

Determinants and benefits of unpaid overtime

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Abstract

While the amount of unpaid overtime hours has increased over the past decades, the potential future benefits and determinants of unpaid overtime have not yet been convincingly established. This study supplements previous findings on the relation between unpaid overtime and both income and promotion, and tests in mostly new ways the fitness of three of the theories explaining unpaid overtime, being human capital, gift exchange and deferred compensation. Using data from the Dutch labor supply panel for the years 2006-2010, the regressions show a positive and significant relation between unpaid overtime and income, which disappears after controlling for individual heterogeneity. The relation between unpaid overtime and promotion is ambiguous. Unpaid overtime seems positively correlated with promotion, whereas the lag of unpaid overtime is negatively related, both without compelling significance levels. Regarding the determinants of unpaid overtime, the analysis shows no support for the deferred compensation theory, whereas the gift exchange theory and human capital theory both seem fairly substantiated by the data.

Keywords: Unpaid overtime, gift exchange theory, deferred compensation theory, human capital theory.

1. Introduction

Unpaid overtime is a widely adopted phenomenon in most industrialized countries. For many workers, overtime is inherent to their job. A report in 2009 by the Dutch Central Statistical Office showed that 38% of Dutch employees work overtime, of which 36% received no compensation for these extra hours (“Iets Minder Overwerk,” 2009). Similar figures are seen in for example Germany (Anger, 2005) and the UK (Campbell, 2002). A natural question that comes to mind is: why do people work longer than they have agreed upon, especially if it is unpaid? While unpaid overtime might be considered of minor importance when looking at a firm’s total labor costs, Hart (2004) states that in fact it constitutes a quantitatively important labor market phenomenon, both for employers and employees. Hence, it is important to establish whether working unpaid overtime increases future payoff like higher income or promotion, hereafter called the investment character of unpaid overtime. Second, it is also important to know what mechanisms drive workers to perform unpaid work. In this paper, overtime is defined as working longer hours than the regular hours the employee contractually agreed upon. In case of paid overtime, the employee receives a monetary reward for the additional hours, mostly including a premium. Unpaid overtime, on the other hand, is not compensated by any reward.

The existing empirical literature on unpaid overtime is not conclusive. Several studies empirically confirmed the investment character of unpaid overtime, yet other studies failed to find any significant effects of working unpaid hours on future benefits. For example, Anger (2005) and Van der Meer & Wielers (2015) found no effect of unpaid overtime on future wage and layoff levels, while on the other hand Pannenberg (2005) and Campell & Green (2002) found significant (long-term) wage increase effects after unpaid overtime. Booth et al. (2003) only found support for unpaid overtime influencing promotion probabilities.

In this paper I will study the investment character and determinants of unpaid overtime in the Netherlands by using panel data for the period 2006-2010. The investment character will be analyzed by applying both pooled OLS and Fixed Effects to model the relation between unpaid overtime and future payoff, where future payoff is subdivided in hourly income and promotion. The theories that will be analyzed to find the determinants of unpaid overtime are human capital theory, deferred compensation theory and gift exchange theory. The focus on the Netherlands is mainly because most past research that did study unpaid overtime focused on Germany (Anger, 2005; Anger, 2008; Pannenberg, 2005) and the UK (Bell & Hart, 1999; Booth, 2003; Campbell, 2002). The one study of unpaid overtime in the Netherlands (Van der

Meer & Wielers, 2015) focused on backward-ward looking incentives and left much room for more studies. Almost all past research used data from the nineties, hence more recent data will be a relevant addition. Furthermore, the three theories that will be tested have not yet been solidly confirmed or rejected. Hence, more studies are warranted, and new methods with different datasets can help to shed light on the causes of unpaid overtime.

The rest of this paper will proceed as follows. Section 2 gives an overview of the presence of unpaid overtime in the Netherlands. Section 3 provides a description of the three theories on unpaid overtime that will be analyzed, being deferred compensation, gift exchange and human capital. Section 4 describes the dataset that will be used in the analysis, together with some descriptive statistics. After this, section 5 presents the analysis and the results, where subsequently the investment character of unpaid overtime and the three different theories will be tested. Finally, section 6 is the conclusion, which summarizes the findings, discusses the limitations, and provides suggestions for further research.

2. Unpaid overtime in the Netherlands

In order to put this research in academic perspective, this section will elaborate on how unpaid overtime work has evolved in the past decades. This is relevant as most studies into unpaid overtime have looked at datasets roughly from 1990 to 1998, while this research focuses on 2006-2010. In the Netherlands, as in most countries, the practice of paid and unpaid overtime has increased significantly in the past decades. Delsen (2001) identifies three reasons for this increase.

First, the Netherlands enacted the *Arbeidstijdenwet* [Working Time Act] in 1996, which led to a range of new regulation on, among others, overtime. Working hours were restricted to eight hours a day and forty hours a week. Some stretch in these hours was provided by giving some leeway to collective agreement negotiations, leading to a maximum of ten working hours a day and 200 hours per four weeks. Additionally, the *Winkeltijdenwet* [Shopping Hours Act] 1996 extended the opening hours of stores, which was not received well by the affected employees. Hence, these employees received compensation in the form of shorter and flexible contracts, which resulted in the fact that between 1994 and 1998, many collective agreements agreed upon a shorter workweek of 36 hours. This mandatory restriction of the work week also meant that some overtime rules for the incumbent personnel expired, which was in practice often substituted for unpaid overtime hours. Hence, these two reforms resulted in an increase of (mostly) unpaid overtime work (Delsen, 2001). Second, the Shopping Hours Act 1996 also decentralized collective bargaining to the firm level, aiming for more customized labor

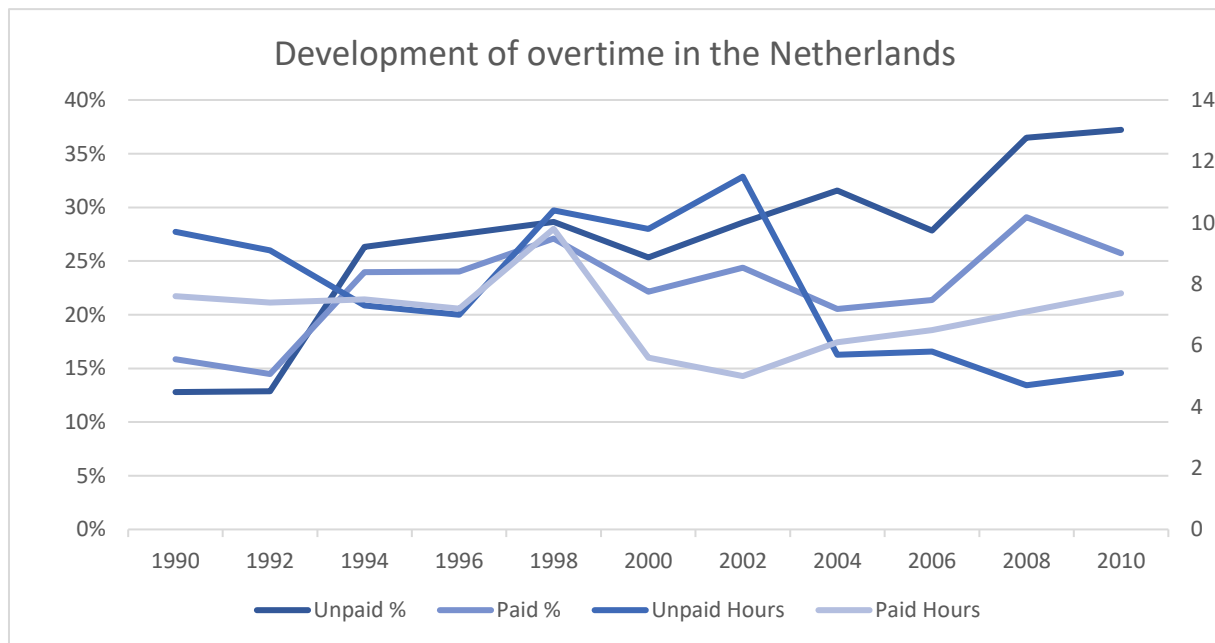
agreements between firms and its workers. As such, decentralization implies increased negotiations between employer and employee, which led to higher recruitment costs for firms. As a consequence, companies tried to minimize these costs by maximizing work hours per employee, which pressured employees into more unpaid overtime work. Moreover, the reduction in working hours that came with the *Arbeidstijdenwet* resulted in shorter than optimal working hours from the perspective of the employee, which increased the room for working overtime. Third, Delsen (2001) notes that the quality of work became increasingly harder to measure. This led firms to use the propensity to work overtime hours as an important selection criterion. Hence, working overtime became more and more a prerequisite for employees.

A fourth reason is provided by Poutsma, Ligthart & Veersma (2006), who attribute the increase in overtime to a change in the compensation system in the Netherlands and other western countries. Compensation schemes used to be governed by backward-looking incentives, in which an employee reciprocates favorable behavior of the employer (such as a wage increase) by putting in more effort. However, in the past decades this has changed to forward-looking incentives, where the employer promises a reward in the future, if the employee increases current effort. Hence, where emphasis used to be on intrinsic motivation via membership of the firm and loyalty to the employer, performance pay schemes were redirected to increase effort focusing on extrinsic motivation. As a consequence, employees were incentivized to work more (unpaid) overtime hours, to increase their future payoffs.

Figure 1 shows how paid and unpaid overtime has developed from 1990 to 2010, calculated from the Labor Supply Panel. The difficulty with searching for trends in unpaid overtime is that it is not officially documented. While firms keep track of paid overtime hours, the amount of unpaid overtime hours are only revealed in surveys like the OSA labor supply panel used in this analysis. However, this dataset does reveal some patterns. The graph shows that the share of people who perform unpaid overtime steadily increased from around 15% 1990, to almost 40% of the working people in the sample in 2010. The share of people doing paid overtime increased from 15% to roughly 25%, but this increase is less significant. Interestingly, the average amount of unpaid overtime decreased significantly from almost 10 hours to about 5 hours per week. It is unclear whether the 'incumbent' respondents gradually decreased working unpaid hours, or that the decrease in unpaid hours is caused by additional respondents working less unpaid hours on average. Data attrition precludes a definitive conclusion, as for instance, only 47 respondents who started in the 1990 wave were present in

the 2010 wave. For paid overtime hours, on the other hand, there is no trend.

Figure 1 Development of overtime in the Netherlands 1990-2010



3. Theories on unpaid overtime

Economic scholars have come up with several theories that provide an economic rationale for the practice of unpaid overtime. Surprisingly, unpaid overtime first received academic attention only some 20 years ago, when Bell & Hart (1999) empirically tested the impact of unpaid hours on hourly earnings. Before that, only paid overtime was studied, as there was no data on unpaid overtime available. The increased popularity of work-related surveys eliminated this problem (Zapf, 2015). Since then, multiple theories have been tested in multiple countries, but the results are inconclusive. Although the number of theories on unpaid overtime coined in these papers is no less than nine¹, three of them are arguably the most important yet relatively little studied. In this section, these three theories will be discussed.

¹ The other theories being: *Signaling*, which assumes that workers perform unpaid overtime to signal their high ability to their employer. *Pareto Improvement*, where for example laws impose inefficiently high overtime compensation, leading employers and employees to negotiate more unpaid overtime to compensate the increased costs for employers. Thus, increased overtime premiums are weighted by increased unpaid overtime, which leads to an efficient outcome. *Uncertainty over task completion*, where workers might have to work unpaid hours to finish a task, if such task is rewarded per output instead of per hour. *Auctions*, where employees make bids for the required time to complete a task, might lead less productive workers to under-bid how long they need, and complement that with unpaid work. *Leadership roles* might induce a manager to work unpaid hours to finish the task of a less productive worker. See Papagiannaki (2009) for an extensive overview of these theories.

Deferred Compensation

The theory of deferred compensation suggests that unpaid overtime hours are an investment in future benefits like increased wages and/or promotions. Deferred compensation was first coined by Lazear (1979), who modelled incentive provisions in a principal-agent relationship. Optimal incentive contracts are specified in such a way that workers earn less than their marginal product at the start of one's career, and above their productivity later on in their career. In this way, workers are incentivized to work hard at the start of their career, to ensure that they stay in the firm and reap the benefits of their effort. Related to this is the incentive created by performance pay schemes. Firms only care about higher output, not about the amount of hours worked needed to complete a task. Hence, employees are induced to work overtime hours to secure the extra compensation, like bonuses or stock options (Prendergast, 1999).

If this deferred compensation argument holds, present and future are substitutes in economic sense, as a worker will eventually always be rewarded for working longer hours. Pannenberg (2005) therefore states that unpaid overtime is in fact not the correct term for this phenomenon, as working longer than strictly necessary will always pay off.

Human Capital

The human capital theory concerns activities that can impact future earnings by investing resources in people. Using this theory, developed by Becker (1962), paid and unpaid overtime hours can be seen as an extra investment in firm-specific human capital. This extra human capital is obtained by either improving existing skills, or developing new skills during the additional work hours. This leads to a higher productivity, which might result in turn in future wage increases or promotions (Bell & Freeman, 2001). As firms also benefit from firm-specific human capital, employers and employees both might want to encourage longer working hours. An implication of this theory is that unpaid overtime should be most prominent in the early phase of a worker's career and when the worker starts at a new firm.

Gift Exchange

In contrast with the previous three theories, the gift exchange theory presumes backward-looking incentives. The central notion is that instead of being incentivized by a possible future wage increase or promotion, employees put in effort to reciprocate gifts received from the employer. Examples of such gifts are an above average wage rate (Akerlof, 1982), or the decision itself to recruit an employee, who subsequently puts in high levels of effort to reciprocate the employer (Williamson, 1985). The true effects of the gift exchange theory might

be undermined, because forward-looking incentives may crowd out any potential backward-looking incentives. According to Frey (1997), if a worker both experiences high intrinsic and extrinsic motivation, it is rational to lower the motivation that is under his control, which is intrinsic motivation. According to this gift exchange theory, the job design of employees who work unpaid overtime must have some notable feature that is distinguishable from similar employees who do not perform unpaid overtime work.

Critique

The aforementioned theories all have some explanatory deficiencies, which will be shortly elaborated on. A strong argument against both the deferred compensation theory and the human capital theory is that while both theories presume that unpaid overtime eventually always pays off, there are many workers who, in practice, are not compensated for their unpaid hours. Especially in case of a promotion, there is only a limited amount of workers who eventually get promoted. Hence, the majority of the workers receives nothing, despite the already performed unpaid hours. This would still be in line with economic reasoning if the unpaid hours pay off in expected terms rather than the eventual outcome. However, Papagiannaki (2009) argues that unpaid overtime is nowadays often done by a large share of employees in a given firm, which makes it unlikely that working unpaid overtime has a positive expected value in general.

A second argument is that empirical research has shown that unpaid overtime not only occurs at the start of one's career or new job, but is also prominent among experienced workers; see for example Pannenberg (2005) and Anger (2005). This is contrary to what the human capital theory and deferred compensation theory implies, namely that in order to benefit from unpaid hours, a worker should do so especially at the start of his career. Regarding the gift exchange theory, one can argue that the term gift exchange is inappropriate. If an employer increases his employee's wage to induce him to work extra hours, there is no question of a gift, and it might as well be formalized in the employment contract. Furthermore, gift exchange does not explain why unpaid overtime is more prominent at higher-level jobs, as reciprocal gifts are not bound to a specific job type.

4. Data

Sample Description

The data used for the empirical analysis comes from the OSA labor supply. This is a biennial series of panel datasets, and captures a representative sample of the Dutch population using surveys. The sample consist of approximately 5,000 respondents per wave, in the age of 16-64.

Due to inevitable data attrition, every wave comprises the original respondents plus additional sampling, where individuals are sought who match the dropped respondents. Van der Meer & Wielers (2015) tested for selective attrition in the OSA data set, but concluded that individuals present in at least two waves of the survey could not be considered a selective sample of all individuals. This strongly reduces this concern for the analysis.

The research will focus on the 2006, 2008 and 2010 waves, with 5,563, 5,139 and 4,872 respondents respectively. These are the most recent years available, and this distinguishes this paper from other papers, as those mostly focused on the years 1990-1998. Extending the dataset to include more waves is not desirable for two reasons. First, due to data attrition, the reduced sample size of respondents present in four or more waves would significantly decrease the power of the regressions. Second, most studies that found support for the investment character of unpaid overtime focused on the short term, which is also supported by economic theory (Anger, 2005). Self-employed persons and cooperating partners were excluded from the sample. Furthermore, only respondents present in at least two waves were kept in the sample. Some studies focused only on full-time workers, but part-time workers are kept in the sample for two reasons. First, part-time workers constitute a high part of the labor force in the Netherlands, more than other western countries who have been researched regarding overtime. Excluding them would therefore not be an accurate depiction of the Dutch labor force, and would only decrease the power of the analysis. Second, unlike some previous studies stated, part-time workers do perform unpaid overtime, albeit on average less than full-time workers (“Mannen en voltijders”, 2011). This leads to a total of 5,187 individual-year observations, which amounts to 1,729 observations per wave.

Descriptive Statistics

While the section on overtime in the Netherlands presented a general overview of overtime in the past 20 years, in this part I will present the 2006-2010 dataset used in the analysis more in-depth. Table A1 of the appendix displays summary statistics for the variables used in the model. The respondents are on average 45 years old, ranging from 16 to 66. Approximately 7% is younger than 30, while 21% is older than 55, revealing a somewhat imbalance between younger and older workers. Almost three-quarter is married, 12% is single, while the remainder of the respondents either cohabitates or is divorced. Strikingly, 48% of the respondents work part-time, working on average 23 hours a week. The three most prominent sectors in the sample are health & welfare, business services and education, with 23%, 16% and 12% respectively. Average tenure is 12 years, and average tenure in the same function is 7 years. In terms of

education, the largest share is vocational education with 40%, followed by college and secondary education, with 38% and 22% respectively. Figure A2 of the appendix shows the distribution of unpaid overtime hours. The majority of the respondents indicated zero unpaid overtime hours, the majority of respondents working unpaid overtime worked 1-10 hours, and there are two small spikes at 15 and 20 hours. Due to this censored distribution, the analysis of the determinants of unpaid overtime will make use of a Tobit model.

Figure A2 of the appendix shows the amount of unpaid overtime hours for different values of the variables present in the model. Except for age, these variables are categorized by two quantiles. Age appears to be mildly positively correlated with unpaid overtime hours, as the group of 48-64 years old respondents work almost one hour unpaid overtime more than the 16-32 group. This can be seen as a preliminary hint that the human capital theory might not be valid to explain unpaid overtime entirely, as this theory presumes that workers specifically work unpaid hours at the start of their career, to later on reap benefits from it. The amount of contracted hours is, as expected, positively correlated with unpaid overtime hours. This figure also shows that, albeit less than fulltime workers, part-time workers do perform unpaid overtime, justifying the inclusion of part-time workers in the sample. Interestingly, unpaid overtime negatively correlates with tenure in the same function, from 2.1 hours for tenure less than two years, to 1.6 hours for tenure longer than 7 years.

Education seems to be an important determinant of working unpaid hours, as unpaid overtime hours increase from 0.8 in case of secondary school, to 3 hours for respondents having attended college. Next, gender appears to be a relevant determinant as well. Overall, women work 1.2 unpaid overtime hours per week, while this is 2.6 hours for men. This difference becomes more pronounced for managers. Men and women taken together, managers perform significantly more unpaid overtime than non-managers, especially so the more employees they manage. Interestingly, the difference in unpaid hours between men and women increases, the more employees they manage. From a difference of 1.3 hours for a manager of less than 5 employees, gradually moving to a difference of 3 more unpaid overtime hours for a male manager of more than 50 employees.

Table A2 of the appendix displays the average amount of unpaid overtime hours per sector. Based on an average of 1.9 hours, four sectors stand out. With 4 hours, education has by far the largest average amount of unpaid overtime hours. The sectors agriculture, health & welfare and transport exhibit significantly less unpaid overtime, with around 1 hour average. These differences can be partly explained by job level/education and part-time differences, two relevant determinants of working unpaid overtime (Bell & Freeman, 2001). For example,

agriculture and transport both have a below average education and job level score, while respondents working in the health & welfare sector tend to work part-time, 77% of this sector, contrary to the sample average of 48%. Respondents working in the sector education, on the other hand, have a much higher average job level and education, despite also having an above average share of part-time workers.

5. Analysis

The analysis consists of two parts. In the first part, the investment character of overtime will be tested, by looking whether and how unpaid overtime and future payoff (wage and promotion) are related. After this, the second part will consist of investigating the reasons for the apparent presence of unpaid overtime. This will be carried out by testing the three previously described theories, being deferred compensation, human capital and gift exchange.

Investment character of unpaid overtime

First, to estimate how unpaid overtime and future payoff are related, both a pooled OLS model and a fixed effects (FE) model will be applied, according to the following specification:

$$Payoff_{i,t} = \beta_0 + \beta_1 Unpaidovh_{i,t} + \beta_2 Unpaidovh_{i,t-1} + \beta_j X_{j,i,t} + \varepsilon_{i,t}$$

where Payoff equals IncHour in the first specification and Promotion in the second. IncHour and Promotion are the log of net hourly income and whether a promotion has been received, respectively. The main variables of interest are unpaid overtime hours and the lag of unpaid overtime hours, which corresponds to the two years earlier wave. Unpaid overtime is a self-reported average of weekly unpaid overtime hours in the past year. X_j comprises all explanatory variables, being standard human capital variables and other relevant variables. The human capital variables are experience, job experience and education. Education is measured using the SOI-2006 first digit, ranging from 2 (primary school) to 7 (university). Experience measures since how long a respondent has a paid job, while job experience measures how long the respondent works at the current job at the current firm. The other control variables are firm size, contracted hours, children, year, and dummy variables for gender, CLA status and firm sector. These are the predominant control variables used in similar studies (Anger, 2005; Bell & Hart, 1999; Sousa-Poza & Ziegler, 2003; Campbell & Green, 2002). The standard errors are clustered around the individual identification number, which helps to satisfy the assumption of independent observations. β_0 , β_1 , β_2 , and β_j are the parameters to be estimated. A positive and significant β_1 and β_2 coefficient would be supportive of the investment character of unpaid

overtime.

Both a pooled OLS model and a FE model will be used, with both models providing complementary interpretations. To test the usefulness of a fixed effects model versus a random effects model, table A3 of the appendix shows the result of the Hausman test. The null hypothesis that the efficient coefficients from the random effects model are the same as the consistent coefficients from the fixed effects model is firmly rejected. Hence, fixed effects will be the preferred specification. Pooled OLS will provide the baseline model, to be contrasted with the stricter FE model. The FE model allows to eliminate unobserved individual heterogeneity that might have a correlation with explanatory variables of the model. In this analysis specifically, this means that the FE model only looks at the variation in unpaid overtime and future benefits within respondents, not between respondents. In this way, FE fully utilizes the panel structure of the data. The model also includes time fixed effects to control for unobserved time-varying characteristics not specific to one individual. Unfortunately, this means that the age variables must be excluded from the specification due to perfect collinearity. However, a regression with age instead of time fixed effects does not change the coefficients of interest.

Unpaid overtime and income

The first column of table 1 displays the results of the first regression, where the dependent variable is net hourly income. Both unpaid overtime and the lag of unpaid overtime are positively and significantly correlated with hourly income. This outcome is in line with the notion of the investment character of unpaid overtime. A one-hour increase in unpaid overtime corresponds to a 0.6% increase in hourly wage, while an extra hour of unpaid overtime two years earlier corresponds to a 1% increase in hourly wage, holding all other variables constant. Both coefficients are significant at the 0.01 level. In line with economic theory, education has the highest correlation with income. Most coefficients have their expected sign, only the negative sign of work hours is notable. The raw correlation coefficient between hours worked and hourly income, however, has the expected positive sign. This difference can be explained by the relatively large proportion of part-time workers in the sample, of which the majority is female. These workers have a comparable education and job level as the average of the full-time workers, which explains why their hourly income is relatively high. Hence, the relation between hourly income and hours worked becomes less distinctive.

Table 1 Unpaid overtime and hourly income

VARIABLES	(1) Pooled OLS	(2) Fixed Effects
Unpaidovh	0.00635*** (0.00156)	0.000171 (0.00228)
Unpaidovh, t-1	0.0100*** (0.00166)	-0.00107 (0.00296)
Tenure	0.00460*** (0.000711)	-0.000525 (0.00141)
Experience	0.00514*** (0.000698)	-0.00221 (0.00162)
TenureFunction	-0.00292*** (0.000758)	-0.00153 (0.00130)
HoursContract	-0.00290*** (0.000785)	-0.0219*** (0.00232)
Children	0.0155*** (0.00432)	-0.0101 (0.0113)
Year 2010	0.0149** (0.00639)	0.0495*** (0.00641)
Firm Size	YES	YES
Sector	YES	YES
Education	YES	YES
Constant	2.211*** (0.0878)	3.337*** (0.145)
Observations	2,764	2,764
R-squared	0.381	0.221
Individual FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The second column displays the regression output of the FE model, which clearly shows the difference regarding both coefficients and significance. An hour increase in unpaid overtime now corresponds to a mere 0.01% increase in hourly income, and a 0.1% decrease in hourly income for the lag of unpaid overtime. However, both coefficients are highly insignificant, with a p-value of around 0.65. Education and contracted hours are the only significant variables in this model.

This discrepancy between pooled OLS and FE is relevant to discuss. One factor that partly explains the insignificance of the FE model is the fact that the within variation of unpaid overtime and other variables is not as big as the between variation. This increases the p-value, as FE exploits the variation within individuals specifically. More relevant to the discussion, however, is the suggestion that unpaid overtime in itself does not increase income. Fixed effects removes time-invariant individual characteristics, while these are still present in the pooled

OLS model. Hence, the insignificant FE model compared to the significant pooled OLS model suggests that both unpaid overtime and income might be caused by some characteristics that do not change over time, for example ability or work ethic. This shows that merely working unpaid overtime aiming to increase income might not be the correct mechanism to achieve this. Applied to for example the signaling theory, this suggests that low-ability workers cannot successfully signal high ability by simply working unpaid hours. The second part of the analysis will delve deeper into the motives for unpaid overtime.

These results correspond partly to the findings in previous literature. Regarding the effect on income, this study showed a positive and significant correlation between unpaid overtime and income, which changed to highly insignificant when individual heterogeneity was corrected for. This is very much in line with the findings of Anger (2005), who used German data. It differs, however, from another German study (Pannenberg, 2005) and two Great Britain studies (Francesconi, 2001; Booth et al., 2003), who all found persistent positive effects, even after controlling for individual heterogeneity. A Dutch study by Van der Meer & Wielers (2015) found no evidence at all for the investment character of unpaid overtime. The difference with Pannenberg (2005) might be explained by the different time horizon of ten years and the restricted sample of only workers who stayed in their firm during those ten years. A reason for the differing results with Francesconi (2001) and Booth et al. (2003) is that both studies used random effects panel estimators, which do not allow the individual specific effect and other independent variables to be correlated. In addition, an extensive comparative study by Bell et al. (2000) showed that the incidence of unpaid overtime in the UK is significantly higher than in countries in continental Europe like Germany and the Netherlands. Three times as many workers in the UK claim to work unpaid overtime compared to Germany. The authors argue that the strong collective bargaining institutions in Germany (and in the Netherlands as well) can explain this difference to a large extent. This high occurrence of unpaid overtime in the UK can also partly explain the significant results of these British studies.

Unpaid overtime and promotion

Table 2 shows the regression output of the model with promotion as the dependent variable. As promotion is a binary variable, this model will be estimated applying logistic regression. Logit is preferred over probit, to be able to apply fixed effects. Also, the coefficients can now be easily translated in the log-odds ratio. The results in the first column, which displays the standard logistic regression, show that both unpaid overtime and the lag of unpaid overtime are significantly related to the probability to receive a promotion. A one hour increase in unpaid

overtime corresponds to a 7.7% increase in the odds of being promoted, whilst this is a 6.1% decrease for the lag of unpaid overtime. This difference might be explained by the timing of the promotion. Respondents answer questions based on the last two years, hence it could well be that workers who received a promotion early on in those two years increased their unpaid overtime during that same wave. Unfortunately, the dataset has no precise information on that. This would explain why unpaid overtime and promotion is positively correlated, while the lag of unpaid overtime has a negative association. This would imply that the lag of unpaid overtime is a more reliable variable to use to analyze the relationship with promotion probability. Some explanatory variables are worth mentioning. Tenure is significantly and negatively associated with the probability to get a promotion.

The second column shows the results of the conditional fixed effects logistic regression. Important to note is that for this regression many observations were dropped because such fixed effects logistic regression models depend on there being variation within the dependent variable. As the large majority of the sample did not receive a promotion in these time periods, those respondents are automatically dropped. This reduces the sample size to around 270 observations. The table shows that unpaid overtime is negatively correlated with promotion probability, but the correlation is highly insignificant. Of interest, however, is the fact that the lag of unpaid overtime is significantly correlated with promotion probability. A one-hour increase in unpaid overtime two years ago corresponds to a 15.6% decrease in the odds to be promoted, holding the other variables constant. This is in line with the pooled logistic regression, which has a somewhat lower coefficient. Apart from the lag of unpaid overtime, no other variable in the model is significant.

Table 2 Unpaid overtime and promotion

VARIABLES	(1) Pooled Logistic	(2) FE Logistic
Unpaidovh	1.077*** (0.0216)	0.998 (0.0608)
Unpaidovh, t-1	0.939** (0.0231)	0.844** (0.0653)
Tenure	0.979*** (0.00716)	1.003 (0.0468)
HoursContract	1.035*** (0.0104)	1.078 (0.0765)
Children	1.061 (0.0625)	0.691 (0.269)
CLA	0.565*** (0.0959)	0.653 (0.340)
10.year	0.842 (0.119)	0.893 (0.177)
Firm Size	YES	YES
Education	YES	YES
Constant	0.0485*** (0.0559)	
Observations	2,780	272
Individual FE	YES	YES
Year FE	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To summarize, unlike with income, the relation between unpaid overtime and promotion is rather ambiguous. However, the pooled logit and FE logit tend to display a negative link between unpaid overtime and promotion, albeit not a strong one. This result differs from some past empirical papers. Bell & Freeman (2001) and Francesconi (2001) found that greater hours worked increases the likelihood of a promotion, while Anger (2005) found a marginal positive such effect for a small subset of his sample. While a negative link between unpaid overtime and promotion may seem counterintuitive, Bell & Hart (1999) argue that less able workers might need more time to complete tasks and thus perform more unpaid overtime. Hence, this could explain the inverse relation between unpaid overtime and promotion, as low ability workers are less likely to be promoted.

The determinants of unpaid overtime

This paragraph presents the analysis of the three theories explaining unpaid overtime. Now that the previous regressions showed some support for the investment character of unpaid overtime, the focus is now on which mechanism might underlie this relation. Since a substantial proportion of the respondents report zero unpaid overtime, OLS would be inappropriate due to the censored dependent variable. Hence, these theories will be tested using a pooled Tobit model, where the explanatory variables influence both the probability of zero outcomes and the quantity of the non-zero outcomes. The model then is as follows:

$$Unpaidovh_{i,t}^* = \beta_0 + \beta_j Z_{j,i,t} + \varepsilon_{i,t}$$

where *Unpaidovh* is the latent amount of unpaid overtime hours per week for individual *i*, $Z_{j,i,t}$ a vector of explanatory variables *j* for individual *i*, β_0 the constant, β_j a vector of coefficients and $\varepsilon_{i,t}$ the error term, all at time *t*. The explanatory variables are based on the specification of Bell & Hart (1999). Included are variables on age, education, tenure, marital status, children, gender, firm size, firm sector, manager, union status and contracted hours. Section III advanced three theories that can explain unpaid overtime hours. These theories will be tested with the following hypotheses.

First, the gift exchange theory postulates that employees reciprocate gifts received from the employer by performing unpaid overtime hours. Hence, this suggests that employees who are satisfied with their wage should be working more unpaid overtime hours than other employees. This will be tested by including a wage satisfaction variable, where there should be a positive correlation between this variable and unpaid overtime. Furthermore, a dummy variable being 1 if a respondent recently received a promotion is added to the model. Promotion can be seen as a gift, hence a recent promotion should correspond to an increase in unpaid overtime. Lastly, the dummy variable *ExtraBonus* indicates whether the respondent received a bonus in the past year, which is a gift from the employer. Therefore, this variable should be positively correlated with unpaid hours.

Second, the deferred compensation argument implies that there should be a strong negative correlation between unpaid overtime and age. Younger employees work more to secure the higher wage when they get older, while older employees have no incentive to do unpaid overtime work, as they are already being overpaid.

Third, the human capital theory assumes that employees perform unpaid work to increase firm-specific human capital. Hence, unpaid hours are expected to be performed

especially for low tenure, as that maximizes the investment. Furthermore, the dummy variable *EvolvePos* is added to the model, which captures whether the respondent considers his firm as a good learning environment. The variable is 1 if a respondent indicates good evolve possibilities, and 0 otherwise. Because the learning aspect is essential in the human capital theory, this variable should be positively linked to unpaid hours. Lastly, I include the variable *KnowledgeGap*, a measure of whether the respondent notices a deficit or surplus in knowledge needed for the job. Important to see is whether workers who notice a deficit in required knowledge perform more unpaid overtime than workers with a knowledge surplus.

Table 3 displays the Tobit regression output, which demonstrates mixed evidence for the different theories. First, wage satisfaction is negatively correlated with unpaid hours, and this negative correlation is even increasing the higher the wage satisfaction. This is contrary to what was expected given the gift exchange theory, but the coefficient is not significant. Furthermore, both dummies for promotion and extra bonus are positively and significantly correlated to unpaid hours, hence supporting the gift exchange theory. Interestingly, this correlation between promotion and unpaid hours cannot be found for the lag of promotion, hence the positive effect of promotion seems short-lived.

Second, the results show no support for the deferred compensation theory. There is a positive and significant relation between age and unpaid overtime. The summary statistics showed as well that workers aged 48-64 work on average one more unpaid hour than workers aged 18-32. Hence, while this theory hinges on age negatively influencing unpaid hours, the deferred compensation argument seems implausible to explain unpaid overtime. While other studies did not study this explicitly, their regressions fail to find a positive and significant correlation between unpaid overtime and age as well (Bell & Hart, 1999; Anger, 2004).

Regarding the human capital theory, the results are fairly supportive. The variable capturing evolve possibilities at the firm is positively and significantly correlated with unpaid overtime, which supports the human capital theory. In line with this, *KnowledgeGap* shows that workers with more knowledge than required work less unpaid overtime, while workers who lack knowledge needed for the job work more unpaid overtime. The former coefficient is significant ($p=0.08$), while the latter is insignificant. Lastly, *Tenure* has a negative and significant relation with unpaid hours ($p=0.10$), also supporting the theory.

The Tobit regression shows further that being manager is strongly correlated with unpaid overtime. Clearly, the more employees a manager manages, the more unpaid overtime hours increase. Women perform significantly less unpaid overtime than men. Regarding sector, only Trade & Hospitality and Education are significantly and positively different from the

reference sector Agriculture. Lastly, unpaid hours increases steadily in firm size.

Table 3 Determinants of unpaid overtime

VARIABLES	(1) Tobit
Age	0.0857*** (0.0199)
Tenure	-0.0100 (0.0212)
TenureFunction	-0.0335 (0.0265)
EvolvePos	0.997*** (0.295)
KnowledgeGap – More than required	-0.605* (0.349)
KnowledgeGap – Less than required	0.417 (0.782)
Wagesatis	-0.121 (0.240)
Promotion	1.035** (0.474)
ExtraBonus	1.124** (0.494)
HoursContract	0.127*** (0.0252)
Children	-0.0663 (0.142)
Gender	-1.093** (0.435)
Year 2008	0.733*** (0.231)
Year 2010	0.617** (0.255)
Constant	-19.47*** (2.764)
Observations	4,616
Firm Size	YES
Manager	YES
Sector	YES
Education	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Robustness Checks

Investment character of unpaid overtime

This paragraph presents some alterations to the models used, to see how the results change. First, I include a lead of income instead of the lag of unpaid overtime. This follows the estimation strategy of for example Anger (2005). Table 4 shows that the results match fairly well. Using pooled OLS, A one-hour increase in unpaid overtime now corresponds to an increase in hourly income in two years of 1.4%, compared to the previous 0.7%. The other explanatory variables stay roughly the same. In the second column, the FE estimations match as well. Unpaid overtime and future income are still highly insignificantly correlated, with very similar coefficients.

Table 4 Robustness: lead of income

VARIABLES	(1) Pooled OLS	(2) Fixed Effects
Unpaidovh	0.0142*** (0.00152)	-0.000635 (0.00239)
Tenure	0.00486*** (0.000775)	0.00220 (0.00206)
Experience	0.00427*** (0.000668)	0.00121 (0.00160)
TenureFunction	-0.00242*** (0.000872)	0.00159 (0.00139)
HoursContract	-0.000730 (0.000668)	0.00827** (0.00343)
Year 2008	0.0171*** (0.00638)	0.0421*** (0.00778)
Constant	2.141*** (0.0711)	2.283*** (0.141)
Firm Size	YES	YES
Sector	YES	YES
Education	YES	YES
Observations	2,843	2,843
R-squared	0.379	0.092
Individual FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A second step is to see whether the result changes if men and women are separately regressed. This method is used regularly in past articles, for example Anger (2005), Pannenberg (2005) and Bell & Hart (1999). Table 5 displays the results of this test, with men in the first

column and women in the second. The table shows that while for men unpaid overtime and income are similarly correlated as the base model, this changes significantly for women. Unpaid overtime is still significant at the 5% level, but the lag of unpaid overtime is highly insignificant and with a much smaller correlation. Another interesting feature is that the variable children is highly insignificant for men (p-value 0.97), while for women children are significantly and negatively associated with unpaid overtime. All other variables show very similar coefficients, but the R-squared, 0.42 and 0.34 for men and women respectively, shows that the model can explain the variation in income better for men compared to for women.

Table 5 Unpaid overtime and income: male/female

VARIABLES	(1) Male	(2) Female
Unpaidovh	0.00572*** (0.00187)	0.00563* (0.00289)
Unpaidovh, t-1	0.0124*** (0.00186)	0.00288 (0.00318)
Education - Secondary	0.0630 (0.0419)	-0.0257 (0.123)
Education – Vocational	0.164*** (0.0415)	0.0729 (0.122)
Education - Polytechnic	0.296*** (0.0438)	0.243** (0.123)
Education - University	0.501*** (0.0476)	0.395*** (0.125)
Tenure	0.00441*** (0.000957)	0.00502*** (0.00103)
Experience	0.00512*** (0.000980)	0.00427*** (0.000999)
TenureFunction	-0.00376*** (0.00100)	-0.00156 (0.00113)
HoursContract	-0.00568** (0.00260)	-0.00421*** (0.00120)
Children	0.0174*** (0.00618)	0.00267 (0.00639)
Year 2010	0.0321*** (0.00821)	-0.00185 (0.00970)
Firm Size	YES	YES
Sector	YES	YES
Constant	2.306*** (0.153)	2.257*** (0.145)
Observations	1,430	1,334
R-squared	0.419	0.344

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

These results are very similar to the promotion model, which is shown in table 6. For men, promotion and unpaid overtime are similarly associated with each other as in the base model, with a significant and positive correlation for unpaid overtime and a significant and negative correlation for the lag of unpaid overtime. For women, however, both the unpaid overtime and the lag of unpaid overtime coefficients are highly insignificant. While summary statistics show that the majority of women work part-time, this alone cannot explain the discrepancy between men and women: a regression with only full-time workers shows that unpaid overtime and promotion are still insignificantly correlated for women. Furthermore, as much men as women received a promotion in this dataset. Booth et al. (2003) found that while women are as likely as men to be promoted, their subsequent wage fell short of what men received, called the sticky floors model. The above results complement to this model by suggesting that the returns to unpaid overtime might be a mechanism in explaining this sticky floors phenomenon, where unpaid overtime has no significant correlation to future payoff for women.

Table 6 Unpaid overtime and promotion: male/female

VARIABLES	(1) Male	(2) Female
Unpaidovh	1.088*** (0.0266)	1.064* (0.0384)
L.Unpaidovh	0.930** (0.0289)	0.975 (0.0394)
Tenure	0.977** (0.00962)	0.992 (0.0116)
HoursContract	1.022 (0.0272)	1.091*** (0.0170)
Children	1.068 (0.0860)	1.286** (0.127)
CLA	0.464*** (0.102)	0.668 (0.191)
Year 2010	0.840 (0.167)	0.816 (0.168)
Education	YES	YES
FirmSize	YES	YES
Constant	0.139 (0.215)	0.00683*** (0.00577)
Observations	1,439	1,335

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Next, the different models are re-estimated by adding or subtracting control variables. In the pooled OLS model I include squared terms for tenure, tenure function and experience.² Furthermore, I exclude those variables altogether from the specification, and alternately add and subtract the variables firm size, union and firm sector.³ These different compositions only change the unpaid overtime coefficients marginally, at most with two percentage points. The FE model shows no significant changes as well. Hence, these regressions are not included in the paper.

Lastly, both pooled OLS and FE models are estimated with a restricted sample of workers with a higher or academic job level, as these workers perform the majority of the unpaid overtime in this sample. The results are displayed in table 7, where the first column is pooled OLS and the second column FE. The pooled OLS coefficients are very similar to the base model: the unpaid overtime coefficients decrease slightly but stay highly significant. The FE coefficients, however, change significantly. While the present unpaid overtime variable is still insignificant (albeit with a much lower p-value), the lag of unpaid overtime is now significantly and positively correlated with hourly income. This is very different from the highly insignificant coefficients in the base model and provides some support for the investment character of unpaid overtime.

² Including squared terms is based on the model of Anger (2005)

³ Running this model with limited control variables is in line with Pannenberg (2005)

Table 7 Unpaid overtime and income: higher job-level only

VARIABLES	(1) Pooled OLS	(2) Fixed Effects
Unpaidovh	0.00440** (0.00180)	0.00322 (0.00246)
Unpaidovh, t-1	0.00989*** (0.00178)	0.00412** (0.00197)
Tenure	0.00300*** (0.000956)	-0.00507** (0.00203)
Experience	0.00724*** (0.000824)	0.000201 (0.00332)
TenureFunction	-0.00301*** (0.00103)	-0.000785 (0.00213)
HoursContract	-0.00699*** (0.00126)	-0.0223*** (0.00414)
Children	0.0236*** (0.00536)	-0.00406 (0.0196)
Year 2010	0.00233 (0.00990)	0.0640*** (0.0105)
Firm Size	YES	YES
Sector	YES	YES
Education	YES	YES
Constant	2.323*** (0.146)	3.289*** (0.150)
Observations	1,280	1,280
R-squared	0.320	0.331
Individual FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Determinants of unpaid overtime

First, I rerun the model for men and women separately. Table 8 shows the results, with men in the first column and women in the second. Most coefficients do not differ considerably.

However, there are some remarkable differences. Next, promotion has a strong and significant correlation with unpaid overtime for men, but the correlation for women is much less pronounced and highly insignificant. Moreover, the lag of promotion has an even stronger correlation for men, and again is insignificant for women. Men seem to increase unpaid hours after a promotion, in line with the gift exchange theory, while the unpaid hours of women remain unchanged.

Table 8 Determinants of unpaid overtime: male/female

VARIABLES	(1) Male	(2) Female
Age	0.101*** (0.0315)	0.0611*** (0.0229)
Tenure	-0.0181 (0.0302)	0.00987 (0.0262)
TenureFunction	-0.0391 (0.0372)	-0.0230 (0.0318)
EvolvePos	1.044** (0.435)	0.837** (0.346)
KnowledgeGap – More than required	-0.870* (0.526)	-0.197 (0.404)
KnowledgeGap – Less than required	-0.0763 (1.154)	0.843 (0.931)
Wagesatis	0.0220 (0.369)	-0.335 (0.269)
Promotion	1.478** (0.708)	0.503 (0.568)
ExtraBonus	1.175* (0.628)	-0.0594 (0.720)
HoursContract	0.193*** (0.0595)	0.101*** (0.0251)
Children	-0.120 (0.208)	-0.104 (0.165)
Year 2008	0.949*** (0.322)	0.419 (0.308)
Year 2010	0.703* (0.364)	0.437 (0.333)
Firm Size	YES	YES
Education	YES	YES
Sector	YES	YES
Manager	YES	YES
Constant	-24.73*** (4.209)	-14.23*** (3.508)
Observations	2,362	2,254

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Second, following the same reasoning as with the robustness check for the investment character model, the model is estimated for workers with a higher or academic job level only. Apart from some reduced coefficients for education and income, the result is very similar to the base model. Reducing the sample to only full-time workers gives a similar outcome. Including squared terms for tenure and tenure function was not possible due to collinearity issues.

6. Conclusion

The aim of this paper was to study the investment character of unpaid overtime and to test three theories that might explain the existence of unpaid overtime, being deferred compensation, gift exchange and human capital. The analysis shows a significant positive correlation between unpaid overtime and income in a simple least squares model, which disappears completely after applying fixed effects. However, a restricted sample of high-job level workers with fixed effects show a positive and significant relation between income and the lag of unpaid overtime. The relation between unpaid overtime and promotion probability appears rather ambiguous. The pooled logit model shows a positive coefficient for unpaid overtime, and a negative coefficient for the lag of unpaid overtime, both significant. After applying fixed effects, this changes to a highly insignificant coefficient for unpaid overtime and a slightly significant negative coefficient for the lag of unpaid overtime. The analysis demonstrates mixed indications for the different theories. The data give no support for the deferred compensation theory, while on the other hand there is fairly strong support for the human capital theory. Regarding the gift exchange theory, some opposing coefficients give an ambiguous results. Further robustness checks reveal that the relation between unpaid overtime and both income and promotion are much stronger for men than for women: simple least squares estimations are not significant for women.

A possible limitation of the analysis is the limited time horizon of the study. Although most papers into unpaid overtime focused on the short term as well, it could be that certain relevant mechanisms only manifest over a longer time period. Unfortunately, this was not possible with the current dataset due to insufficient observations. Next, the relatively high proportion of part-time workers in the sample might impact the generalizability of the results to countries with a different composition of the labor market. Furthermore, the analysis could have benefited from a larger sample size, especially for the fixed effects logistic regression with promotion.

In order to find more conclusive evidence on the theories behind unpaid overtime, more information on the motivations of employees should be gathered. Specifically, existing surveys should be extended with questions that directly ask respondents why they do or do not work unpaid overtime. For example, the deferred compensation argument assumes that workers know their productivity and net added value over the course of their career, while in fact they might be unaware of such metrics.

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8. Appendix

Table A 1 Descriptive Statistics

Variable	Description	Mean	Std. Dev.
Unpaidovh	Weekly unpaid overtime hours	1.87	3.78
IncHour	Log of net hourly income	2.48	0.31
IncHourReal	Net hourly income	12.61	4.53
Education			
2	Elementary school	0.01	
3	Secondary school	0.21	0.41
4	Vocational school	0.39	0.49
5	Polytechnic school	0.28	0.45
6	University	0.11	0.31
Tenure	Time at the same firm in years	12.20	10.41
Experience	Previous work experience as employee in years	23.45	10.27
TenureFunction	Time working in the current job in years	7.07	7.86
Age	Age in years	45.36	9.77
FirmSize			
1	Firm size <50 employees	0.37	
2	Firm size >50 and <250 employees	0.28	0.45
3	Firm size >250 employees	0.35	0.48
Sector			
1	Agriculture	0.01	
2	Industry	0.11	0.32
3	Construction Sector	0.04	0.19
4	Trade & Hospitality	0.11	0.32
5	Transport	0.06	0.24
6	Business Services	0.16	0.37
7	Health & Welfare	0.23	0.42
8	Other Services	0.04	0.20
9	Government	0.11	0.31
10	Education	0.12	0.33
HoursContract	Contractual hours per week	30.90	9.70
Children	Children 0-12 years at home	1.27	1.17
Gender	Gender, 1=female, 0=male	0.50	0.50
Manager			
1	0	0.69	
2	1-4	0.14	0.34
3	5-9	0.07	0.26
4	10-19	0.05	0.22
5	20-49	0.03	0.18
6	50-99	0.01	0.11
7	>100	0.01	0.09
Promotion	Promotion received in past year, 1=yes 0=no	0.08	0.26
EvolvePos	Satisfactory evolve possibilities at firm, 1=yes 0=no	0.51	0.50
Wagesatis	How a respondent ranks his/her wage		

1	Low	0.07	
2	Not so high	0.57	0.50
3	Fairly high	0.34	0.47
4	High	0.02	0.14
KnowledgeGap	Respondents' knowledge and skills		
1	Are equal to required knowledge	0.58	
2	Are more than required knowledge	0.33	0.47
3	Are less than required knowledge	0.03	0.17
4	Are mostly for a different profession	0.04	0.20
5	Are obsolete due to changing work	0.01	0.09
6	Are not sufficiently practically oriented	0.00	0.06
7	Other	0.01	0.08
ExtraBonus	Extra bonus received in past year, 1=yes 0=no	0.13	0.34

Figure A 2 Histogram of unpaid overtime

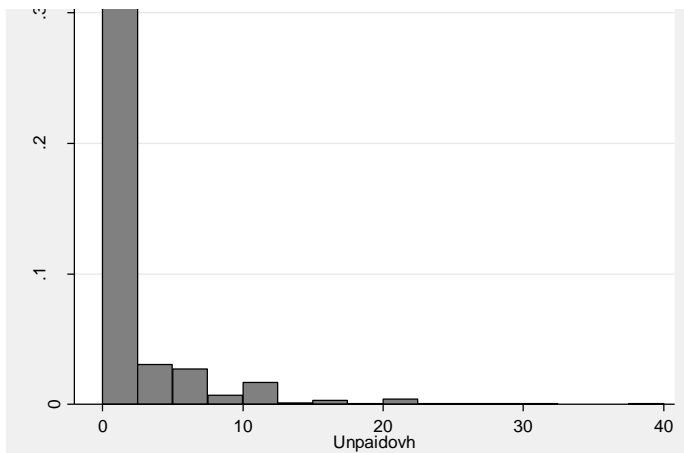


Figure A 1 Distribution of unpaid overtime

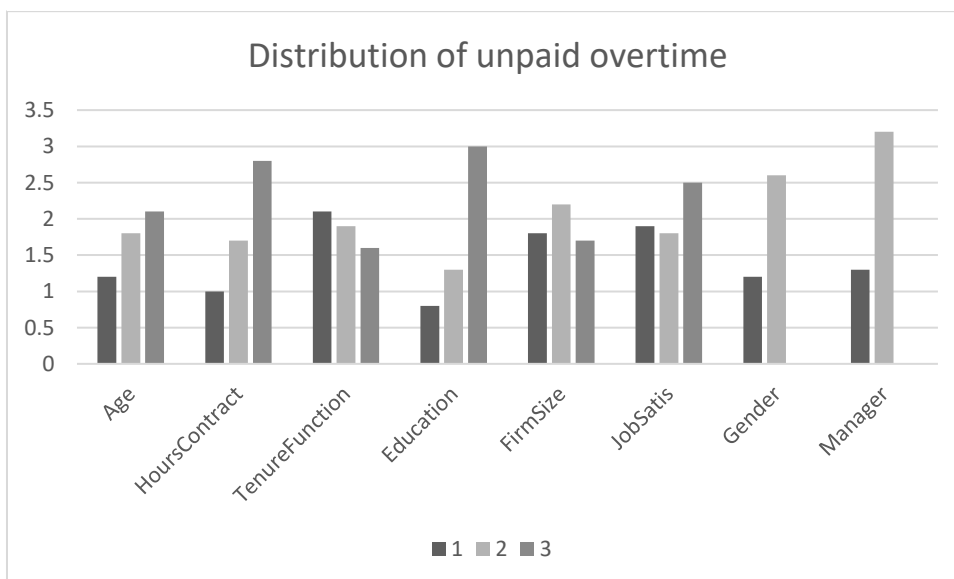


Table A 2 Unpaid overtime per sector

Sector	Unpaid overtime hours
Agriculture	1
Industry	1.7
Construction	2.3
Trade & Hospitality	1.7
Transport	1.1
Business Services	2.2
Health & Welfare	1
Other Services	2.2
Government	1.5
Education	4

Table A 3 Hausman test FE vs RE

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	Fixed Effect	Random Effect	Difference	S.E.
Unpaidovh	0.000692	0.008217	-0.00753	0.001561
L.Unpaidovh	-0.0011	0.009025	-0.01013	0.001529
Education	0.024931	0.126703	-0.10177	0.012603
Tenure	-7.1E-05	0.004304	-0.00437	0.001171
Experience	-0.00212	0.005247	-0.00736	0.001415
TenureFunction	-0.00113	-0.00293	0.0018	0.000733
FirmSize	0.00741	0.027782	-0.02037	0.007649
2bn.Sector	0.098096	0.047887	0.050209	0.039268
3.Sector	0.042314	0.021729	0.020585	0.044983
4.Sector	0.045973	-0.03115	0.077122	0.041897
5.Sector	-0.04848	0.001241	-0.04972	0.048427
6.Sector	0.019808	0.054798	-0.03499	0.041068
7.Sector	0.037779	-0.04501	0.082787	0.050086
8.Sector	0.04627	0.034234	0.012036	0.044412
9.Sector	0.021013	0.047505	-0.02649	0.045189
10.Sector	-0.03597	-0.01685	-0.01912	0.055797
HoursContract	-0.02328	-0.00791	-0.01537	0.00133
Children	-0.01205	0.005301	-0.01735	0.010093
10.year	0.055374	0.030098	0.025276	0.003319

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(19) = (b-B)'[(V_b-V_B)^(-1)](b-B)
301.11
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

