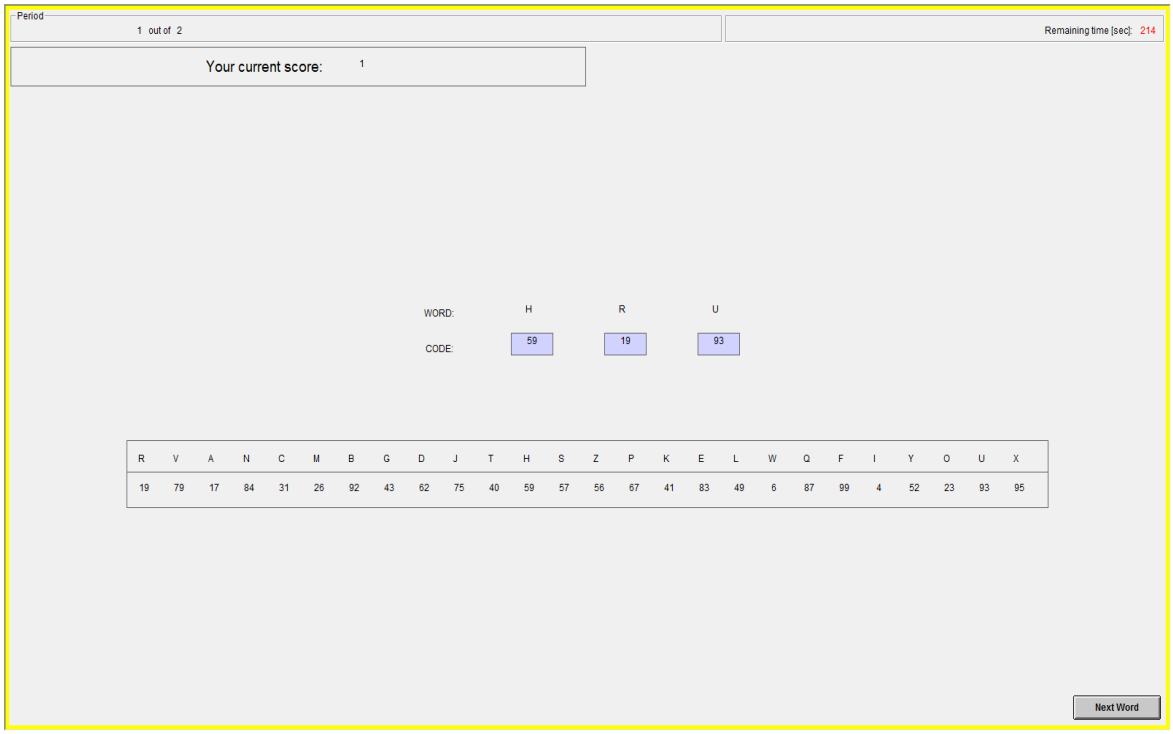
4.3 Experimental Design

The experiment has three treatments and all treatments were designed on z-Tree (Fischbacher, 2007). Each treatment consists of two stages. The first stage of each treatment was the same in all treatments however there were differences in the second stages.

The first stage consists of 2 periods and each period lasts 4 minutes. Participants were asked to perform an identical genuine task in both periods. This task was introduced by Erkal *et al,* (2011) and it consists of encoding words into numbers. Each word is a combination of three letters and participants have to submit a code (0-100) to each letter. The encryption code is given in a table below the corresponding word. Once a word is encoded correctly, the computer prompts another word, which the participant is asked to encode. If one or more of the codes that a participant submits is wrong, the participant is warned about the mistake and he or she is supposed to continue trying until the correct codes are submitted. Participants can encode as many words as they can do in a period of 4 minutes. In this word encryption task, introduced by Erkal *et al.,* (2011), the table showing the letters and the codes does not change within the period. It has been discussed that it may cause learning behaviour. For this reason, in my design, I have used another version of this task which was introduced by Benndorf *et al*., (2014). In this version, there is double randomization meaning that the computer shuffles the place of the

letters in the table and assigns new codes between 0-100 to the letters when a participant is asked a new word within the period. The screenshot of the task can be seen below.

Figure 33: Real Effort Task



A participant's score in the task is equal to the number of words encoded correctly within 4 minutes. All participants were able see their current score on their screen within the period. However, no-one was able to see other players' scores. After the first period was finished, the second period was started. This was identical to the first period. The score of the participants was set to 0 before the second period started since the periods were independent.

During the experiment, instead of pounds (GBP), participants used an imaginary currency, called *experimental currency units* (ECU) with the exchange rate 70 ECU= £1. Each word encoded correctly provides 10 ECU as payoff to a participant in the first stage. At the end of the experiment (after the second stage is finished), the computer chooses a number randomly between 1 and 2 (either 1 or 2) in order to determine the period from which participants' earnings will be calculated.

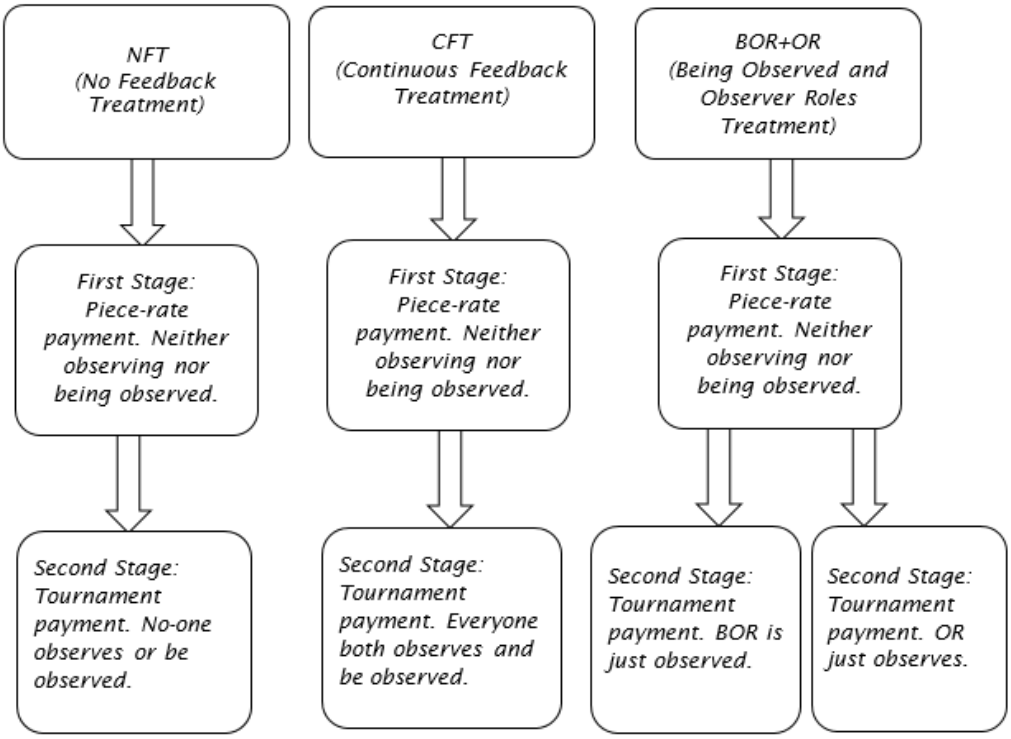
After the first stage was finished, the second stage of the experiment was started. The second stage consists of 6 periods and each period was 4 minutes, as it was in the first stage, in all treatments. The word encryption task was also the same in the second stage as the first stage. However there were some differences between the treatments in terms of the second stage rules. In the second stage of the first

treatment, participants were randomly divided into groups of two before each period started. Instead of piece rate as it was in the first stage, there was a tournament payment scheme in the second stage. This implies that whoever has the better performance in the group of two wins 250 ECU for that period, whereas the other player in the same group wins nothing or 0 ECU. If there was a tie between two participants in the same group, meaning if both participants' (in the same group) scores were the same, then the computer chose the winner randomly. Participants were re-matched with another person randomly in each period and they were told this in the instructions. No-one was able to learn the other participants' scores in the first treatment. A participant was only told his or her payoff (either 250 or 0 ECU) at the end of each period. The first treatment was called No Feedback Treatment (NFT).

The second stage of the second treatment was the same as the first treatment with one difference. On the contrary to the first treatment, each participant was able to see the current score of the other participant in the same group on his or her screen within the period. Whenever a participant encodes a word correctly, the other participant in the same group can see the new score of the rival on the screen at the same time. This treatment is called Continuous Feedback Treatment (CFT). The rest of the rules are identical to the first treatment.

In the first two treatments, everyone had the same roles. Therefore, there was no difference between the participants in the same treatment. However, in the third treatment, participants were assigned one of the two roles randomly at the beginning of the second stage. Half of the total participants were assigned the *observer role* (OR) and the other half was assigned to the *being observed role* (BOR). Everyone kept the same roles during the second stage. Each participant with the observer role was paired with a participant with the being observed role before each period started. Each participant was re-matched with another person in each period of the second stage. A participant having the observer role could see the current score of the participant having the being observed role, in the same group, within the period. However, a participant having the being observed role could not see the score of the other participant in the same group. Participants being observed learnt only their payoffs at the end of each period (250 or 0 ECU). There was asymmetry between the observers and the being observed participants and this case was clearly explained to the participants in the instructions. Summary of the comparison of the treatments can be seen from Figure 34 below.

Figure 34: Comparison of the Treatments



In terms of determining the total payoff for how much a participant earns from the second stage, there was a similar method as in the first stage. This time, the computer chose three numbers randomly between 1 and 6. These chosen periods were applied for everyone. Total earnings for the experiment were calculated with the formula below.

The money a participant earns from the experiment= Earnings for the first stage + Earnings for the second stage+ Participation fee (£4).

One issue which is needed to be discussed is the repeated- game effects as in the previous lab experiment chapter. The experiment was based on a group game with two participants competing against each other. Participants played this game for 6 periods. Perfect stranger procedure was applied in the experiment. This means that each participant was re-matched with another participant in each round randomly. It was clearly explained in the instructions that any participant would not be matched with the same person twice during the experiment. For this reason, repeated-game effects were not expected to be a concern for this experiment. On the other hand, the payment was determined based on randomly chosen period method so that there should not be an issue related to earnings either.

4.3.1 Running the Experiment

The experiment was run in the ExpReSS Lab at Royal Holloway, University of London in November, 2016. All students who participated in the sessions were students at Royal Holloway. Students who registered to be on the database to participate in the experiments were informed via emails.

94 students participated in the experiment. There were 28 participants (14 females and 14 males) in the first treatment whereas there were 26 participants (14 females and 12 males) in the second treatment. Each treatment was conducted in one session. However, there were two sessions for the third treatment. There were 20 participants (5 female observers and 5 females being observed- 5 male observers and 5 males being observed) in each session of the third treatment. I attempted to achieve a gender-balanced population in the experiment since competition behaviour might be different between genders (see. Niederle and Vesterlund, 2011).

When the participants entered the lab, each participant picked a number from a bag and sat at the terminal depending on the number chosen. After everyone sat at a terminal, consent forms and participant information sheets were given to the participants. After the signed consent forms were collected, the general rules and the instructions of the first stage were distributed to the participants and the general rules were read aloud by the computer. When the first stage was finished, the instructions of the second stage were distributed to the participants. They did not know anything about the tournament payment scheme until they were given these instructions just before the second stage started. After the second stage was finished, all participants were asked some survey questions before they learnt their earnings for the experiment. This process was the same in all treatments. Each session was finished in 75 minutes and participants earned £12.65 on average. Instructions for the experiment can be seen in Appendix C.1.

4.3.2 Hypotheses

H1a: Observing the rival causes decrease in performance.

Observing the rival might generate negative peer effects which make the underdogs[27] discouraged and frontrunners slack off leading participants to decrease their performance (Eriksson *et al*., 2008). If the underdogs notice that they are behind their rivals, they may reduce their effort since they believe that they are more likely to lose the tournament. On the other hand, frontrunners might slack off since they believe that they are more likely going to win the tournament. For this reason, if there are negative peer effects due to observing the rival, then the performance values in OR should be lower than NFT. The important thing is, if there is no peer effect at all, then the performance should still be lower in OR than NFT just like the negative peer effects. Eriksson *et al*. (2008) explain that it is not possible to distinguish between the negative peer effects and no peer effects because there should be the same results in these two cases. If there are no peer effects, the rational behaviour would be to decrease performance or even to quit for underdogs (frontrunners) because maintaining the same performance level is not necessary when the probability of winning is decreasing (increasing). NFT and OR are the same except the participants in OR observed their rivals. However, neither of these groups were observed by their rivals. Therefore, the comparison between the two groups allows one to understand the effects of observing the rival on the performance. The issue of OR is that they are aware of how much they are behind, or ahead of their rival.

H1b: Observing the rival does not cause decrease in performance.

Observing the rival might generate positive peer effects on the underdogs because if a participant notices that he is behind of his rival, then he will increase his performance or at least will not decrease since being behind is unpleasant (feelings of shame) and can make the participant suffer disutility (Eriksson *et al*., 2008). On

[27] In most cases, underdogs are defined as who are behind during the tournament whereas frontrunners are defined as who are leading the tournament. However, in some cases underdogs are used for the people who have less ability compared to rivals who are called as favourites. Due to some technical problems while the experiment was run, the performance values could not be recorded over time within a period. For this reason, unfortunately, defining people as underdogs or frontrunners based on their performance within a period was not possible for the study. Instead of that, I used the average performance value for the first stage (average of the two periods were calculated) for each participant and people were called as underdogs or frontrunners based on their first stage performance. Since the first stage was based on the piece-rate, I assumed that participants tried their best performance as much as possible under these conditions in order to increase their payoffs. For this reason, I assumed that a person whose first stage average performance was 15 would be an underdog when he competed against a rival whose first stage average performance was 25. According to the results, in 93% of cases, people who were defined as underdogs according to their first stage performance and their rivals' first stage performance indeed lost the tournament.

the other hand, being ahead of the rival might also generate positive peer effects on the frontrunners since outperforming others is pleasant (feelings of pride) and one gains utility, such that frontrunners also increase or at least do not decrease their performance (Eriksson *et al*., 2008). Therefore, performance in the OR should be equal or greater than the NFT.

H2a: Being observed by the rival causes decrease in the performance.

Being observed might generate negative peer effects. The reason for the negative peer effects is that people might have evaluation anxiety when they are observed by others (Ellingsen and Johannesson, 2008; Zeidner and Matthews, 2005). This may lead people to have a lower level of performance (Heimberg *et al*., 1992; Donaldson *et al*., 2002). This can be valid for both underdogs and frontrunners. Therefore, if being observed generates negative peer effects on frontrunners (underdogs), the performance of the frontrunners (underdogs) in CFT is lower than the performance of the frontrunners (underdogs) in OR. The difference between CFT and OR is that participants in OR are only observing the rival and not being observed whilst participants are both observing and being observed in CFT. Due to comparing both treatments, the effect of being observed on underdogs and frontrunners is discernible.

H2b: Being observed by the rival causes increase in the performance.

Being observed might generate positive peer effects on underdogs due to social-esteem. As previously discussed, people consider what others think about them (Fershtman and Weiss, 1998). It is widely accepted that there is a powerful social norm that "one should never give up" (Eriksson *et al*., 2008). For this reason, a person who considers others' thoughts about himself does not want them to think that he is a "quitter" (Eriksson *et al*., 2008; Fershtman and Gneezy, 2011). Therefore, even if he believes that he will lose the tournament, he will still try to perform well in order to impress the others. On the other hand, although a frontrunner is ahead of his rival, he does not decrease his performance because the feeling of pride due to outperforming others is greater if it is known/observed by the others (Tavkof, 2013). For this reason, frontrunners do not want to decrease the difference with their rivals. As a result, being observed might generate positive peer effects on both frontrunners and underdogs so that the performance of the frontrunners (underdogs) in CFT which the participants both observe and be observed is greater than the performance of frontrunners (underdogs) in OR which the participants only observed and not be observed.

H3a: Revealing the relative performance information generates negative peer effects such that the overall performance decreases.

As explained in H1a and H2a, observing the rival and being observed by the rival might lead both underdogs and frontrunners to decrease their performance. For this reason, observing the rival and being observed by the rival simultaneously, can cause decrease in the overall performance. In the CFT, participants both observed and were observed at the same time whereas participants in NFT neither observed nor be observed. This comparison between CFT and NFT shows whether or not the relative performance information should be revealed during the tournament period in order to increase the overall performance. For this reason, participants' performance values are compared without defining them as underdogs or frontrunners.

H3b: Revealing the relative performance information generates positive peer effects such that the overall performance increases.

As explained in H1b and H2b, observing the rival and being observed by the rival might prevent both underdogs and frontrunners from decreasing their performance due to positive peer effects. Then, observing and being observed simultaneously should also prevent decreases in the performance. CFT and NFT are compared to analyse this hypothesis without distinguishing the participants as underdogs or frontrunners, as the same logic in H3a.

4.4 Results

4.4.1 The First Stage Statistics

In the first stage of each treatment, participants were paid through a piece-rate scheme and were not aware of the rules for the second stage. For this reason, there should be no difference in the average value of the performance across treatments. Table 34 shows the average values of the performance in the first stage of each treatment.

According to the M-W test result, there is no difference in the performance of the first stage between NFT and CFT, shown by the p-value of 0.39. The same test was applied for the difference between the CFT and BOR+OR (there was no difference for the observer and being observed types in the first stage). The M-W test result shows that there is no difference in the performance with a p-value of 0.52. There

is no difference in the performance between NFT and BOR+OR either according to M-W test result, with a p-value of 0.58.

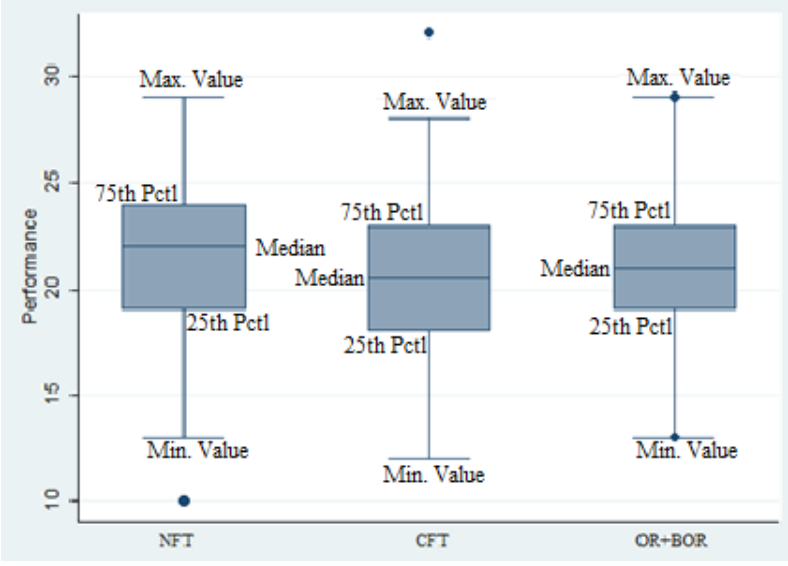
The distributions for the performance values in the first stage in each treatment can be seen from Figure 35 below. There is no difference in the distributions of NFT and CFT with a p-value of 0.24 according to the K-S test. On the other hand, K-S test results also show that the distribution of BOR+OR is not statistically different than CFT and NFT with the p-values 0.56 and 0.27, respectively.

Table 34: Average Values of the Performance In the First Stage

	N	Observation	Mean of the Performance	Min- Max
NFT	28	56	21.25	10-29
			(4.14)	
CFT	26	52	20.96	12-32
			(4.07)	
OR+BOR	40	80	21.17	13-29
			(3.32)	

Notes: Standard deviations are in parentheses.

Figure 35: Distributions of the Performance in Three Treatments



Note: Minimum and Maximum values do not include the outliers. Outliers are presented with the dots in the figure. Pctl is used for Percentile.

4.4.2 The Second Stage Statistics

Mean values of the performance in the second stages of the treatments can be seen in Table 35 below. The comparisons of the treatments in this part is related to

overall performance regardless of whether the participants are underdogs or frontrunners. Result of the M-W test shows that there is no statistical difference in the performance between the NFT and CFT with a p-value of 0.86. However, the M-W test result shows that the performance value in BOR is significantly different than that in NFT with a p-value of 0.003. In terms of the difference between NFT and OR, M-W test result shows that the performance in NFT is significantly different from the performance in OR with a p-value of 0.005. On the other hand, the performance in CFT is statistically different than the performance in OR and the performance in BOR with a p-value of 0.002 according to the M-W test results. Lastly, OR performance values are different from BOR according to the same test-result with a p-value of 0.000. The results in terms of statistical significance do not change if the Holm-Bonferroni method is applied for all the comparisons together.

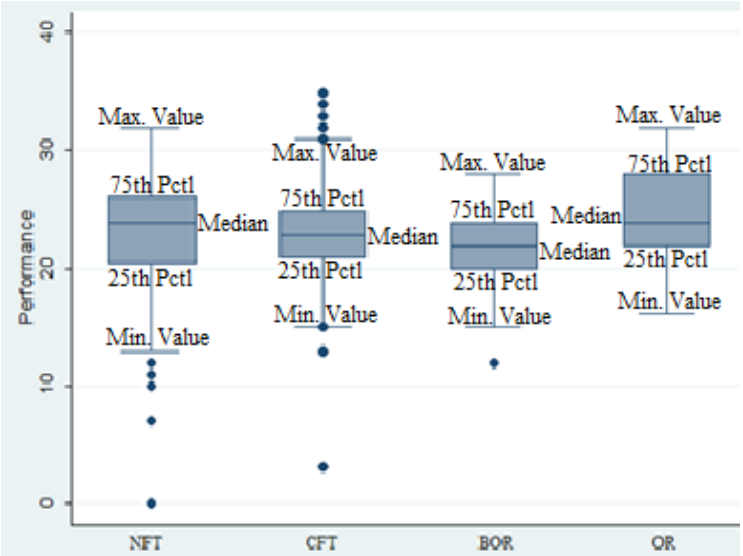
Table 35: Average Values of the Performance In the Second Stage

	N	Observation	Mean of The Performance	Min- Max
NFT	28	168	22.55	0-32
			(5.36)	
CFT	26	156	23.23	3-35
			(4.59)	
BOR	20	120	21.95	12-28
			(2.81)	
OR	20	120	24.64	16-32
			(3.47)	

Notes: Standard deviations are in parentheses.

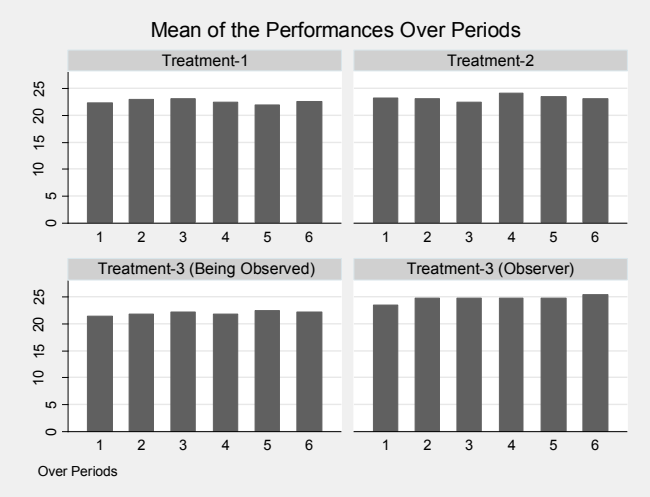
On the other hand, distributions of the performance in the second stage across treatments can be seen from Figure 36 below. The distribution of NFT is not statistically different than the distribution of CFT, according to the K-S test with a p-value of 0.41. On the other hand, the distribution of NFT is statistically different from the distribution of BOR and OR with the p-values 0000 and 0.019, respectively, according to K-S test results. In addition, the distribution of CFT is also statistically different than the distribution of BOR and OR with the p-values of 0.012 and 0.003, respectively, according to the same test results. Lastly, the distributions of the BOR and OR are also statistically different according to the K-S test results with a p-value of 0.000.

Figure 36: Distributions of the Performance in Three Treatments



Note: Minimum and Maximum values do not include the outliers. Outliers are presented with the dots in the figure. Pctl is used for Percentile.

Figure 37: Mean of the Performance over Periods for Each Treatment in the Second Stage



One another issue which needs to be discussed is the learning problem in the real-effort tasks as previously mentioned. Learning might cause increases in the performance in the later periods since participants become more efficient in performing the task as they gain more experience (Benndorf *et al.*, 2014). This causes important performance differences between the periods such that interpretations of performance changes might be misleading. Figure 37 above shows the average value of the performance over the periods for each treatment. As can be seen in the figure, there is no regular change between the periods,

indicating that the performance does not increase regularly over the periods such that it can be claimed there is no learning issue in the results[28].

4.4.3 Regression Analysis

Result.1: Observing the rival does not lead underdogs to decrease their performance, although they do not increase it either. Whilst the frontrunners increase their performance when they can observe their rival, the results are not robust.

As discussed in H1a and H1b, in order to analyse the effect of observing on the underdogs and frontrunners, NFT and OR are compared since participants in NFT were not observing their rivals or observed by their rivals whereas participants were only able to observe their rivals in OR. The average performance in NFT is 19.85 whereas it is 21.79 in OR for the underdogs. However, the difference is not statistically significant according to the M-W test results with a p-value of 0.47. On the other hand, the average performance value for the frontrunners is 25.18 and 25.42 for NFT and OR, respectively. The difference in the performance between two treatments is not statistically significant according to the M-W test either with a p-value of 0.90.

Table 36 below shows the regression results for the performance differences between these two treatments for the underdogs and frontrunners. The dependent variable is the performance for the second stage in each period whereas the independent variables are average performance (average performance in the first stage for each participant), difference[29] variable showing the difference in

[28] There might be differences in performance between the first stage and the second stage in each treatment due to different payment schemes. Participants might increase their performance from piece-rate payment to rank-order tournament due to competitiveness. For this reason the increase in performance between the two stages cannot be evaluated by learning. Therefore, only 6 periods in the second stage is checked for the learning issue.

[29] The variable difference refers to the difference of the average performance (in the first stage) of two participants matched in a certain period. The first stage which is based on the piece-rate performance can be accepted as the ability of the participant for this certain task. For this reason, if one's ability is lower (higher) than his rival's then the discouragement (slacking off) is more likely to be observed if there are negative peer effects. In order to include the difference of the abilities between two participants competing against each other, this variable is included into the model. For each period and for each participant, this value is calculated based on the two participants who were matched for that certain period. For example, let's assume that Participant A's average performance in the first stage is 25, Participant B's average performance in the first stage is 20 and Participant C's is 15. If Participant A and B are matched in the first period of the second stage, then the difference value for Participant A is 5 for this period. If Participant A and Participant C are matched in

performance based on the first stage with the rival who is in the same group with that subject and a dummy for the OR treatment (the NFT treatment is omitted as the reference category). In addition, there is a variable called Type which is equal to 0 for the underdogs and 1 for the frontrunners. Each variable above is interacted with this dummy variable in order to measure the effect of observing on the frontrunners. There is a dummy for the gender which is equal to 0 for females and 1 for males. There are also dummies for the periods in case there is any learning effect or changes in certain periods and the control variables[30].

As can be seen from the results in Table 36, the variable average which shows the relation between the average variable and the performance for the underdogs is positive and statistically significant at the 1% level (Column 1) as expected, since the average variable shows the ability of the participants for this real-effort task and it is expected to observe positive relation between ability and the performance. Therefore, a higher performance in the first stage leads to a better performance in the second stage. On the other hand, the relationship between the average and performance for the frontrunners is measured with the addition of the coefficients of two variables: Average and Average*Type. As can be seen from the table, addition of these two coefficients yield a positive number and this is statistically different than 0 according to Wald test with a p-value of 0.000. On the other hand, the difference variable is negative which is also as expected in terms of negative peer effects: as the difference with the rival increases, underdogs might be more likely to quit the tournament and decrease their performance. However, the coefficient is not statistically significant. It is also statistically insignificant for the frontrunners since the addition of the coefficients of Difference and Difference*Type are not statistically different from 0 according to the Wald test with a p-value of 0.66. The coefficient of the OR dummy is positive, meaning that underdogs increase their performance when they can observe their rivals. However, this is not statistically significant. The addition of the coefficient of OR and OR*Type yields also a positive value meaning that frontrunners also increase their performance when they can observe their rivals. In fact, this value is statistically different than 0 according to the Wald test result with a p-value of 0.051.

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the second period of the second stage then the difference value for Participant A is 10 for this period.

[30] Control variables are based on the survey questions asked at the end of the experiment. There are five control variables showing competitiveness of the participants, how altruistic they are, their ages, if they are undergraduate or post-graduate students and if they performed this real-effort task before or not.

Table 36: Regression Results for the Effect of Observing

Dependent Variable:	Performance (1)	Performance (2)	Performance (3)	Performance (4)
Constant	-4.39	-8.23	-8.54	-6.52
	(5.76)	(5.85)	(6.02)	(5.73)
Average	1.23***	1.33***	1.32***	1.25***
	(0.23)	(0.22)	(0.23)	(0.21)
Average*Type	-0.22	-0.32	-0.32	-0.23
	(0.24)	(0.23)	(0.24)	(0.22)
Difference	-0.17	-0.25	-0.22	-0.23
	(0.28)	(0.26)	(0.28)	(0.27)
Difference*Type	0.20	0.27	0.25	0.21
	(0.29)	(0.27)	(0.28)	(0.27)
Type	5.78	9.45	9.08	3.95
	(5.93)	(6.01)	(6.19)	(6.06)
OR Dummy	0.85	1.21	1.12	1.49
	(0.82)	(0.83)	(0.80)	(0.94)
OR*Type	-0.34	-0.72	-0.63	-1.14
	(0.86)	(0.88)	(0.85)	(0.98)
Male	-	Yes	Yes	Yes
Period Dummies	No	No	Yes	Yes
Control Variables	No	No	No	Yes
Observation	282	282	282	282
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.66	0.68	0.69	0.72

Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01. Average is the average value of the performance in the first stage. Difference variable refers to differences in the average performance of two participants matched. OR dummy equals 1 for the OR treatment and 0 for the NFT. Male is a dummy which equals to 1 for males and 0 for females. Type variable is a dummy which is 0 for the underdogs and 1 for the frontrunners. Average*Type, Difference*Type and OR*Type are the interaction terms which show how different the average, difference and OR variables affect the frontrunners. Period dummies refer to a dummy for each period in the second stage except the first period. Control Variables: Competitiveness, Altruism, University Status, Age, Performed the Word Encryption Before.

Column 2 shows the same regression as Column 1 with the male variable but adding the male variable does not affect the results showed in Column 1. This means that the average variables for both the underdogs and frontrunners are positive and statistically significant at the 1% level, difference variable is negative but statistically insignificant for both type of participants, and observing the rival leads frontrunners to increase their performance (addition of the coefficients is statistically different than 0 according to the Wald test with a p-value of 0.07) whereas there is no statistically significant effect of observing on the underdogs as can be seen from the coefficient of OR in Column 2. Column 3 shows the same

regression as Column 2 but including the period dummies, whereas Column 4 shows the regression results with the control variables in addition to the period dummies. For the results in Column 3, in terms of the signs and statistical significance, the results are completely consistent with the results in the first two columns. However, there is one difference in the results in Column 4. When the control variables are included into the model, the addition of the OR and OR*Type coefficients is not statistically different from 0 according to the Wald test with a p-value of 0.19.

To conclude, these regression results show that observing the rival does not lead underdogs to increase their performance. However, nor do they decrease their performance. For this reason, as previously discussed, even if there is no increase in the performance, it can be interpreted that a positive peer effect is generated by observing the rival. For the frontrunners, these results indicate that while the performance of the frontrunners increases from observing their rivals, this finding is not robust. On the other hand, since observing is not associated with a decrease in the performance, as discussed before, it can still be interpreted that there are positive peer effects for the frontrunners due to observing their rivals as well.

Result.2: Being observed by the rival lead underdogs to increase their performance. However, there is no statistically significant effect on frontrunners.

The average value of the performance for the underdogs is 21.79 in OR and 21.20 in CFT. The difference of the performance between treatments is not statistically significant according to the M-W test result a p-value of 0.81. On the other hand, the average of the performance in OR is 25.42 and it is 25.31 in CFT for the frontrunners. The difference is not statistically significant either according to the M-W test result with a p-value of 0.34.

Table 37 below shows the regression results for the performance differences between CFT and OR for the underdogs and frontrunners. The regression model is the same as the previous one except one difference. Instead of comparing NFT and OR, CFT and OR are compared in this model. This means that OR is omitted as the reference category and the CFT is used to analyse the effect of being observed on the underdogs. With the same logic, the interaction term CFT*Type is included into the regression model. All the other variables are the same as the previous regression model.

Table 37: Regression Results for the Effect of Being Observed

Dependent Variable:	Performance (1)	Performance (2)	Performance (3)	Performance (4)
Constant	1.66	0.84	0.45	-2.76
	(2.68)	(2.93)	(3.07)	(4.03)
Average	1.01***	1.04***	1.04***	1.11***
	(0.13)	(0.10)	(0.14)	(0.14)
Average*Type	-0.01	-0.04	-0.05	-0.14
	(0.15)	(0.15)	(0.16)	(0.16)
Difference	0.13	0.13	0.12	0.16
	(0.10)	(0.10)	(0.10)	(0.09)
Difference*Type	-0.17	-0.16	-0.13	-0.22*
	(0.12)	(0.12)	(0.12)	(0.11)
Type	0.57	1.49	1.26	1.08
	(3.04)	(3.27)	(3.40)	(4.59)
CFT Dummy	1.13*	1.17*	1.12*	1.24*
	(0.64)	(0.65)	(0.66)	(0.69)
CFT*Type	-1.28*	-1.32*	-1.29*	-1.35*
	(0.74)	(0.74)	(0.75)	(0.78)
Male	-	Yes	Yes	Yes
Period Dummies	No	No	Yes	Yes
Control Variables	No	No	No	Yes
Observation	260	260	260	260
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.70	0.70	0.71	0.73

Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01. Average is the average value of the performance in the first stage. Difference variable refers to differences in the average performance of two participants matched. CFT dummy equals 1 for the CFT treatment and 0 for the OR. Male is a dummy which equals to 1 for males and 0 for females. Type variable is a dummy which is 0 for the underdogs and 1 for the frontrunners. Average*Type, Difference*Type and CFT*Type are the interaction terms which show how different the average, difference and CFT variables affect the frontrunners. Period dummies refer to a dummy for each period in the second stage except the first period. Control Variables: Competitiveness, Altruism, University Status, Age, Performed the Word Encryption Before.

As can be seen in Column 1, the results show that, as was previously the case, the average is positive and significant at the 1% level and the coefficient of the difference is positive though not statistically significant. These variables show the relations for the underdogs as the previous model. The coefficient of the CFT dummy is positive and significant at the 10% level. It means that underdogs increase their performance when they are observed and they can observe compared to the case when they are not observed but can observe. This shows the effect of being observed on the underdogs. Adding the male, period and control variables does not affect the results as can be seen in Columns 2, 3 and 4. These results are

consistent with the idea discussed in H2b that people care what others think about them and even if they think that they will lose the tournament they continue trying to improve their performance. Therefore, it can be interpreted that being observed generates positive peer effects on underdogs. On the other hand, the relation between the average variable and the performance is similar for the frontrunners. In all columns, addition of the coefficients of Variable and Variable*Type yields positive numbers and these are statistically different than 0 according to the Wald test results with the p-values 0.000 for each case. On the other hand, the difference has no effect on the frontrunners' performance based on the results in all columns like the underdogs. However, the important thing is that there is no effect of being observed by the rival on frontrunners' performance. According to the results in all columns, addition of the CFT and CFT*Type coefficients is not statistically different from 0 based on the Wald test results with all the p-values are greater than 0.60.

Result.3: Revealing the relative performance information increases overall performance.

Table 38 shows the regression results for the overall performance. The dependent variable is the performance for the second stage in each period as the previous models whereas the independent variables are average (average of the performance), difference variable and there is a dummy for each treatment and role (the NFT treatment is omitted as the reference category), a dummy for males, period dummies and control variables.

As can be seen from the results in Table 38, the average variable is significant at the 1% level (Column 1) as expected. The coefficient of the difference variable is not statistically significant. Treatment dummies (CFT, BOR, OR) are all significant at the 1% level with different coefficients in the first regression (Column 1). The coefficient of the CFT shows that the overall performance is higher if continuous feedback about the rival is provided to the participants compared to the treatment with no feedback. This shows that revealing the relative performance information is increasing the overall performance, as discussed in H3b. The coefficient of the BOR dummy, which is positive and significant at the 1% level, shows that being observed by the rival has a positive effect on performance. The coefficient of the OR dummy is also significant at the 1% level, which indicates that just observing the peer increases the overall performance compared to the case of no feedback as discussed in H1b. However, there is no statistical difference between these treatment coefficients according to the Wald test results with all the p-values greater than 0.45.

Table 38: Regression Results for the Overall Performance Among the Treatments

Dependent Variable:	Performance	Performance	Performance	Performance
	(1)	(2)	(3)	(4)
Constant	0.50	-0.02	-0.52	-2.05
	(1.32)	(1.39)	(1.37)	(1.37)
Average	1.03***	1.05***	1.05***	1.03***
	(0.05)	(0.05)	(0.05)	(0.05)
Difference	-0.01	-0.01	-0.01	-0.01
	(0.03)	(0.03)	(0.03)	(0.03)
CFT Dummy	0.98***	1.00***	0.99***	0.95***
	(0.33)	(0.33)	(0.34)	(0.32)
BOR Dummy	0.91***	0.92***	0.93***	0.92***
	(0.33)	(0.33)	(0.33)	(0.33)
OR Dummy	0.76***	0.75***	0.76***	0.82***
	(0.30)	(0.30)	(0.30)	(0.30)
Male	-	0.46**	0.46**	0.42**
		(0.23)	(0.23)	(0.28)
Period Dummies	No	No	Yes	Yes
Control Variables	No	No	No	Yes
Observation	542	542	542	542
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.67	0.67	0.67	0.68

Notes: Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01. Average is the average value of the performance in the first stage. Difference variable refers to difference in the average performance of two participants matched. CFT, BOR and OR are the dummies for each treatment. Male is a dummy which equals to 1 for males and 0 for the females. Period dummies refer to a dummy for each period in the second stage except the first period. Control Variables: Competitiveness, Altruism, University Status, Age, Performed the Word Encryption Before.

Column 2 shows the same regression as Column 1 with the addition of the male variable. Adding this variable does not affect the results discussed in the first regression. Column 3 shows the same regressions with the period dummies, whereas Column 4 shows the regression with the control variables. We see from Columns 3 and 4 that adding these variables does not affect the results shown in the first two columns. These regression results show that either being observed or observing or both simultaneously observing and being observed, is better than

giving no feedback since they all increase the performance compared to no-feedback case. We can interpret this as evidence that giving feedback improves the overall performance and shows evidence of generating positive peer effects with consistent with the previous results.

4.4.4 Robustness Check

For the further analysis, instead of defining people as underdogs and frontrunners in each period, I divided participants into two categories based on their average performance in the first stage: low-productivity and high-productivity. People whose performance are higher than the median are defined as high-productivity participants and the rest are defined as low-productivity participants. The reason for this analysis is that high-productivity participants may try their best in the first stage and they might not be affected by the incentives in the second stage since it might not be possible to further increase their performance in a certain time period. For this reason, changes in their performance might not show the treatment effects. Instead, the low-productivity participants might show treatment effects more clearly. For this reason, focusing on their behaviours might give more information. Table 39 below shows the median values and the number of observations for the low-productivity and high-productivity participants in the second stage.

Table 39: Low and High Productivity Statistics

	Median	Low-Productivity Observation	High-Productivity Observation
NFT	22	90	78
CFT	20.5	84	72
BOR	19.75	60	60
OR	21.75	60	60

Table 40 below shows the regression results for the low and high-productivity participants. The dependent variable is again performance in the second stage and the independent variables are the average performance in the first stage, the difference variable and a dummy variable for each treatment, except NFT which is omitted as the reference category. The coefficients of these variables show the relationship between these variables and the dependent variable for the low-productivity workers. There is a dummy variable called Type which is 0 for the low-productivity workers and 1 for the high-productivity workers. Each independent

variable which is just mentioned is interacted with the Type in order to measure the effects on high-productivity workers as it was done in the previous regression models.

Table 40: Regression Results for the Low and High-Productivity Participants

Dependent Variable:	Performance (1)	Performance (2)	Performance (3)	Performance (4)
Constant	-2.47	-3.84	-4.13	-5.96
	(2.49)	(2.69)	(2.63)	(2.62)
Average	1.18***	1.22***	1.22***	1.20***
	(0.11)	(0.12)	(0.12)	(0.11)
Average*Type	-0.15	-0.19	-0.19	-0.24*
	(0.13)	(0.13)	(0.13)	(0.13)
Difference	-0.02	-0.02	-0.02	-0.02
	(0.05)	(0.05)	(0.02)	(0.05)
Difference*Type	0.02	0.02	0.02	-0.01
	(0.06)	(0.06)	(0.06)	(0.06)
Type	3.52	4.80	4.51	5.98*
	(2.88)	(3.06)	(3.01)	(3.19)
BOR Dummy	1.58***	1.77***	1.77***	2.07***
	(0.54)	(0.57)	(0.57)	(0.58)
BOR*Type	-1.36**	-1.57**	-1.57**	-2.26***
	(0.62)	(0.65)	(0.65)	(0.70)
OR Dummy	0.72	0.81*	0.81*	0.97*
	(0.46)	(0.46)	(0.46)	(0.53)
OR*Type	-0.18	-0.29	-0.29	-0.64
	(0.57)	(0.58)	(0.58)	(0.60)
CFT Dummy	1.94***	2.10***	2.10***	2.17***
	(0.51)	(0.53)	(0.53)	(0.50)
CFT*Type	-2.05***	-2.23***	-2.23***	-2.21***
	0.61	(0.64)	(0.64)	(0.64)
Male	-	Yes	Yes	Yes
Period Dummies	No	No	Yes	Yes
Control Variables	No	No	No	Yes
Observation	564	564	564	564
Prob>F	0.000	0.000	0.000	0.000
R-squared	0.69	0.69	0.69	0.71

Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01. Average is the average value of the performance in the first stage. Difference variable refers to differences in the average performance of two participants matched. BOR, OR and CFT are the dummies for these treatments. NFT is omitted as the reference category. Type variable is a dummy which is 0 for the low-productivity and 1 for the high-productivity participants. Average*Type, Difference*Type, BOR*Type, OR*Type and CFT*Type are the interaction terms which show how different the average, difference and treatment variables affect the high-productivity participants. Male is a dummy which equals to 1 for males and 0 for the females. Period dummies refer to a dummy for each period in the second stage except the first period. Control Variables: Competitiveness, Altruism, University Status, Age, Performed the Word Encryption Before.

Column 1 in Table 40 shows that the coefficients of the difference variable and the OR dummy, are not statistically significant. However, Average, BOR Dummy and

CFT Dummy variables' coefficients are statically significant at the 1% level. This shows that when the participants are able to observe each other, low-productivity participants increase their performance compared to in the no-feedback condition since the coefficient of the CFT dummy is positive and statistically significant. In addition, being observed without observing (BOR) also increases the performance of the low-productivity participants compared to in the no-feedback condition which gives the effect of being observed on these participants. Although the coefficient of the dummy for the OR is not significant (Column 1), if the male, period dummies and control variables are included in the regressions (columns 2, 3 and 4), it becomes significant at the 10% level. Overall, these results show that either being observed by, or observing the rivals increases the performance of low-productivity participants compared to the no-feedback case. This is further evidence of positive peer effects.

On the other hand, there is no effect of observing the rival or being observed by the rival or the same act simultaneously on the high-productivity workers. According to the Wald test results, addition of the coefficients (OR Dummy and OR*Type, BOR Dummy and BOR*Type, CFT Dummy and CFT*Type) do not yield values which are statistically different than 0 with all the p-values are greater than 0.10. Adding the other variables in the other columns also does not change these results. However, the reason for finding these results might be related to the issue discussed above. Even if these participants wanted to increase their performance, they might not be able to do that in a 4-minute time period.

4.5 Discussion and Concluding Remarks

In order to increase workers' performance, tournaments are organised in workplaces. One of the important issues about these tournaments is whether or not the relative performance information should be revealed to the participants or not. It is an important issue because revealing the information might generate negative peer effects leading underdogs and frontrunners to decrease their performance.

There are several studies that have analysed the way in which revealing relative performance information can generate peer effects. These studies have only focused on observing the rivals' performance during the tournament period. However, while participants are able to observe their rivals' performance, they are also being observed by their rivals. In this study, I have disentangled the effects of being observed by the rival and observing the rival during the tournament. It is an

important issue because if we have a better understanding about these effects, then we can further increase the performance of workers.

In order to analyse these effects, I conducted a laboratory experiment based on a real-effort task. The results show that underdogs increase their performance if they are being observed. However, there is no effect of being observed on the frontrunners. These results show that social-esteem is an important phenomenon for underdogs in that they consider how people evaluate them and try to leave a good impression on others. In terms of the effect of observing the rival, there is neither an increase nor decrease in the underdogs' performance. Therefore, as before, we can still claim that positive peer effects exist for the underdogs. On the other hand, observing the rival led frontrunners to increase their performance. However, this result is not robust since including control variables in the regression changes the results in terms of statistical significance. Nevertheless, for the same reason, this is also accepted as evidence that observing the rival generates positive peer effects on frontrunners. These results also show that self-esteem is also important for people. Even if they are not being observed, underdogs do not decrease their performance in order not to suffer the disutility of shame and frontrunners do not decrease their performance to gain utility of pride due to outperforming others. In addition, in order to analyse if the relative performance information should be provided or not, the overall effects were also tested, regardless of being an underdog or frontrunner. The results show that just observing or being observed or both observing and being observed simultaneously increase the performance compared to the case in which people cannot either observe or be observed. These results present evidence of the existence of positive peer effects consistent with the previous results.

It can be understood from these results that, to some degree, people both care what they think about themselves (self-esteem) and what others think about them (social-esteem). In terms of the effect of observing the rival, if self-esteem is not important for them, their performance would be affected by the rival's performance. However, the difference variable had no effect on a participant's performance whether he is underdog or frontrunner. This means that even if the rival is so good or so bad they did not change their performance based on this. This shows that their decisions about how they should perform are related to themselves, at least to a degree. However, based on these results, it appears that this effect is strong enough to maintain but not necessarily increase one's performance. Since they are only observing and they are not observed, keeping the

distance with the rival might satisfy their concerns in terms of self-esteem. On the other hand, the effect of being observed led underdogs to increase their performance whereas it does not affect the frontrunners. These results show that underdogs are more sensitive about how they are evaluated by others. This suggests that leaving a good impression on others is more important for those performing poorly compared to others. They may think that although they are going to lose the tournament, it is better to lose but perform well so that they can leave a better impression on the winner, potentially making them more satisfied in terms of social-esteem. On the other hand, frontrunners might think that winning or performing better than the others is enough to leave a good impression on the observers. For this reason, they may just maintain their performance.

As a result, positive peer effects are found for both underdogs and frontrunner due to observing the rival. However, being observed only has effects on the underdogs. Except for the underdogs being observed, other groups do not increase their performance. Therefore, if the main purpose of revealing the relative performance is to increase the performance by incentivising workers, these issues should be considered. For this reason, there is a need for further research regarding methods to motivate these groups.

Chapter 5: Conclusion

This purpose of this thesis is to examine how workers react to one of the most common exogenous policy change in the labour market, the minimum wage, and to an endogenous policy change within the firms. It consists of three studies, with each study focusing on a specific subject related to these policy changes. The first two studies are related to the new minimum wage policies in the labour markets whereas the third study focuses on an endogenous change related to the compensation systems.

In the first study, I analyse how workers and employers react to the introduction of a minimum wage in terms of horizontal fairness concerns. In particular, I study how minimum wage introduction affects the reservation wages and wage offers in terms of spillover effects based on these fairness concerns. For this research, I conducted a laboratory experiment consisting of two treatments. In the first treatment, there are two type of workers having different productivity levels, so-called low-skilled and high-skilled workers. In the second treatment, there is one type of workers but two type of sectors, covered and uncovered sectors, depending on whether or not the minimum wage is introduced. I found some evidence that the introduction of minimum wage generates spillover effects on the high-skilled workers' reservation wages and wage offers due to horizontal fairness concerns. However, there is no evidence of spillover effect of introduction of a minimum wage on the wage offers and reservation wages in the uncovered sector for the same type of workers. The results are interpreted as workers are more sensitive about being advantageous and then losing it, than starting at the same point but then become disadvantageous.

The aim of the second study is to analyse whether or not workers change their performance if their fixed wages are increased due to increase in the minimum wage when they are paid both fixed wage and piece rate. The national minimum wage was increased by 30% in Turkey in January, 2016. For the analysis of this study, the dataset was obtained from a Turkish company. The dataset covers three months before and after the minimum wage increase. The results show that there is no significant effect of minimum wage increase on workers' overall performance. However, if workers are divided as low and high-productivity workers based on being below or above the median of the performance values, there are opposite effects being observed. Low-productivity workers increase their performance since the value of the job loss increases with the minimum wage increase. On the other

hand, high-productivity workers decrease their performance due to income targeting. According to the results, since the low-productivity workers increase their performance, the focus should be on how to prevent decrease in the high-productivity workers' performance. Since the reason for the decrease in the performance of these workers' is income-related, non-monetary incentives can be practiced.

The third study deals with understanding the behavioural mechanisms generated by peer effects during the tournaments. Tournament incentives which is part of the compensation policies, are common practice in order to increase the performance of employees in the workplace. One important issue regarding these tournaments is whether or not the workers should be able to observe the others' performance during the tournament. The reason for this discussion is that observing the rivals' performance might generate negative or positive peer effects on the underdogs and frontrunners. However, previous studies were only focused on the effect of observing disregarding the fact that a worker who is observing his rivals is also being observed by his rival simultaneously. While the act of observing might generate peer effects, being observed might also generate peer effects. The purpose of this study is to disentangle the peer effects based on observing and being observed by the rivals through conduction of a laboratory experiment. The experiment consists of three treatments. In the first treatment, no-one observes the others' performance or is being observed by their rivals. In the second treatment, everyone observes and is observed. In the third treatment, participants are divided into two roles as either being only the observer or only being observed. Participants undertaking the observer role are able to observe their rival but are not observed whereas participants undertaking the being observed role are not able to observe their rival but are being observed. The results show that observing or being observed or both at the same time increases the overall performance without distinguishing the underdogs and frontrunners. In terms of the underdogs, I find that the average performance increases when participants are being observed however there is no significant effect of observing the rival on the underdogs. Conversely, either observing or being observed does not increase the performance of the frontrunners, however it does not decrease the performance either. These results suggest that workers should be able to observe the others' performance and be observed of the performance by others at the same time during the tournament process in order to take more advantage from the tournaments.

To conclude, these studies show that an exogenous or and endogenous policy change might generate different effects which are not considered in the beginning. Studying these policies from the different perspectives as much as possible is important to have more information about these effects. The reason for that is there might be generated adverse consequences which might be negative for workers, firms or even for the economy. If we can learn about these effects, then these negative consequences might be prevented even before than they exist.

Appendix A

A.1. Instructions for the Lab Experiment

GENERAL RULES

(These rules were the same for both treatments except the exchange rate.)

You are now taking part in an economic experiment. Please read the instructions carefully since it is critical for the success of the study that you understand the rules of the experiment. You will earn at least **£4(participation fee)** when you have finished the experiment – regardless of your performance. Depending on your decisions, you can earn a greater amount of money. Therefore, in order to earn more money, please concentrate during the experiment. If you still do not understand something after having read the instructions carefully, please raise your hand and wait for us to help you.

You are not allowed to interact with other participants for any reason! You **must not use your mobile phone** and you should be silent until you finish the experiment and leave the laboratory. The instructions handed to you are intended solely for your personal information.

This experiment deals with companies (firm owners) and two different type of employees: low-skilled workers and high-skilled workers. Each individual will be assigned a certain role before the experiment starts. You and everyone else will keep the assigned role during the **whole** experiment.

The experiment consists of **30 periods**. However, before the first period of the experiment is started, you will have **3 practice periods** to get used to the experiment. Your decisions during these **3 periods** will not be considered in terms of money you will earn from the experiment. After the 3rd practice period is finished you will start to the first period of the experiment. The number of the current period of the experiment appears in the top left corner of the screen. If you can see "Practice Period" it means you are in the practice period that your decisions will not be considered for calculating the money you will earn from the experiment. When you see "Period 1 out of 30" it means the experiment has started. The top right corner shows the remaining time to make your decision.

Appendix A

During the experiment, instead of pounds (GBP) you will use an imaginary currency, called *experimental currency units* (ECU). During each period, you will therefore earn ECU. At the end of the experiment, we will **choose 3 of 30 periods randomly** and the **summation of these 3 periods** will be how much ECU you earn from the experiment. The same 3 periods will be chosen for everybody in the experiment. It means that if (hypothetically) the periods 5, 19 and 23 are chosen then everybody gets whatever profit he or she earned from the 5th, 19th and 23rd periods. There will be an **additional lottery for firm owners**. We will choose a number between 1 and 2 and if we draw 1 then firm owners will earn the profit they make thanks to low-skilled workers and if we draw 2 they will earn the profit they make thanks to high-skilled workers.

The total amount of ECU you earn in the course of the experiment will be converted into pounds after completion of the experiment. The exchange rate is **100 ECU = 1.0 pound (GBP).**

After this calculation, your earnings from the experiment will be added to £4 and this will be the money we will give to you after the experiment.

INSTRUCTIONS FOR FIRM OWNERS IN THE FIRST TREATMENT

Your role during the experiment will be: a firm owner.

In each period you will be assigned six employees **randomly**: three of these workers will be low-skilled workers and three of these workers will be high-skilled workers. Although your role **as a firm owner will not change during the whole experiment**, the individuals you will have to deal with will be matched randomly each time. *This means you might be matched with different workers in each period – three of them will always be high-skilled workers and three of them will always be low-skilled workers.*

Neither your role identity, nor the role identity of other participants (workers or firm owners) will be revealed to any other participant. So please consider everyone in the experiment to be **anonymous**.

Specific Rules for the Firm Owners

At the beginning of **each** period you as the firm owner must submit four different hiring decisions**:**

(1) You submit **a wage** offer to **low-skilled** workers.
(2) You submit the number of how many low-skilled workers you would like to hire (You may want to hire 0 or 1 or 2 or 3 low-skilled workers).

(3) You submit **a wage** offer to **high-skilled** workers.
(4) You submit the number of how many high-skilled workers you would like to hire (You may want to hire 0 or 1 or 2 or 3 high-skilled workers).

The important issue you have to be aware of is that wages within one skill group will be all the same. For example, the wage you propose to the low-skilled workers will be valid for all low-skilled workers who receive an offer from you (who work in your company in that period). This rule is valid for high-skilled workers as well.

You will enter your wage offers, while workers will enter the lowest wage they are willing to accept in the current period. In the case that a worker gets a wage offer, he or she will see the details of that offer on the screen. If the offer is **equal to or** greater than the lowest wage entered by the worker then it is accepted and the proposed wage will be his earnings for the current period of the experiment. If the offer is below the lowest wage entered by the worker it is rejected and his earnings for this period will be zero. All workers will enter their lowest wages without knowing the decisions of the other participants.

A worker only learns about his own earnings and how much his firm owner earns thanks to low-skilled and high-skilled workers. It means that a worker you are matched with will be informed of his own earnings as well as of yours but not other workers in the same company.

If you hire a worker depending on your offer and his lowest wage he is willing to accept an offer, he will enter into an employment contract with you. The **profit** you as firm owner receives in each period depends on the wages you offer and the income that workers you hire provide to you. Therefore your profit for a period is determined by the wages you pay to your workers and the income you earn thanks to them. We can define your profit such as:

Profit = Income - Cost.

The table below shows how much ECU you earn for each skill category by hiring an additional worker.

Number of hired workers	Low-Skilled Workers	High-Skilled Workers
1	400	800
2	750	1500
3	1000	2000

The interpretation of the table is simple. For example, if you hire only one low-skilled worker, you will get 400 ECU, as your **income** thanks to his work. If you hire only one high-skilled worker, you will get 800 ECU, as your **income**. However, if you want to hire two low-skilled workers, your income will be 750 ECU thanks to these 2 low-skilled workers. The same logic is valid for high-skilled workers: if you hire two high-skilled workers, your income will be 1500 for the high-skilled workers.

On the other hand, you should also consider your **costs**, namely the wages you have to pay to your workers! In order to calculate your profit you **should subtract your costs from your income**. If you offer 15 ECU to the two low-skilled workers and you don't hire any high-skilled workers for this period and if you can hire 2 low-skilled workers, these two workers **cost** you 30 ECU in total (you pay 15 to each low-skilled worker). Since your **income** from two low-skilled workers is 750 ECU (see table) and your **costs** for two low-skilled workers are 30 ECU, your **profit** is 720 ECU for this period (750 – 30 = 720).

EXAMPLES FOR CALCULATING INCOME

- Recruiting all 6 employees: If you enter into contracts with **all three low-skilled workers and all three high-skilled workers**, your income will be **1000 ECU for the low-skilled workers** and **2000 ECU for the high-skilled workers.**

- If you enter into contracts with **two low-skilled workers** and **one high-skilled worker,** your income thanks to low-skilled workers will be **750 ECU and 800 ECU thanks to high-skilled worker**. *Note: it doesn't matter which two low-skilled workers you are matched. This will be determined by the computer* ***randomly****.*

- If you enter into a contract with **zero low-skilled** worker and **two high-skilled** workers you will achieve an income of **1500 ECU for the high-skilled workers and 0 ECU for the low-skilled workers**.

- If you enter into **no contracts** at all which means you make no offers to any workers of either type **or** you cannot hire any of the workers since their lowest wages they are willing to accept your offer are greater than your offers, you will receive an income of 0 ECU **since you do not receive any income**.

EXAMPLES FOR CALCULATING **COSTS**

- Let's assume you offer a 100 ECU wage to low-skilled workers and you want to hire **two of them**. The following cases might occur:
  1- You can hire 2 workers. In this case your cost will be 200 ECU (100+100).
  2- You can hire only one of these workers. In this case, your cost will be 100 ECU.
  3- You can hire neither of the two low-skilled workers and in this case your **cost** will **be 0 ECU**.

Let's assume you offer a 200 ECU wage to low-skilled workers and a 300 ECU to high-skilled workers. If you make three offers to the low-skilled workers and two offers to the high-skilled workers, then there are four different cases for the low-skilled workers and three different cases for the high-skilled workers.

The cases for the low-skilled workers are as follows:

You can hire 3 low-skilled workers depending on their lowest wage they are willing to accept your offer. In this case your costs for the low-skilled workers will be 600 ECU (200+200+200).

Two of low-skilled workers can be hired and one of them cannot be hired. In this case your costs will be 400 ECU (200+200+0).

One low-skilled worker is hired and two of them are not. In this case your costs will be 200 ECU (200+0+0).

If you cannot hire any of the low-skilled workers, your costs will be zero (0+0+0).

The cases for the high-skilled workers are as follows:

You can hire 2 high-skilled workers. In this case your costs for the high-skilled workers will be 600 ECU (300+300).

One high-skilled worker can be hired and other one cannot be hired. In this case your cost will be 300 ECU (300+0).

If you cannot hire any of the high-skilled workers, your costs will be zero (0+0+0).

Appendix A

EXAMPLES FOR CALCULATING **PROFITS**

As was mentioned before, your profit for one period is your remaining ECU (income minus costs). Let's consider the same example just explained above: you make offers to three low-skilled workers of 200 ECU. In addition, you make offers to two high-skilled workers of 300 ECU. If we assume that **two** low-skilled workers and **one** high-skilled worker are hired, then your profit (income-cost) will be calculated as:

Profit for low-skilled workers: 750 -200 -200= 350

Profit for high-skilled workers: 800- 300=500

We can see that 800 ECU comes from hiring one high-skilled worker (you can check the table again), 750 ECU comes from hiring two low-skilled workers. Subtractions in the profit calculation relate to the wages you pay to these workers. 300 is the offer you make to the high-skilled worker and 200 is the wage for the low-skilled workers.

After you have learned your profit for this period, a new period starts and you will start over again. You will again decide what wages to offer and how many offers you would like to make.

EXAMPLE FOR CALCULATING **THE TOTAL ECU YOU WILL EARN FROM THE EXPERIMENT**

After you play the game, according to the rules above, 30 times (30 periods), then we will draw 3 periods randomly from the first lottery. These 3 periods will apply to everyone in the experiment as stated in the general rules. It means that if we draw 3-13-25 then the computer will calculate everybody's earnings from the 3rd, 13th and 25th periods. After these 3 periods are determined we will also choose if you earn the profit you make thanks to either the low-skilled workers or high-skilled workers.

Let's assume that you play this game for 30 periods and we draw 3-13-25. Let's say, the numbers below are your results for some periods in 30 periods:

Profits/Periods	1st Period	2nd Period	**3rd Period**	…	12th Period	**13th Period**	…	**25th Period**	…	30th Period
Profit of Low-skilled workers	300	0	**400**	…	150	**300**	…	**0**	…	230
Profit of High-skilled workers	400	750	**650**	…	850	**150**	…	**200**	…	850

If the results of the first lottery are 3-13-25 then we will add your profits from these 3 periods. However, we should also determine whether you get the profits you make from the low-skilled workers or the high-skilled workers. If the result of second lottery is 1 then we will add your low-skilled workers' profits which is: 400+300+0=700 (ECU). However, if the result of the second lottery is 2 then we will add your high-skilled workers profits which is: 650+150+200=1000 (ECU).

After the computer calculates all participants' total earnings (ECU), then it will be changed to real money with the exchange rate written in the general rules. After this process, participation fee (£4) will be added to all participants' earnings.

IMPORTANT REMINDERS

- You will only need to pay the **wage** you have offered if you can hire the worker(s).
- If a worker is not hired, you do not have to pay that worker but you also earn nothing thanks to this worker.
- The payment schedules above apply to all companies and all workers. They are known to each company and to each worker.
- **You cannot offer a wage less than 0 and greater than 1,000 inclusive**.
- **The employees will be informed of their own earnings and yours**. However, they will not know the earnings of their fellow workers.

IF YOU HAVE ANY QUESTIONS PLEASE RAISE YOUR HAND AND WAIT FOR US TO HELP YOU!

INSTRUCTIONS FOR LOW-SKILLED WORKERS

Your role during the experiment will be: <u>a low-skilled worker</u>.

In each period you will be **randomly** assigned to a firm, which has one firm owner, along with 3 high-skilled workers and 3 low-skilled workers (including yourself). **Although your role as a low-skilled worker will not change during the whole experiment**, the firm you are assigned to and the workers assigned to that firm with you will be selected randomly each time. *This means you might be matched*

with different workers and a different firm owner in each period – one of them will always be the firm owner, three of them will always be high-skilled workers and three (including you) of them will always be low-skilled workers.

Neither your role identity, nor the role identity of other participants (workers or firm owners) will be revealed to any other participant. So please consider everyone in the experiment to be **anonymous**.

Specific Rules for the Low-Skilled Workers

At the beginning of each period the firm owner – representing the company – must submit four different hiring decisions:

(1) He submits **a wage** offer to **low-skilled** workers.
(2) He submits the number of how many low-skilled workers he would like to hire (he may want to hire 0 or 1 or 2 or 3 low-skilled workers).
(3) He submits **a wage** offer to **high-skilled** workers.
(4) He submits the number of how many high-skilled workers he would like to hire (he may want to hire 0 or 1 or 2 or 3 high-skilled workers).

If your firm owner wants to hire 1 (or 2) low-skilled worker(s), the computer will choose 1(or 2) worker(s) from your group **randomly.** For this reason you should be aware that if your firm owner wants to hire 1(or 2) low-skilled worker(s) you might not get an offer which means that you earn nothing for that period. If you get an offer from the firm owner, you will be informed by the computer about the amount of the wage offer. However, **before** you are informed about the offer received, if any, you must submit the **lowest wage offer you are willing to accept**. After you enter the **lowest wage offer you are willing to accept** and if you get an offer then the computer will compare your decision and the offer. If **the wage you enter** is **greater than the offer** the **computer** will **reject** the offer automatically and you earn **nothing** for this period. If **the wage you enter** is **equal to or less than the offer** the **computer accepts** the offer automatically and your earning for this period is the **wage offer**.

We can summarise 3 possible cases for you such as:

1- You get an offer and the **lowest wage offer you are willing to accept** that you enter is **less** than **or equal** to this offer, you then get hired and you earn the wage offer made by the firm owner for this period.
2- You get an offer and the **lowest wage offer you are willing to accept** that you enter is **greater** than the offer, the computer then rejects the offer automatically on your behalf and you earn nothing for this period.
3- You do not get any offers and you earn nothing for this period.

In order to decide the **lowest wage offer you are willing to accept** that you enter, it is necessary to learn how the firm owners make **profits**.

Number of hired workers	**Low-Skilled Workers**	High-Skilled Workers
1	**400**	800
2	**750**	1500
3	**1000**	2000

The interpretation of the table is simple. If your firm owner hires only 1 **low**-skilled worker, he will get 400 ECU, as his **income** for that period thanks to the single low-skilled worker hired. If he hires only 1 **high**-skilled worker, he will get 800 ECU, as his **income**. However, if he wants to hire 2 **low**-skilled workers, his income will be 750 ECU for the low-skilled workers. The same logic is valid for high-skilled workers: if he hires 2 high-skilled workers, his income will be 1.500 ECU for the high-skilled workers.

For example: Let's assume he hires 2 low-skilled and 2 high-skilled workers. Then his **income** will be 750 ECU for two low-skilled workers and 1500 for two high-skilled workers.

On the other hand, he faces **costs** to pay, namely the wages of his workers! In order to calculate his **profit** he should **subtract his costs from his income**. If he offers 100 ECU to the 2 low-skilled workers and let's say he does not want to hire any high-skilled workers for the period and if both low-skilled workers are hired, these two workers cost him 200 ECU in total (he offers 100 ECU to each low-skilled worker). Since his **income** from two low-skilled workers is 750 ECU (see table) and his **costs** for two low-skilled workers are 200 ECU, his **profit** is 550 ECU for this period for the low-skilled workers (750 – 200 = 550). Since he does not hire any of the high-skilled workers, his **profit is 0 ECU** for the high-skilled workers.

EXAMPLES FOR CALCULATING **YOUR EARNINGS**

Let's say;

1- The firm owner wants to hire **all** low-skilled workers and his wage offer is 300 ECU. If you enter the **lowest wage offer you are willing to accept** as 275, or 260 or 299 or 300, then you earn 300 ECU for that period.

2- The firm owner wants to hire 2 low-skilled workers and the computer does not choose you. It means that you cannot get an offer and your earning is **0 ECU** for this period.
3- The firm owner wants to hire 2 low-skilled workers and the computer chooses you. If the firm owner offers 20 ECU to your group and if you enter 21 or 22 or 50 or any more than 20, then you earn nothing since the **lowest wage offer you are willing to accept** is greater than the offer.
4- All rules explained so far are valid for high-skilled workers as well.

EXAMPLE FOR CALCULATING **THE TOTAL ECU PARTICIPANTS EARN FROM THE EXPERIMENT**

After you play the game, according to the rules above, 30 times (30 periods), then we will draw 3 periods randomly from the first lottery. These 3 periods will apply to everyone in the experiment as stated in the general rules. It means that if we draw 10-20-29 then the computer will sum everybody's earnings from the 10th, 20th and 29th periods. If you earn X ECU from the 10th period, Y ECU from the 20th period and Z ECU from the 29th period, the total ECU you will earn from the experiment will be X+Y+Z for this example. This process will be valid for all workers.

However there is another lottery for **firm owners**. We will choose a number between 1 and 2 randomly for the second lottery. Let's **assume** that a firm owner plays this game for 30 periods as well and we draw 3-13-25 from the first lottery. Let's say, the numbers below are his profits for some periods in 30 periods as an example:

Profits/Periods	1st Period	2nd Period	**3rd Period**	…	12th Period	**13th Period**	…	**25th Period**	…	30th Period
Profit thanks to Low-skilled workers	300	0	**400**	…	150	**300**	…	**0**	…	230
Profit thanks to High-skilled workers	400	750	**650**	…	850	**150**	…	**200**	…	850

If the result of the second lottery is **1** then we will add his low-skilled workers' profits which is: 400+300+0=700 (ECU). However, if the result of the second

lottery is **2** then we will add his high-skilled workers' profits which is: 650+150+200=1000 (ECU).

After the computer calculates all participants' total earnings (ECU), it will be changed to real money with the exchange rate written in the general rules. After this process, participation fee (£4) will be added to all participants' earnings.

IMPORTANT REMINDERS

- **You should consider that firm owners can only earn thanks to either the low-skilled workers or high-skilled workers hired but not both. As stated above, after the initial 3 periods are chosen, we will have another lottery for firm owners that will determine from which type of worker profits will be earned.**
- You must enter the **lowest wage offer you are willing to accept** before you learn if you get an offer or not.
- The payment schedules above apply to all firms and all workers in this experiment. They are known to each firm and to each worker.
- **You cannot learn how much ECU other workers earn**. They cannot learn your earnings either. However, you will learn how much ECU your firm owner earns in each period.
- **You cannot enter the lowest wage offer you are willing to accept** as **less than 0 and greater than 1,000 inclusive**.

IF YOU HAVE ANY QUESTIONS PLEASE RAISE YOUR HAND AND WAIT FOR US TO HELP YOU!

INSTRUCTIONS FOR HIGH-SKILLED WORKERS

Your role during the experiment will be: a high-skilled worker.

In each period you will be **randomly** assigned to a firm, which has one firm owner, along with 3 low-skilled workers and 3 high-skilled workers (including yourself). **Although your role as a high-skilled worker will not change during the whole experiment**, the firm you are assigned to and the workers assigned to that firm with you will be selected randomly each time. *This means you might be matched with different workers and a different firm owner in each period – one of them will always be the firm owner, three of them will always be low-skilled workers and three (including you) of them will always be high-skilled workers.*

Neither your role identity, nor the role identity of other participants (workers or firm owners) will be revealed to any other participant. So please consider everyone in the experiment to be **anonymous**.

Specific Rules for the High-Skilled Workers

Appendix A

At the beginning of each period the firm owner – representing the company – must submit four different hiring decisions:

(1) He submits **a wage** offer to **low-skilled** workers.
(2) He submits the number of how many low-skilled workers he would like to hire (he may want to hire 0 or 1 or 2 or 3 low-skilled workers).
(3) He submits **a wage** offer to **high-skilled** workers.
(4) He submits the number of how many high-skilled workers he would like to hire (he may want to hire 0 or 1 or 2 or 3 high-skilled workers).

If your firm owner wants to hire 1 (or 2) high-skilled worker(s), the computer will choose 1(or 2) worker(s) from your group **randomly.** For this reason you should be aware that if your firm owner wants to hire 1(or 2) high-skilled worker(s) you might not get an offer which means that you earn nothing for that period. If you get an offer from the firm owner, you will be informed by the computer about the amount of the wage offer. However, **before** you are informed about the offer received, if any, you must submit your **lowest wage offer you are willing to accept**. After you enter the **lowest wage offer you are willing to accept** and if you get an offer then the computer will compare your decision and the offer. If **the wage you enter** is **greater than the offer** the **computer** will **reject** the offer automatically and you earn **nothing** for this period. If **the wage you enter** is **equal to or less than the offer** the **computer accepts** the offer automatically and your earning for this period is the **wage offer**.

We can summarise 3 possible cases for you such as:

1- You get an offer and the **lowest wage offer you are willing to accept** that you enter is **less** than or **equal** to this offer, you then get hired and you earn the wage offer made by the firm owner for this period.
2- You get an offer and the **lowest wage offer you are willing to accept** that you enter is **greater** than the offer, the computer then rejects the offer automatically on your behalf and you earn nothing for this period.
3- You do not get any offers and you earn nothing for this period.

In order to decide the **lowest wage offer you are willing to accept** that you enter, it is necessary to learn how the firm owners make **profits**.

Number of hired workers	Low-Skilled Workers	**High-Skilled Workers**
1	400	**800**
2	750	**1500**
3	1000	**2000**

The interpretation of the table is simple. If your firm owner hires only 1 **low**-skilled worker, he will get 400 ECU, as his **income** for that period thanks to the single low-skilled worker hired. If he hires only 1 **high**-skilled worker, he will get 800 ECU, as his **income**. However, if he wants to hire 2 **low**-skilled workers, his income will be 750 ECU for the low-skilled workers. The same logic is valid for high-skilled workers: if he hires 2 high-skilled workers, his income will be 1.500 ECU for the high-skilled workers.

For example: Let's assume he hires 2 low-skilled and 2 high-skilled workers. Then his **income** will be 750 ECU for two low-skilled workers and 1500 for two high-skilled workers.

On the other hand, he faces **costs** to pay, namely the wages of his workers! In order to calculate his **profit** he should **subtract his costs from his income**. If he offers 300 ECU to the 2 high-skilled workers and let's say he does not want to hire any low-skilled workers for the period and if both high-skilled workers are hired, these two workers cost him 600 ECU in total (he offers 300 ECU to each high-skilled worker). Since his **income** from two high-skilled workers is 1500 ECU (see table) and his **costs** for two high-skilled workers are 600 ECU, his **profit** is 900 ECU for this period for the high-skilled workers (1500 – 600 = 900). Since he does not hire any of the low-skilled workers, his **profit is 0 ECU** for the low-skilled workers.

EXAMPLES FOR CALCULATING **YOUR EARNINGS**

Let's say;

1- The firm owner wants to hire **all** high-skilled workers and his wage offer is 100 ECU. If you enter the **lowest wage offer you are willing to accept** as 95, or 97 or 99 or 100, then you earn 100 ECU for that period.
2- The firm owner wants to hire 2 high-skilled workers and the computer does not choose you. It means that you cannot get an offer and your earning is **0 ECU** for this period.
3- The firm owner wants to hire 2 high-skilled workers and the computer chooses you. If the firm owner offers 20 ECU to your group and if you enter 21 or 22 or 50 or any more than 20, then you earn nothing since the **lowest wage offer you are willing to accept** is greater than the offer.
4- All rules explained so far are valid for low-skilled workers as well.

EXAMPLE FOR CALCULATING **THE TOTAL ECU PARTICIPANTS WILL EARN FROM THE EXPERIMENT**

After you play the game, according to the rules above, 30 times (30 periods), then we will draw 3 periods randomly from the first lottery. These 3 periods will apply

to everyone in the experiment as stated in the general rules. It means that if we draw 10-20-29 then the computer will sum everybody's earnings from the 10th, 20th and 29th periods. If you earn X ECU from the 10th period, Y ECU from the 20th period and Z ECU from the 29th period, the total ECU you will earn from the experiment will be X+Y+Z for this example. This process will be valid for all workers.

However there is another lottery for **firm owners**. We will choose a number between 1 and 2 randomly for the second lottery. Let's **assume** that a firm owner plays this game for 30 periods as well and we draw 3-13-25 from the first lottery. Let's say, the numbers below are his profits for some periods in 30 periods as an example:

Profits/Periods	1st Period	2nd Period	**3rd Period**	…	12th Period	**13th Period**	…	**25th Period**	…	30th Period
Profit thanks to Low-skilled workers	300	0	**400**	…	150	**300**	…	**0**	…	230
Profit thanks to High-skilled workers	400	750	**650**	…	850	**150**	…	**200**	…	850

If the result of the second lottery is **1** then we will add his low-skilled workers' profits which is: 400+300+0=700 (ECU). However, if the result of the second lottery is **2** then we will add his high-skilled workers' profits which is: 650+150+200=1000 (ECU).

After the computer calculates all participants' total earnings (ECU), it will be changed to real money with the exchange rate written in the general rules. After this process, participation fee (£4) will be added to all participants' earnings.

IMPORTANT REMINDERS

- **You should consider that firm owners can only earn thanks to either the low-skilled workers or high-skilled workers hired but not both. As stated above, after the initial 3 periods are chosen, we will have another lottery for firm owners that will determine from which type of worker profits will be earned.**
- You must enter the **lowest wage offer you are willing to accept** before you learn if you get an offer or not.

- The payment schedules above apply to all firms and all workers in this experiment. They are known to each firm and to each worker.
- **You cannot learn how much ECU other workers earn**. They cannot learn your earnings either. However, you will learn how much ECU your firm owner earns in each period.
- **You cannot enter the lowest wage offer you are willing to accept** as **less than 0 and greater than 1,000 inclusive**.

IF YOU HAVE ANY QUESTIONS PLEASE RAISE YOUR HAND AND WAIT FOR US TO HELP YOU!

INSTRUCTIONS FOR FIRM OWNERS IN THE SECOND TREATMENT

Your role during the experiment will be: a firm owner.

In each period you will be assigned six employees **randomly**: three of these workers will be Type-1 workers and three of these workers will be Type-2 workers. Although your role **as a firm owner will not change during the whole experiment**, the individuals you will have to deal with will be matched randomly each time. *This means you might be matched with different workers in each period – three of them will always be Type-1 workers and three of them will always be Type-2 workers.*

Neither your role identity, nor the role identity of other participants (workers or firm owners) will be revealed to any other participant. So please consider everyone in the experiment to be **anonymous**.

Specific Rules for the Firm Owners

At the beginning of **each** period you as the firm owner must submit four different hiring decisions**:**

(1) You submit **a wage** offer to **Type-1** workers.
(2) You submit the number of how many **Type-1** workers you would like to hire (You may want to hire 0 or 1 or 2 or 3 **Type-1 workers**).
(3) You submit **a wage** offer to **Type-2** workers.
(4) You submit the number of how many **Type-2** workers you would like to hire (You may want to hire 0 or 1 or 2 or 3 **Type-2** workers).

The important issue you have to be aware of is that wages within one type group will be all the same. For example, the wage you propose to the **Type-1** workers will be valid for all **Type-1** workers who receive an offer from you (who work in your company in that period). This rule is valid for **Type-2** workers as well.

Appendix A

You will enter your wage offers, while workers will enter **the lowest wage they are willing to accept** in the current period. In the case that a worker gets a wage offer, he or she will see the details of that offer on the screen. If the offer is **equal to or greater than** the lowest wage entered by the worker then it is accepted and the proposed wage will be his income for the current period of the experiment. If the offer is below the lowest wage entered by the worker it is rejected and his income for this period will be zero. All workers will enter their lowest wages without knowing the decisions of the other participants.

A worker only learns about his own earnings and how much his firm owner earns thanks to Type-1 workers and Type-2 workers. It means that a worker you are matched with will be informed of his own earnings as well as of yours but not other workers in the same company.

If you hire a worker depending on your offer and his lowest wage he is willing to accept an offer, he will enter into an employment contract with you. The **profit** you as firm owner receives in each period depends on the wages you offer and the income that workers you hire provide to you. Therefore your profit for a period is determined by the wages you pay to your workers and the income you earn thanks to them. We can define your profit such as:

Profit = Income - Cost.

The table below shows how much ECU you earn for each type category by hiring an additional worker.

INCOME TABLE FOR FIRM OWNERS

Number of hired workers	Type-1 Workers	Type-2 Workers
1	400	400
2	750	750
3	1000	1000

The interpretation of the table is simple. For example, if you hire only one **Type-1** worker, you will get 400 ECU, as your **income** thanks to his work. If you hire only one **Type-2** worker, you will get 400 ECU, as your **income** as well. However, if you want to hire two Type-1 workers, your income will be 750 ECU thanks to these 2 Type-1 workers. The same logic is valid for Type-2 workers: if you hire two Type-2 workers, your income will be 750 for the Type-2 workers.

On the other hand, you should also consider your **costs**, namely the wages you have to pay to your workers! In order to calculate your profit you **should subtract your costs from your income**. If you offer 15 ECU to the two Type-1 workers and you don't hire any Type-2 worker for this period and if you can hire 2 Type-1 workers, these two workers **cost** you 30 ECU in total (you pay 15 to each Type-1 worker). Since your **income** from two Type-1 workers is 750 ECU (see table) and your **costs** for two Type-1 workers are 30 ECU, your **profit** is 720 ECU for this period (750 – 30 = 720).

EXAMPLES FOR CALCULATING **INCOME**

Recruiting all 6 employees: If you enter into contracts with **all three Type-1 workers and all three Type-2 workers**, your income will be **1000 ECU for the Type-1 workers** and **1000 ECU for the Type-2 workers**.

If you enter into a contract with **two Type-1** workers and **one Type-2 worker**, your income thanks to **Type-1 workers will be 750 ECU** and **400 ECU thanks to Type-2 worker**. *Note: it doesn't matter which two Type-1 workers you are matched. This will be determined by the computer* ***randomly.***

If you enter into a contract with zero Type-1 worker and two Type-2 workers you will achieve an income of **750 ECU for the Type-2** workers and **0 ECU for the Type-1** workers.

If you enter into **no contracts** at all which means you make no offers to any workers of either type **or** you cannot hire any of the workers since their lowest wages they are willing to accept your offer are greater than your offers, you will receive an income of 0 ECU **since you do not receive any income**.

EXAMPLES FOR CALCULATING **COSTS**

Let's assume you offer a 100 ECU wage to Type-1 workers and you want to hire **two of them**. The following cases might occur:
1- You can hire 2 workers. In this case your cost will be 200 ECU (100+100).
2- You can hire only one of these workers. In this case, your cost will be 100 ECU.
3- You can hire neither of the two Type-1 workers and in this case your **cost** will **be 0 ECU**.

Let's assume you offer a 200 ECU wage to Type-1 workers and a 300 ECU to Type-2 workers. You make three offers to the Type-1 workers (it means that you want to hire 3 Type-1 workers) and two offers to the Type-2 workers (it means that you want to hire 2 Type-1 workers). Then, there are four different cases for the Type-1 workers and three different cases for the Type-2 workers.

The cases for the Type-1 workers are as follows:

You can hire 3 Type-1 workers depending on their lowest wage they are willing to accept your offer. In this case your costs for the Type-1 workers will be 600 ECU (200+200+200).

Two of Type-1 workers can be hired and one of them cannot be hired. In this case your costs will be 400 ECU (200+200+0).

One Type-1 worker is hired and two of them are not. In this case your costs will be 200 ECU (200+0+0).

If you cannot hire any of the Type-1 workers, your costs will be zero (0+0+0).

The cases for the Type-2 workers are as follows:

You can hire 2 Type-2 workers. In this case your costs for the Type-2 workers will be 600 ECU (300+300).

One Type-2 worker can be hired and other one cannot be hired. In this case your cost will be 300 ECU (300+0).

If you cannot hire any of the Type-2 workers, your costs will be zero (0+0+0).

EXAMPLES FOR CALCULATING **PROFITS**

As was mentioned before, your profit for one period is your remaining ECU (income minus costs). Let's consider the same example just explained above: you make offers to three Type-1 workers of 200 ECU. In addition, you make offers to

two Type-2 workers of 300 ECU. If we assume that **two** Type-1 workers and **one** Type-2 worker are hired, then your profit (**income-cost**) will be calculated as:

Profit for Type-1 workers: 750 -200 -200= 350

Profit for Type-2 workers: 400- 300=100

We can see that 400 ECU comes from hiring one Type-2 worker (you can check the table again), 750 ECU comes from hiring two Type-1 workers. Subtractions in the profit calculation relate to the wages you pay to these workers. 300 is the offer you make to the Type-2 worker and 200 is the wage for the Type-1 workers.

After you have learned your profit for this period, a new period starts and you will start over again. You will again decide what wages to offer and how many workers you would like to hire.

EXAMPLE FOR CALCULATING **THE TOTAL ECU YOU WILL EARN FROM THE EXPERIMENT**

After you play the game, according to the rules above, 30 times (30 periods), then we will draw 3 periods randomly from the first lottery. These 3 periods will apply to everyone in the experiment as stated in the general rules. It means that if we draw 3-13-25 then the computer will calculate everybody's earnings from the 3rd, 13th and 25th periods. After these 3 periods are determined we will also choose if you earn the profit you make thanks to either the Type-1 workers or Type-2 workers.

Let's assume that you play this game for 30 periods and we draw 3-13-25. Let's say, the numbers below are your results for some periods in 30 periods:

Profits/Periods	1st Period	2nd Period	**3rd Period**	…	12th Period	**13th Period**	..	**25th Period**	..	30th Period
Profit thanks to Type-1 workers	300	0	**400**	…	150	**300**	..	**0**	..	230
Profit thanks to Type-2 workers	400	750	**150**	…	850	**200**	..	**350**	..	850

If the results of the first lottery are 3-13-25 then we will add your profits from these 3 periods. However, we should also determine whether you get the profits you make from the Type-1 workers or the Type-2 workers. If the result of second lottery is 1 then we will add your Type-1 workers' profits which is: 400+300+0=700 (ECU). However, if the result of the second lottery is 2 then we will add your Type-2 workers profits which is: 150+200+350=700 (ECU).

After the computer calculates all participants' total earnings (ECU), then it will be changed to real money with the exchange rate written in the general rules. After this process, participation fee (£4) will be added to all participants' earnings.

IMPORTANT REMINDERS

- You will only need to pay the **wage** you have offered if you can hire the worker(s).
- If a worker is not hired, you do not have to pay that worker but you also earn nothing thanks to this worker.
- The payment schedules above apply to all companies and all workers. They are known to each company and to each worker.
- **You cannot offer a wage less than 0 and greater than 1,000 inclusive**.
- **The employees will be informed of their own earnings and yours**. However, they will not know the earnings of their fellow workers.
-

IF YOU HAVE ANY QUESTIONS PLEASE RAISE YOUR HAND AND WAIT FOR US TO HELP YOU!

INSTRUCTIONS FOR TYPE-1 WORKERS

(Instructions for Type-2 workers were the same except exchanging the words Type-1 and Type-2.)

Your role during the experiment will be: a Type-1 worker.

In each period you will be **randomly** assigned to a firm, which has one firm owner, along with three Type-1 workers (including yourself) and three Type-2 workers. Although your role **as a Type-1 worker will not change during the whole experiment**, the firm you are assigned to and the workers assigned to that firm with you will be selected randomly each time. *This means you might be matched with different workers and a different firm owner in each period – one of them will always be the firm owner, three of them will always be Type-2 workers and three (including you) of them will always be Type-1 workers.*

Neither your role identity, nor the role identity of other participants (workers or firm owners) will be revealed to any other participant. So please consider everyone in the experiment to be **anonymous**.

Specific Rules for the Type-1 Workers

At the beginning of each period the firm owner – representing the company – must submit four different hiring decisions:

(1) He submits **a wage** offer to **Type-1** workers.

(2) He submits the number of how many Type-1 workers he would like to hire (he may want to hire 0 or 1 or 2 or 3 Type-1 workers).
(3) He submits **a wage** offer to **Type-2** workers.
(4) He submits the number of how many Type-2 workers he would like to hire (he may want to hire 0 or 1 or 2 or 3 Type-2 workers).

If your firm owner wants to hire 1 (or 2) Type-1 worker(s), the computer will choose 1(or 2) worker(s) from your group **randomly.** For this reason you should be aware that if your firm owner wants to hire 1(or 2) Type-1 worker(s) you might not get an offer which means that you earn nothing for that period. If you get an offer from the firm owner, you will be informed by the computer about the amount of the wage offer. However, **before** you are informed about the offer received, if any, you must submit the **lowest wage offer you are willing to accept**. After you enter the **lowest wage offer you are willing to accept** and if you get an offer then the computer will compare your decision and the offer. If **the wage you enter** is **greater than the offer** the **computer** will **reject** the offer automatically and you earn **nothing** for this period. If **the wage you enter** is **equal to or less than the offer** the **computer accepts** the offer automatically and your earning for this period is the **wage offer**.

We can summarise 3 possible cases for you such as:

1- You get an offer and the **lowest wage offer you are willing to accept** that you enter is **less** than or **equal** to this offer, you then get hired and you earn the wage offer made by the firm owner for this period.
2- You get an offer and the **lowest wage offer you are willing to accept** that you enter is **greater** than the offer, the computer then rejects the offer automatically on your behalf and you earn nothing for this period.
3- You do not get any offers and you earn nothing for this period.

In order to decide the **lowest wage offer you are willing to accept** that you enter, it is necessary to learn how the firm owners make profits.

INCOME TABLE FOR FIRM OWNERS

Number of hired workers	**Type-1 Workers**	Type-2 Workers
1	**400**	400
2	**750**	750
3	**1000**	1000

The interpretation of the table is simple. If your firm owner hires only 1 **Type-1** worker, he will get 400 ECU, as his **income** for that period thanks to the single Type-1 worker hired. If he hires only 1 **Type-2** worker, he will get 400 ECU, as his **income** as well. However, if he wants to hire 2 **Type-1** workers, his income will be 750 ECU for the Type-1 workers. The same logic is valid for Type-2 workers: if he hires 2 Type-2 workers, his income will be 750 ECU for the Type-2 workers.

For example: Let's assume he hires two Type-1 and three Type-2 workers. Then his **income** will be 750 ECU for two Type-1 workers and 1000 ECU for two Type-2 workers.

On the other hand, he faces **costs** to pay, namely the **wages** of his workers! In order to calculate his **profit** he should **subtract his costs from his income**. If he offers 100 ECU to the two Type-1 workers and let's say he does not want to hire any Type-2 workers for the period and if both Type-1 workers are hired, these two workers **cost** him 200 ECU in **total** (he offers 100 ECU to each Type-1 worker). Since his **income** from two Type-1 workers is 750 ECU (see table) and his **costs** for two Type-1 workers are 200 ECU, his **profit** is 550 ECU for this period for the Type-1 workers (750 – 200 = 550). Since he does not hire any of the Type-2 workers, his profit is **0 ECU** for the Type-2 workers.

EXAMPLES FOR CALCULATING **YOUR EARNINGS**

Let's say;

1- The firm owner wants to hire all Type-1 workers and his wage offer is 300 ECU. If you enter the **lowest wage offer you are willing to accept** as 275, or 260 or 299 or 300, then you earn 300 ECU for that period.
2- The firm owner wants to hire 2 Type-1 workers and the computer does not choose you. It means that you cannot get an offer and your earning is **0 ECU** for this period.
3- The firm owner wants to hire 2 Type-1 workers and the computer chooses you. If the firm owner offers 20 ECU to you and if you enter 21 or 22 or 50 or any more than 20, then you earn nothing since the **lowest wage offer you are willing to accept is** greater than the offer.
4- All rules explained so far are valid for Type-2 workers as well.

EXAMPLE FOR CALCULATING **THE TOTAL ECU PARTICIPANTS WILL EARN FROM THE EXPERIMENT**

After you play the game, according to the rules above, 30 times (30 periods), then we will draw 3 periods randomly from the first lottery. These 3 periods will apply to everyone in the experiment as stated in the general rules. It means that if we draw 10-20-29 then the computer will sum everybody's earnings from the 10^{th}, 20^{th} and 29^{th} periods. If you earn X ECU from the 10^{th} period, Y ECU from the 20^{th} period and Z ECU from the 29^{th} period, the total ECU you will earn from the experiment will be X+Y+Z for this example. This process will be valid for all workers.

However there is another lottery for **firm owners**. We will choose a number between 1 and 2 randomly for the second lottery. Let's **assume** that a firm owner plays this game for 30 periods as well and we draw 3-13-25 from the first lottery. Let's say, the numbers below are his profits for some periods in 30 periods as an example:

Profits/Periods	1st Period	2nd Period	**3rd Period**	…	12th Period	**13th Period**	…	**25th Period**	…	30th Period
Profit thanks to Type-1 workers	300	0	**400**	…	150	**300**	…	**0**	…	230
Profit thanks to Type-2 workers	400	750	**350**	…	850	**150**	…	**200**	…	850

If the result of the second lottery is **1** then we will add his Type-1 workers' profits which is: 400+300+0=700 (ECU). However, if the result of the second lottery is **2** then we will add his Type-2 workers' profits which is: 350+150+200=700 (ECU).

After the computer calculates all participants' total earnings (ECU), it will be changed to real money with the exchange rate written in the general rules. After this process, participation fee (£4) will be added to all participants' earnings.

IMPORTANT REMINDERS

- **You should consider that firm owners can only earn thanks to either Type-1 workers or Type-2 workers hired but not both. As stated above, after the initial 3 periods are chosen, we will have another lottery for firm owners that will determine from which type of worker profits will be earned.**
- You must enter the **lowest wage offer you are willing to accept** before you learn if you get an offer or not.
- The payment schedules above apply to all firms and all workers in this experiment. They are known to each firm and to each worker.
- **You cannot learn how much ECU other workers earn**. They cannot learn your earnings either. However, you will learn how much ECU your firm owner earns in each period.
- **You cannot enter the lowest wage offer you are willing to accept** as **less than 0 and greater than 1,000 inclusive**.

IF YOU HAVE ANY QUESTIONS PLEASE RAISE YOUR HAND AND WAIT FOR US TO HELP YOU!

Appendix A

A.2.

Table A1: Average Values of the Wage Offers for Each Session

	Type-1 Workers	Type-2 Workers
Session-1	154.90	121.4
	(29.25)	(32.34)
Session-2	138.82	147.77
	(53.74)	(47.14)
Session-3	62.28	51.40
	(61.24)	(36.13)
Session-4	141.01	144.77
	(38.48)	(42.84)

Notes: Standard deviations are in parentheses.

Appendix B

Table B.1: Fixed Effect and Pooled Cross-Sectional Model Results- December vs. The Subsequent Months- Overall Analysis

	Dec.vs.Jan		Dec.vs.Feb		Dec.vs.Mar	
	F-E-M	P-C-S-M	F-E-M	P-C-S	F-E-M	P-C-S-M
Dependent Variable:	Perform.	Perform.	Perform.	Perform.	Perform.	Perform.
	(1)	(2)	(3)	(4)	(5)	(6)
MWI Dummy	0.010**	0.014***	-0.006	-0.006	-0.042***	-0.04***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)
Index	-0.036***	-0.049***	-0.057***	-0.048***	-0.059***	-0.05***
	(0.009)	(0.001)	(0.007)	(0.001)	(0.005)	(0.001)
Constant	0.973***	0.479***	0.999***	0.720***	1.013***	0.492***
	(0.012)	(0.037)	(0.011)	(0.064)	(0.013)	(0.065)
MLA	No	Yes	No	Yes	No	Yes
Control Variables	No	Yes	No	Yes	No	Yes
Observation	3554	3554	3136	3136	4023	4023
R-squared	0.62	0.30	0.58	0.29	0.56	0.29

Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. The first two columns are the results of the comparison of December to January, columns 3 and 4 show the results of the comparison of December to February whereas columns 5 and 6 show the results of the comparison of December to March. Dependent variable is the performance of the workers. F-E-M is an abbreviation for Fixed-Effect Model and P-C-S-M is an abbreviation for Pooled Cross-Sectional Model. MWI dummy equals 0 before the minimum wage increase and 1 after the increase. The index variable refers to the difficulty of producing the products. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

Table B.2: Fixed Effect and Pooled Cross-Sectional Model Results- December vs. The Subsequent Months- Low and High-Productivity Worker Analysis

	Dec.vs.Jan		Dec.vs.Feb		Dec.vs.Mar	
	F-EM	P-C-S-M	F-E-M	P-C-S-M	F-E-M	P-C-S-M
Dependent Variable:	Perform.	Perform.	Perform.	Perform.	Perform.	Perform.
	(1)	(2)	(3)	(4)	(5)	(6)
MWI Dummy	0.022**	0.027***	0.010	0.011*	-0.03***	-0.036***
	(0.006)	(0.005)	(0.007)	(0.005)	(0.006)	(0.006)
MWI*Type	-0.023***	-0.028***	-0.037***	-0.039***	-0.011*	-0.014**
	(0.006)	(0.005)	(0.008)	(0.006)	(0.008)	(0.005)
Index	-0.084***	-0.036***	-0.104***	-0.038***	-0.072***	-0.035***
	(0.025)	(0.001)	(0.014)	(0.002)	(0.008)	(0.001)
Index*Type	0.070***	0.008***	0.087***	0.011***	0.031***	-0.001
	(0.026)	(0.001)	(0.014)	(0.002)	(0.007)	(0.002)
Type	0.175*	0.110***	0.098	0.097***	0.208***	0.132***
	(0.082)	(0.004)	(0.061)	(0.008)	(0.038)	(0.005)
Constant	0.780***	0.461***	0.867***	0.710***	0.791***	0.445***
	(0.085)	(0.063)	(0.066)	(0.067)	(0.046)	(0.067)
MLA	No	Yes	No	Yes	No	Yes
Control Variables	No	Yes	No	Yes	No	Yes
Observation	3554	3554	3136	3136	4023	4023
R-squared	0.63	0.38	0.59	0.36	0.56	0.37

Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. The first two columns are the results of the comparison of December to January, columns 3 and 4 show the results of the comparison of December to February whereas columns 5 and 6 show the results of the comparison of December to March. Dependent variable is the performance of the workers. F-E-M is an abbreviation for Fixed-Effect Model and P-C-S-M is an abbreviation for Pooled Cross-Sectional Model. MWI dummy equals 0 before the minimum wage increase and 1 after the increase. Type is a dummy to classify the workers and it is 0 for the low-productivity workers whereas 1 for the high-productivity workers. MWI*Type is an interaction term for minimum wage increase and the type of worker. It is equal to 1 if the time period is after the minimum wage increase and the worker is a high-productivity worker but it is equal to 0 otherwise. The index variable refers to the difficulty of producing the products. Index*Type is also an interaction term. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

Table B.3: Fixed Effect and Pooled Cross-Sectional Model Results- Trend Changes

	Overall		Low-Productivity		High-Productivity	
	F-E-M	P-C-S-M	F-E-M	P-C-S-M	F-E-M	P-C-S-M
Dependent Variable:	Perform. (1)	Perform. (2)	Perform. (3)	Perform. (4)	Perform. (5)	Perform. (6)
MWI Dummy	0.163***	0.167***	0.200***	0.201***	0.131***	0.128***
	(0.009)	(0.008)	(0.012)	(0.011)	(0.011)	(0.011)
Index	-0.056***	-0.055***	-0.074***	-0.045***	-0.033***	-0.026***
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
Month	0.014***	0.014***	0.018***	0.017***	0.011***	0.01***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)	(0.001)
MWI*Month	-0.042***	-0.042***	-0.049***	-0.048***	-0.036***	-0.036***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Constant	0.968***	0.457***	1.079***	0.049	0.958***	0.631***
	(0.007)	(0.029)	(0.020)	(0.065)	(0.005)	(0.037)
MLA	No	Yes	No	Yes	No	Yes
Control Variables	No	Yes	No	Yes	No	Yes
Observation	10398	10398	5053	5053	5345	5345
R-squared	0.55	0.33	0.40	0.23	0.37	0.30

Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. The first two columns are the results for the overall effects, columns 3 and 4 show the results for the low-productivity workers whereas columns 5 and 6 show the results for the high-productivity workers. Dependent variable is the performance of the workers. F-E-M is an abbreviation for Fixed-Effect Model and P-C-S-M is an abbreviation for Pooled Cross-Sectional Model. MWI dummy equals 0 before the minimum wage increase and 1 after the increase. The index variable refers to the difficulty of producing the products. Month variable refers to the months starting from 1 for the first month (October). MWI*Month is an interaction term for minimum wage increase and the month. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

Table B.4: Fixed Effect and Pooled Cross-Sectional Model Results- Non-Linear Model

	Overall Effect		Low-Productivity		High-Productivity	
	F-E-M	P-C-S-M	F-E-M	P-C-S-M	F-E-M	P-C-S-M
Dependent Variable:	Perform.	Perform.	Perform.	Perform.	Perform.	Perform.
	(1)	(2)	(3)	(4)	(5)	(6)
November	0.030***	0.030***	0.039***	0.038***	0.023***	0.022***
	(0.004)	(0.004)	(0.008)	(0.008)	(0.003)	(0.003)
December	0.029***	0.028***	0.036***	0.035***	0.022***	0.021***
	(0.004)	(0.003)	(0.006)	(0.006)	(0.002)	(0.002)
January	0.042***	0.043***	0.060***	0.060***	0.022***	0.019***
	(0.003)	(0.003)	(0.007)	(0.006)	(0.003)	(0.003)
February	0.022***	0.021***	0.047***	0.042***	-0.003	-0.007
	(0.001)	(0.001)	(0.004)	(0.004)	(0.003)	(0.004)
March	-0.012**	-0.013**	0.001	-0.001	-0.028***	-0.031***
	(0.004)	(0.004)	(0.007)	(0.007)	(0.003)	(0.003)
Index	-0.056***	-0.055***	-0.074***	-0.045	-0.032***	-0.026***
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
Constant	0.978***	0.465***	1.090***	0.060	0.965***	0.639***
	(0.005)	(0.029)	(0.018)	(0.065)	(0.005)	(0.038)
MLA	No	Yes	No	Yes	No	Yes
Control Variables	No	Yes	No	Yes	No	Yes
Observation	10398	10398	5053	5053	5345	5345
R-squared	0.55	0.33	0.40	0.23	0.37	0.30

Standard errors clustered by day level are in parentheses. *p<0.10, **p<0.05, ***p<0.01. The first two columns are the results for the overall effects, columns 3 and 4 show the results for the low-productivity workers whereas columns 5 and 6 show the results for the high-productivity workers. Dependent variable is the performance of the workers. F-E-M is an abbreviation for Fixed-Effect Model and P-C-S-M is an abbreviation for Pooled Cross-Sectional Model. There is a dummy for each month except October which is excluded as the reference category. The index variable refers to the difficulty of producing the products. MLA (minimum living allowance) is a categorical variable. Control Variables: Age, sex, experience, age-squared, experience-squared.

Table B.5: Wald Test Results for the Coefficients

	1st Column	2nd Column	3rd Column	4th Column	5th Column	6th Column
Null Hypothesis	p-value	p-value	p-value	p-value	p-value	p-value
November=December	0.716	0.293	0.613	0.464	0.828	0.740
November=January	0.015	0.016	0.012	0.009	0.503	0.243
November=February	0.144	0.079	0.302	0.504	0.000	0.000
November=March	0.000	0.000	0.002	0.002	0.000	0.000
December=January	0.016	0.008	0.006	0.003	0.831	0.586
December=February	0.131	0.081	0.165	0.213	0.000	0.000
December=March	0.000	0.000	0.001	0.001	0.000	0.000
January=February	0.001	0.000	0.040	0.010	0.000	0.000
January=March	0.000	0.000	0.000	0.000	0.000	0.000
February=March	0.000	0.000	0.000	0.000	0.004	0.003

The alternative hypotheses are that the coefficients are different. Each column refers to the results of the model presented on Table B.4. For example, p-values in the 1st column were calculated according to the results in the first column of Table B.4 above.

Appendix C

C.1. Instructions for the Experiment

General Rules (For All Treatments)

You are now taking part in an economic experiment. Please read the instructions carefully since it is critical for the success of the study that you understand the rules of the experiment. You will earn at least £4 (participation fee) when you have finished the experiment – regardless of your performance. Depending on your decisions, you can earn a greater amount of money. Therefore, in order to earn more money, please concentrate during the experiment. If you still do not understand something after having read the instructions carefully, please raise your hand and wait for us to help you.

You are not allowed to interact with other participants for any reason! **You must not use your mobile phone** and you should be silent until you finish the experiment and leave the laboratory. The instructions handed to you are intended solely for your personal information.

Neither your role identity, nor the role identity of other participants will be revealed to any other participant. So please consider everyone in the experiment to be **anonymous**.

The experiment consists of two stages. Firstly, you will be given instructions for the first stage. After everyone reads and understands the rules of the first stage, the first stage of the experiment will be started. When everyone finishes the first stage, a new set of instructions for the second stage will be distributed to the participants. After these new rules about the second stage are understood, the experiment will continue with the second stage. You will be asked some survey questions at the end of the second stage. The first stage and the second stage are independent. It means that your performance in the first stage will not affect anything in the second stage. How much money you earn from the first stage and from the second stage will be calculated at the end of the experiment (when both stages are finished).

During the experiment, instead of pounds (GBP) you will use an imaginary currency, called experimental currency units (ECU). At the end of the experiment (after the

second stage is finished) the computer will determine how much ECU you will earn from the experiment in total. The total amount of ECU you earn in the course of the experiment will be converted into pounds after completion of the experiment. The exchange rate is **70 ECU = 1 pound (GBP).**

It will be calculated as:

The Money You Will Earn from the Experiment= Your earnings for the first stage + Your earnings for the second stage+ Participation fee (£4).

We will explain how your earnings for the first stage and the second stage will be calculated in the instructions you will be given before each stage starts.

If you have any questions please just raise your hand and wait for the assistance. Otherwise, please wait for us to distribute the instructions for the first stage of the experiment.

INSTRUCTIONS FOR THE FIRST STAGE FOR ALL TREATMENTS

The first stage consists of 2 periods and each period lasts 240 seconds. You will undertake an identical task in both periods. This task consists of encoding words into numbers. Each word is a combination of three letters. You have to allocate a number (0-100) to each letter. The encryption code can be found in a table below the corresponding word. Once you encode a word correctly, the computer will prompt you with another word which you will be asked to encode. Once you encode that word, you will be given another word, and so on. Your score in the task will be the number of words encoded correctly within 240 seconds. As an example, the decision screen can be seen in the figure below. **Note that the encryption table during the experiment will be different from the given example**. When you encode a word correctly, the computer will shuffle the position of the letters and assign a new set of random numbers (0-100). It means that you will see different tables as you keep encoding the words.

The screenshot above is the screen you will see in a period. The important information areas are circled on the screenshot. The circle on the left-upper corner shows which period you are in and the circle under this area shows your current score at that moment for that period. You should be aware that your score will be set to **0** before each period starts since all periods are independent. The circle in the right corner shows how many seconds you still have for that period.

As you can see on the screenshot, there are three letters making up a word in the centre of the screen (H, R and U for this example) and one input area under each letter. This is the question part. There is also a table between the arrows under the question part. You are supposed to find the letters on this table, then check the codes under the letters and you should type these codes in the question part.

If you check the question on the screenshot, you will see that the first letter you are asked to encode is H. If you check the table and find the letter H, you can see the code written under H is 59. You should type this code "59" under the letter H in the question part. The second letter you are asked about is R. If you find the letter R in the table, you can see that its code is 19. You should type 19 under R in the question part as well. The last letter in the question word is U. According to the table, its code is 93. You are supposed to type this code under U in the question part. After you finish typing the codes on the screen, you should click the "Next Word" button which is in the bottom right corner. If the codes you submit are correct, then you will be given a new word to encode if you still have time in that period. If one or more of the codes you submit are wrong, you will see a red warning on the screen. You are supposed to try and solve a question until you submit the

correct codes. You cannot pass a question without solving it correctly. You can solve as many questions as you can do in a period/in 240 seconds.

You should be aware of that you will not be able to see or learn other participants' scores in both periods. No other participants will be able to learn of your scores in both periods either.

Payoff Calculation for the Periods of the First Stage

As mentioned in the general rules, during the experiment, instead of pounds (GBP), you will use an imaginary currency, called experimental currency units (ECU). In this section, we will explain how your payoffs for the periods in the first stage will be calculated.

The number of questions you solve in a period will be your score. Each question you solve will provide you 10 ECU as your payoff. For example, if your score is 18 (if you solve 18 questions) in the first period of the first stage, your payoff for this period will be 180 ECU or if your score is 25 then your payoff will be 250 ECU. The calculation of the payoffs will be the same in both periods for the first stage. If you solve 15 questions in the second period, your payoff for the second period will be 150 ECU. As was said before, periods are independent.

Your Earnings From The First Stage

At the end of the experiment (**after the second stage is finished**), the computer will choose a number randomly between 1 and 2 (either 1 or 2) for the first stage. If the computer chooses 1 then everyone is paid whatever their payoffs from the first period are. If the computer chooses 2, then everyone is paid for the first stage whatever their payoffs for the second period are.

Example

1- If your score for the first period is 14 and if it is 28 for the second period, your payoffs will be: 140 ECU for the first period and 280 ECU for the second period. Let's assume that the experiment is finished and the computer chooses the number (1 or 2) in order to calculate the earnings of the participants for the first stage. For this example(with the scores written in this example) if the computer chooses 1 then your earnings from the **first stage** will be 140 ECU or if the computer chooses 2 then your earnings will be 280 ECU for **the first stage**.

If you have any questions please just raise your hand and wait for the assistance.

INSTRUCTIONS FOR THE SECOND STAGE (NO-FEEDBACK TREATMENT)

The second stage of the experiment consists of 6 periods and each period will last 240 seconds. The task is the same as the previous stage. You are supposed to encode the words consisting of three letters and submit the answers on the screen in all 6 periods as you did in the first stage.

There are important differences in this stage, so please read the instructions carefully. In this stage, you will be paired with another participant randomly by the computer before each period starts. Let's call the person you are matched with as "Other Player". **You should know that you will be paired with a different person in each period**.

You will work on the same task (encoding words) in all periods in the second stage as well. However, the payoff calculation will be different compared to the first stage. In the second stage (in all 6 periods) your payoff will not depend only your performance but also other player's performance you are paired. Whoever's performance is better, that participant will get 250 ECU and the other one will get 0 ECU. For example, if your score in the 3rd period is 19 and the other player's 20, then your payoff for the 3rd period will be 0 ECU and the other player's payoff is 250 ECU. Or, if your score in the 6th period is 30 and the other player's score is 29, then your payoff will be 250 ECU and the other player's payoff will be 0 ECU. In order to get 250 ECU payoff, you are supposed to perform better than the other player. **This will be the same for all 6 periods but remember that you will be matched with a different player before each period starts.**

If there is a tie between you and the other player, meaning that if you both solve the same number of questions, then the computer will choose the winner randomly. It means that (for example) if you and the person you are matched will solve 23 questions in the 2nd period, then one of you (between you and the other player) will be chosen as the winner randomly by the computer. If you are chosen as the winner then your payoff will be 250 ECU and the other person's payoff will be 0 ECU. Or, if the other player is chosen as the winner then your payoff will be 0 ECU and the other player's payoff will be 250 ECU.

The screen will be the same as it was in the first stage. All information (which period you are in and the remaining time, your current score, warning message when you submit a wrong answer etc.), which was shown in the periods of the first stage, will be on the screen in all periods of this stage as well. You will learn your payoff at the end of the each period.

Appendix B

In terms of determining the money how much you earn from the second stage, we will use a similar method as the first stage. This time, the computer will choose **three** numbers randomly between 1 and 6. These chosen periods will be valid for everyone. If the computer chooses 1-4-6 then everyone will earn whatever their payoffs from the 1st, 4th and 6th periods. Let's say the computer chooses 3-5-6 and your payoffs for these periods are: 0 ECU for the 3rd period, 250 ECU for the 5th period and 250 for the 6th period. Your earnings **for the second stage** will be 500 ECU (0+250+250).

After the computer determines everyone's total earnings from **the first stage** and **the second stage**, then your total ECU will be converted into the pounds (70 ECU=£1) and will be paid to you at the end of the experiment.

INSTRUCTIONS FOR THE SECOND STAGE (CONTINOUS FEEDBACK TREATMENT)

The second stage of the experiment consists of 6 periods and each period will last 240 seconds. The task is the same as the previous stage. You are supposed to encode the words consisting of three letters and submit the answers on the screen in all 6 periods as you did in the first stage.

There are important differences in this stage, so please read the instructions carefully. In this stage, you will be paired with another participant randomly by the computer before each period starts. Let's call the person you are matched with as "Other Player". **You should know that you will be paired with a different person in each period**.

You will work on the same task (encoding words) in all periods in the second stage as well. However, the payoff calculation will be different compared to the first stage. In the second stage (in all 6 periods) your payoff will not depend only your performance but also other player's performance you are paired. Whoever's performance is better, that participant will get 250 ECU and the other one will get 0 ECU. For example, if your score in the 3rd period is 19 and the other player's 20, then your payoff for the 3rd period will be 0 ECU and the other player's payoff is 250 ECU. Or, if your score in the 6th period is 30 and the other player's score is 29, then your payoff will be 250 ECU and the other player's payoff will be 0 ECU. In order to get 250 ECU payoff, you are supposed to perform better than the other player. **This will be the same for all 6 periods but remember that you will be matched with a different player before each period starts.**

If there is a tie between you and the other player, meaning that if you both solve the same number of questions, then the computer will choose the winner randomly. It means that (for example) if you and the person you are matched will solve 23 questions in the 2nd period, then one of you (between you and the other player) will be chosen as the winner randomly by the computer. If you are chosen as the winner then your payoff will be 250 ECU and the other person's payoff will be 0 ECU. Or, if the other player is chosen as the winner then your payoff will be 0 ECU and the other player's payoff will be 250 ECU.

The screen will be **almost** the same as it was in the first stage. All information (which period you are in and the remaining time, your current score, warning message when you submit a wrong answer etc.), which was shown in the periods of the first stage, will be on the screen in all periods of this stage as well. **However, in this stage, in all 6 periods, you will also see the other player's current score on your screen (it will be written just next to your current score area as "Other Player's Score").** Whenever the other player who is matched with you solves a question, you will be able to see his or her new score on your screen**. On the other side, the other player will also be able to see your score on his or her screen.** You will learn your payoff at the end of the each period.

In terms of determining the money how much you earn from the second stage, we will use a similar method as the first stage. This time, the computer will choose **three** numbers randomly between 1 and 6. These chosen periods will be valid for everyone. If the computer chooses 1-4-6 then everyone will earn whatever their payoffs from the 1st, 4th and 6th periods. Let's say the computer chooses 3-5-6 and your payoffs for these periods are: 0 ECU for the 3rd period, 250 ECU for the 5th period and 250 for the 6th period. Your earnings **for the second stage** will be 500 ECU (0+250+250).

After the computer determines everyone's total earnings from **the first stage** and **the second stage**, then your total ECU will be converted into the pounds (70 ECU=£1) and will be paid to you at the end of the experiment.

INSTRUCTIONS FOR THE SECOND STAGE (BEING OBSERVED ROLE)

The second stage of the experiment consists of 6 periods and each period will last 240 seconds. The task is the same as the previous stage. You are supposed to encode the words consisting of three letters and submit the answers on the screen in all 6 periods as you did in the first stage.

There are important differences in this stage, so please read the instructions carefully. In this stage, **you will be paired** with another participant randomly by the computer before each period starts. Let's call the person you are matched with as "Other Player". **You should know that you will be paired with a different person in each period**.

You will work on the same task (encoding words) in all periods in the second stage as well. However, the payoff calculation will be different compared to the first stage. In the second stage (in all 6 periods), your payoff will not depend only on your performance but also on the other player's performance you are paired. Whoever's performance is better, that participant will get 250 ECU and the other one will get 0 ECU. For example, if your score in the 3rd period is 19 and the other player's is 20, then your payoff for the 3rd period will be 0 ECU and the other player's payoff will be 250 ECU. Or, if your score in the 6th period is 30 and the other player's score is 29, then your payoff will be 250 ECU and the other player's payoff will be 0 ECU. In order to get 250 ECU payoff, you are supposed to perform better than the other player. **This will be the same for all 6 periods but remember that you will be matched with a different player before each period starts.**

If there is a tie between you and the other player, meaning that if you both solve the same number of questions, then the computer will choose the winner randomly. It means that (for example) if you and the person you are matched will solve 23 questions in the 2nd period, then one of you (between you and the other player) will be chosen as the winner randomly by the computer. If you are chosen as the winner then your payoff will be 250 ECU and the other person's payoff will be 0 ECU. Or, if the other player is chosen as the winner then your payoff will be 0 ECU and the other player's payoff will be 250 ECU.

The screen will be the same as it was in the first stage. All information (which period you are in and the remaining time, your current score, warning message when you submit a wrong answer etc.), which was shown in the periods of the first stage, will be on the screen in all periods of this stage as well. **However, in this stage, in all 6 periods, the other player will see your current score on his or her screen.** Whenever you solve a question, he or she will be able to see your new score on his or her screen**. On the other hand, you will not be able to see the other player's score on your screen**. The other player who is matched with you will know that you are not able to see his or her current score on your screen during the periods. You will learn your payoff at the end of the each period.

In terms of determining your earnings from **the second stage**, we will use a similar method as the first stage. This time, the computer will choose **three** numbers randomly between 1 and 6. These chosen periods will apply everyone. For example, if the computer chooses 1-4-6 then everyone will earn whatever their payoffs from the 1st, 4th and 6th periods. Let's say the computer chooses 3-5-6 and your payoffs for these periods are (for example): 0 ECU for the 3rd period, 250 ECU for the 5th period and 250 for the 6th period. Your earnings **from the second stage** will be 500 ECU (0+250+250).

After the computer determines everyone's total earnings from **the first stage** and **the second stage**, then your total ECU will be converted into pounds (70 ECU=£1), which will be paid to you at the end of the experiment.

At the end of the second stage, you will be asked some survey questions before you learn your earnings from the experiment. Your answers for the survey questions will **not** affect your earnings.

INSTRUCTIONS FOR THE SECOND STAGE (OBSERVER ROLE)

The second stage of the experiment consists of 6 periods and each period will last 240 seconds. The task is the same as the previous stage. You are supposed to encode the words consisting of three letters and submit the answers on the screen in all 6 periods as you did in the first stage.

There are important differences in this stage, so please read the instructions carefully. In this stage, you will be paired with another participant randomly by the computer before each period starts. Let's call the person you are matched with as "Other Player". **You should know that you will be paired with a different person in each period**.

You will work on the same task (encoding words) in all periods in the second stage as well. However, the payoff calculation will be different compared to the first stage. In the second stage (in all 6 periods), your payoff will not depend only on your performance but also on the other player's performance you are paired. Whoever's performance is better, that participant will get 250 ECU and the other one will get 0 ECU. For example, if your score in the 3rd period is 19 and the other player's is 20, then your payoff for the 3rd period will be 0 ECU and the other player's payoff will be 250 ECU. Or, if your score in the 6th period is 30 and the other player's score is 29, then your payoff will be 250 ECU and the other player's payoff will be 0 ECU. In order to get 250 ECU payoff, you are supposed to perform better than the other

player. **This will be the same for all 6 periods but remember that you will be matched with a different player before each period starts.**

If there is a tie between you and the other player, meaning that if you both solve the same number of questions, then the computer will choose the winner randomly. It means that (for example) if you and the person you are matched will solve 23 questions in the 2nd period, then one of you (between you and the other player) will be chosen as the winner randomly by the computer. If you are chosen as the winner then your payoff will be 250 ECU and the other person's payoff will be 0 ECU. Or, if the other player is chosen as the winner then your payoff will be 0 ECU and the other player's payoff will be 250 ECU.

The screen will be **almost** the same as it was in the first stage. All information (which period you are in and the remaining time, your current score, warning message when you submit a wrong answer etc.), which was shown in the periods of the first stage, will be on the screen in all periods of this stage as well. **However, in this stage, in all 6 periods, you will also see the other player's current score on your screen (it will be written just next to your current score area as "Other Player's Score").** Whenever the other player who is matched with you solves a question, you will be able to see his or her new score on your screen**. On the other hand, the other player who is matched with you will not be able to see your score on his or her screen**. The other player will know that you will see his or her current score on your screen. You will learn your payoff at the end of the each period.

In terms of determining your earnings from **the second stage**, we will use a similar method as the first stage. This time, the computer will choose **three** numbers randomly between 1 and 6. These chosen periods will apply everyone. For example, if the computer chooses 1-4-6 then everyone will earn whatever their payoffs from the 1st, 4th and 6th periods. Let's say the computer chooses 3-5-6 and your payoffs for these periods are (for example): 0 ECU for the 3rd period, 250 ECU for the 5th period and 250 for the 6th period. Your earnings **from the second stage** will be 500 ECU (0+250+250).

After the computer determines everyone's total earnings from **the first stage** and **the second stage**, then your total ECU will be converted into pounds (70 ECU=£1), which will be paid to you at the end of the experiment.

At the end of the second stage, you will be asked some survey questions before you learn your earnings from the experiment. Your answers for the survey questions will **not** affect your earnings.

EXAMPLES FOR THE SECOND STAGE GIVEN IN ALL TREATMENTS

1-If your score for the 2nd period is 23 and the other player's (you are matched with) is 19 then your payoff will be 250 ECU whereas his or her payoff will be 0 ECU for the second period.

2- Please check the table below:

Period	Your Score	Other Player's Score	Your Payoff	Other Player's Payoff
1	15	21	0 ECU	250 ECU
2	29	15	250 ECU	0 ECU
3	8	13	0 ECU	250 ECU
4	23	27	0 ECU	250 ECU
5	19	19	If the computer chooses you: 250 ECU Otherwise: 0 ECU	If the computer chooses you: 0 ECU Otherwise: 250 ECU
6	25	14	250 ECU	0 ECU

Let's assume your scores and the other players' scores are like the table above. At the end of the experiment, if the computer chooses 2nd, 4th and 6th periods for the payment, then your earnings from the second stage will be: 250+0+250=500 ECU.

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