# The carrot or the stick: incentivizing overtime in Vietnamese apparel factories

An honors thesis for the Department of Economics

Janet Rubin

Tufts University, 2014

**Abstract**

This paper aims to identify the variables that drive workers off of their labor supply curves in the Vietnamese apparel factories monitored by the Better Work initiative of the International Labor Organization. It is assumed that firm managers can use various non-wage incentives or punishments to shift a worker's labor supply curve. A theoretical model of worker behavior is developed, incorporating insights from psychology. The empirical analysis quantitatively assesses the impact of non-wage variables on labor supply. The analysis estimates that 22% of overtime hours worked in the Vietnamese firms surveyed result from employer-driven shifts of the labor supply curve and can thus be considered involuntary. That figure rises to 24% when extending the definition of involuntary overtime to include hours overtime hours worked as a result of low levels of base pay.

# Contents

## 1 Introduction

Journalists frequently describe excessive, sometimes unpaid overtime hours in garment factories. The *New York Times* (2013) reports that labor rights groups have accused Haitian firms of coercing extra hours by setting unrealistic production quotas. The *Guardian* (2013) claims that workers in Bangladesh have been locked in factories for over 15 hours a day without the corresponding pay. As the *Toronto Star* (2011) writes, long hours are presumably a cause of fainting spells in Cambodian factories. Such anecdotal evidence raises several economic questions and motivates an empirical analysis of labor market outcomes in the apparel industry. Why do supposedly rational, utility-maximizing individuals return day after day long enough to induce fainting? How can economic models explain observed hours, even when inappropriately compensated, far exceeding any reasonably expected supply? How many hours do garment workers really want to work?

Defining voluntary and involuntary economic behavior here requires some theory about rational decision-making in the context of labor markets. Voluntary overtime is defined by this paper as the equilibrium of labor demand and labor supply along a wage-hours curve in the absence of dismissal threats, intimidation, and coercion. Involuntary overtime, on the other hand, exists if the employer engages in any of those behaviors, which could cause an outwards shift of the labor supply curve. Consequently, actual hours are modeled as an outcome of wages, endogenous to the labor supply curve, and non-wage employer behavior, exogenous to the curve.

A theoretical model departs from the assumption that dismissal threats, coercion, and intimidation change a worker's utility maximization problem. The model explains why workers make choices that seem inexplicable in a neoclassical economic framework and suggests the use of four distinct strategies by firms, consistent with anecdotal evidence from Vietnam. Firstly, firms may pay low base wages in order to incentivize overtime. Secondly, firms may comply with minimum wage regulations and offer relatively high base wages, but low overtime wages, and motivate workers with the threat of dismissal, resulting in an efficiency-wage situation where hours are analogous to work effort. Intimidation and coercion comprise a third strategy (although intimidation may also be used in combination with any other strategy to lower wage rates). As a fourth option, a firm may simply incentivize overtime through wage rates without threats or manipulation. The fourth strategy is likely the most expensive for the firm, unless abusive treatment introduces the need for a compensating differential in wages, which could make any heavy-handed strategy more expensive.

Data from Better Work Vietnam is used to measure the effect of non-wage incentives on labor supply. The empirical approach requires comparing actual hours to a counterfactual that represents voluntary behavior. The difference between low-wage and high-wage workers is considered and also estimated. Two methods are used to estimate the extent of involuntary overtime. The first method (the "direct method") uses the parameters for the control group to predict desired hours for other workers. The second method (the "estimated delta" method) estimates the marginal effects of hypothesized incentive schemes and uses those to predict involuntary hours.

The data reveals patterns consistent with the theoretical model. There is robust empirical support for the idea that firms use low base wages combined with relatively high overtime wage rates to incentivize workers to do overtime. The theoretical model shows that this pattern is to be expected of profit-maximizing firms. There is also evidence that the threat of dismissal effectively incentivized otherwise undesired hours. It is estimated that 22% of overtime hours worked in the Vietnamese sample are involuntary. When considering low base wages a form of unfair manipulation, this percentage rises to 24%.

This paper proceeds as follows. Section 2 reviews the context of this paper in the literature. Section 3 presents the theoretical model, and Section 4 introduces the empirical approach. Section 5 provides an overview of the data. Section 6 presents the empirical analysis, and Section 7 concludes.

## 2 Related literature

The literature on hours helps to explain the impact of demand-side constraints by evaluating why employers demand long hours and how firms get employees to meet that demand. Neoclassical labor market models assume that observed hours are the outcome of a competitive interaction between workers and employers. The labor supply curve is assumed to show the number of hours a worker would freely choose to supply at a given wage. However, theoretical reasoning and empirical evidence suggest that such assumptions are rarely realistic. In particular, non-wage elements of employer behavior and features of the labor market alter a worker's utility-maximization problem. As a result, demand-side constraints have a significant role in determining hours outcomes.

Kuroda and Yamamoto (2013) show that employer demand for hours can be traced to the costs of hiring and training new workers. Using a matched dataset of Japanese firms and workers, they regress observed working hours on demand-side factors including training costs. The worker survey asks employees to explicitly state their desired hours, which enables the delineation of supply and demand-side preferences.

Kuroda and Yamamoto's findings fit into the theory that the profitability of long working hours depends on non-linearities in labor costs and production functions with respect to hours. If hiring new labor involves high fixed costs such as training, it will be more profitable for firms to elicit longer hours from existing workers than to hire additional employees when necessary. Kuroda and Yamamoto note that employers may demand long hours even when market demand is low, due to the stickiness of wages and hours.

In the long run, sorting of employees between firms may eliminate the difference between a worker's desired and actual hours, as workers will choose firms whose demand for hours is compatible with the worker's preferences. However, job transition costs obstruct this process. Additionally, imperfectly competitive labor markets in which workers face limited employment options or are uncertain about their options are likely to be characterized by limited job mobility.

Bryan (2004) evaluates the extent of sorting in his discussion of working hours in British firms. He finds that about a third of variation among hours can be traced to firm characteristics. In other words, hours vary across firms for workers with similar labor supply preferences even when controlling for wages, suggesting that firms have different demand for hours of labor and have non-wage mechanisms by which they manipulate worker behavior. Thus, workers are imperfectly sorted to firms that match their personal preferences. In particular, sorting on human capital characteristics is stronger than sorting on labor supply preference variables such as marital and family status. Bryan's findings, like Kuroda and Yamamoto's, undermine the neoclassical model of labor supply by showing that employees' hours decisions are constrained by demand-side factors.

Smyth et. al. (2013) pursue a similar analysis in the context of manufacturing plants and show that it is applicable. They also describes the adverse consequences that hours have on worker wellbeing. The authors show that awareness of how to refuse overtime hours is a determinant of hours worked.

Employers with a high demand for overtime hours may have strong incentives to make use of non-wage strategies to more cheaply obtain the desired quantity of labor. Apparel factories generally purchase large amounts of capital, making it optimal to have workers operating machinery as many hours as possible. Finally, unpredictable buyer behavior such as rush orders may drive firms to demand overtime but not increase the number of employees, especially if hiring new workers is costly.

By neoclassical models, the equilibrium wage is determined by the intersection of the employer's labor demand and the worker's labor supply. If workers are compensated for extra hours, some workers will voluntarily work overtime. Diminishing marginal utility of income, however, implies that at some point the worker will prefer leisure to additional hours. If the wages that the firm is willing to pay do not elicit the desired quantity of labor, the firm may resort to more complex schemes of incentives in order to shift the labor supply. Frictions in the labor market, efficiency wage considerations, and intimidation are theoretical explanations for the mechanisms that enable the firm to do so. Levels of non-overtime income also factor into the position of the labor supply curve and, anecdotally, are an important tool used by firms to that end.

Stewart and Swaffield (1997) claim that there is an efficiency locus in wage-hours space between the utility maximizing worker and profit maximizing firm. The points to the right of the individual's labor supply curve result from the firm having additional power. Stewart and Swaffield focus on the role of lack of opportunities and job transition costs in giving the employer that extra power. They find evidence for involuntary overtime in British data.

Bloemen (2008) focuses on the costs of job transition and the limited options available to the job-seeker due to employer preferences or generally accepted paradigms, such as the 40-hour work week. He develops a model that enables the comparison of options available to the worker, considering both the wage and working hours. In his model, the worker chooses the highest-utility option, which is consistent with an efficiency wage model. Bloemen's work is distinguished by its focus on job search and transition costs. By Bloemen's reasoning, the reservation wage rate is minimized where hours are optimal, positing a trade-off between wages and hours or a compensating differential whereby sub-optimal hours must be accompanied by a higher wage rate.

Efficiency wage models show the relevance of dismissal threats to labor supply outcomes. Stiglitz and Shapiro (1984) show that the threat of equilibrium unemployment leads workers to adapt to the employer's labor demand. In that case, the worker values job security, fearing unemployment as a lower-utility alternative to the worker's current situation. In the Stiglitz and Shapiro model, workers choose their effort level keeping in mind the negative consequences of failing to meet the employer's standard. The responsiveness of worker hours to employer demand will be related to labor market conditions and the worker's perceived next-best alternative utility. Generally, efficiency wage models such as Stiglitz and Shapiro's consider the employer's labor demand in terms of a desired effort level, but the models can easily be interpreted in term of hours.

In the context of this paper, the most relevant common feature of efficiency wage models is that they show that a worker accepts any job yielding higher-than-reservation utility. This turns the worker's decision of hours into a discrete choice from the options available, rather than an optimizing process.

Rebitzer and Taylor (1995) model the wage that the firm must set to elicit from the worker the "no-shirking" effort level. They do so by constructing the worker's utility function given the expected outcomes if they shirk, compared to the utility from not shirking. To elicit the desired effort, the utility the worker expects from not shirking must be greater than that from shirking. Setting that inequality provides the employer with a lower bound on the wage, given a number of parameters, which could be expressed in terms of another choice variable. This provides a starting point for the model developed here, which begins by interpreting effort level as analogous to overtime hours. If the firm has a demand for a certain amount of overtime, it will need to set a wage under similar considerations to a "no-shirking wage," which in the Rebitzer and Taylor model shows how much the firm must pay to elicit the desired effort.

Beyond efficiency wage models, there is a possibility that heavy-handed labor management strategies have psychological implications for a worker's behavior. Anecdotal evidence suggests that garment workers are often subject to harsh management tactics and abusive forms of punishment. Economically, it is difficult to comprehend why a utility-maximizing agent would accept abusive conditions or continue to provide above his or her optimal amount of labor, even after accounting for self-interest based on efficiency-wage considerations (when the worker has internalized employer demands and market conditions into his or her decision-making). Economic theory would suggest that rational, utility-maximizing agents would require a compensating differential to make up for abuse, making harsh tactics overall costly for the firm. If firms that use abusive tactics are profit-maximizing, there must be a counterbalancing effect of abuse that lowers the firm's costs and explains why workers are willing to put up with harsh treatment. The model developed here draws from the psychology literature to incorporate factors that may influence worker decision-making in an apparel factory and provide an alternative to the compensating differential theory.

Psychological explanations can show how firms may be able to affect participation constraints endogenously by using manipulative and abusive tactics. The model shows how workers in this situation may believe that they are still earning utility greater than their next best alternative. This will largely depend on abusive tactics and, likely, psychological manipulation, including disempowerment and cognitive dissonance.

Workers who are disempowered may behave in ways that are not economically rational. Galinsky (2003) conducted a series of experiments that suggest power is associated with increased likelihood of taking action. Conversely, disempowered individuals may be less likely to act to pursue their goals. The disempowerment effect is represented by an experiment that put subjects in either a high power or low power mindset by having them write about a time when they were in either position. During the task, a strong fan was blowing on the participants. The participants completing the high-power mindset task were significantly more likely to turn off the fan that was disrupting them. This result has been interpreted by psychologists to suggest that people who feel disempowered are less likely to take action to remedy a situation. In an apparel factory, this is especially relevant because the structure of such factories is usually hierarchical and often involves forceful labor management techniques. A worker who is disempowered by these mechanisms may be less likely to remove him or herself from the situation. A firm may be able to abuse workers without them leaving because the more abuse they must face, the less likely they are to act in response.

Cognitive dissonance can also be used to explain worker behavior. Earl (1992) provides an overview of cognitive dissonance as it relates to economic theory. Theories of cognitive dissonance suggest that people do not like to hold contradictory beliefs. As an extension, people may change their assessment of a situation that objectively does not meet their expectations or would force them to recognize that they had made a bad decision.

Economists have related the theory of cognitive dissonance to labor supply. Goldsmith et. al. (2004), for example, models cognitive dissonance by allowing it to affect the parameter that measures the utility of non-market time. They posit that job-seekers subject to discrimination may either see a decrease or an increase in that parameter because of competing effects. On one hand, they may alter their beliefs about the quality of a job they can hope to attain. On the other hand, they may assign higher value to work experience that could help them defy stereotypes and overcome discrimination in the future. Akerlof and Dickens also bridge cognitive dissonance theory with models of labor supply, focusing on the behavior of individuals in dangerous occupations.

Because of cognitive dissonance, in garment factories, unpleasant situations may lead workers to adjust their perceptions of the labor market and the quality of jobs available. A worker who is forced to do overtime may try to ignore the unpleasantness of the situation. If the worker believes that few alternatives to his or her current employment are available, the worker may disregard the disutility of forced labor in order to reduce dissonance between the worker's expectations and actual situation or avoid the stress of considering other employment possibilities.

## 3 Theoretical Model

The following sections present a model of observed work hours as an outcome of the worker's utility maximization problem, which is affected by choices of the firm. The model distinguishes between incentivized and forced overtime and analyzes the profit-maximization problem of the firm to identify the optimal incentive configurations.

### 3.1 The worker's utility maximization problem

Worker utility is assumed to be increasing in base and overtime income ($I_B$ and $I_{OT}$) and decreasing in overtime hours ($H_{OT}$) and workplace abuse ($V$), as given by Equation 1. Note that $I_{OT}$ is equal to $W_{OT}H_{OT}$, where $W_{OT}$ is the overtime wage rate and $H_{OT}$ is overtime hours. The firm chooses $W$ and the worker chooses $H$, making $I_{OT}$ ultimately determined by the worker's choice of hours, as the worker is the second mover. $I_B$, however, is determined by the employer's choice of base wage, assuming that base hours are a fixed constant.

Income is assumed to provide diminishing marginal utility, which is expressed as an exponent $0 < a < 1$. The disutility from hours and abuse is assumed to be marginally increasing, expressed in the exponents $b > 1$ and $c > 1$. $V$ is calibrated such that $V = 1$ corresponds to no abuse. The basis for the utility function with incentivized overtime is shown in Equation 1.

$$U_{OTI} = (I_B + I_{OT})^a - H_{OT}^b - (V_{OTI} - 1)^c \tag{1}$$

The subscript OTI (overtime incentivized) is used to distinguish the incentivized overtime case from the forced overtime and no overtime cases that follow.

The worker expects to receive the same utility in the following period ($U_{OTI}$), which the worker discounts by rate $\frac{1}{1+r}$. The net present value of the utility in Equation 1 then becomes[1]:

$$U_{OTI} = (I_B + I_{OT})^a - H_{OT}^b - (V_{OTI} - 1)^c + \frac{U_{OTI}}{1+r} \tag{2}$$

Solving Equation 2 for $U_{OTI}$ gives Equation 2', worker utility with incentivized overtime:

$$U_{OTI} = \frac{\left[(I_B + I_{OT})^a - H_{OT}^b - (V_{OTI} - 1)^c\right][1+r]}{r} \tag{2'}$$

*Utility with incentivized overtime (Case OTI)*

Equation 2' represents the worker's expected utility if the firm has chosen an incentive structure that induces the worker to voluntarily accept overtime. Alternatively, the firm may attempt to force the worker to work overtime against the employee's will, which shall be called Case OTF (overtime forced). The firm is assumed to have a mechanism "$f$," such as locking doors, that prevents the worker from leaving the workplace. Worker utility decreases when $f$ is used, an effect modeled in the utility function by the subtraction of $f$. However, a worker forced into an undesirable situation like forced overtime may downplay its unpleasantness as a response to cognitive dissonance, modeled as a function $g(f)$ that reduces disutility from work hours. Consequentially, the net effect of $f$ on worker utility is theoretically ambiguous.

The basis of the utility function in Case OTF case is shown in Equations 3.

$$U_{OTF} = (I_B + I_{OT})^a - \frac{H_{OT}^b}{g(f)} - (V_{OTF} - 1)^c - f + \frac{u_{OTF}}{1+r} \tag{3}$$

[1]Design of utility functions used is adapted from Rebitzer and Taylor (1995), who represent worker utility as a linear function increasing in the wage rate and decreasing in effort expended on the job.

Solving Equation 3 for $U_{OTF}$ yields Equation 3', worker utility with forced overtime:

$$u_{OTF} = \frac{\left[(I_B + I_{OT})^a - \frac{H_{OT}^b}{g(f)} - (V_{OTF} - 1)^c - f\right][1 + r]}{r} \tag{3'}$$

*Utility with forced overtime (Case OTF)*

It is also possible that the worker is neither incentivized nor forced to work overtime. That situation will be referred to as Case N (no overtime). In Case N, the worker earns only regular income. The worker may face consequences for refusing to work overtime, such as negative interactions or abuse from the supervisor ($V_N$) and/or a probability of termination in the following period ($D$).

Abuse as a form of punishment, similarly to force $f$, may affect the worker psychologically. Abuse may distort the worker's perception of his or her ability to act, as discussed in Section 2. For this reason, $\theta$, a function of $V_N$, is included as a parameter that reflects a distortion of the worker's perception of the worker's next-best alternative ($\overline{U}$). The existence of a psychological effect would imply $\theta'(V_N) < 0$.[2]

For simplicity, it is assumed that the worker considers the reservation utility purely in the form of income, which allows the use of the exponent $a$ to measure diminishing marginal returns.

The worker expects to continue gaining his or her current level of utility if he or she is not dismissed and the reservation utility if dismissed. The future utility is expressed as an average of those two, weighted by the probability of each outcome.

The setup of the utility function with no overtime is shown in Equation 4.

$$U_N = (I_B)^a - (V_N - 1)^c + \frac{D(\theta\bar{U})^a + (1 - D)U_N}{1 + r} \tag{4}$$

Solving Equation 4 for $U_N$ gives Equation 4', worker utility with no overtime:

$$u_N = \frac{\left[(I_B)^a - (V_N - 1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right][1 + r]}{r + D} \tag{4'}$$

*Utility with no overtime (Case N)*

### 3.2 Participation and incentive compatibility

In the Rebitzer and Taylor framework, the worker chooses his or her highest-utility option. The minimum no-shirking wage is determined by setting the worker's utility without shirking greater than the worker's utility with shirking and solving for wages. A similar strategy is deployed here to determine how the firm elicits its desired number of hours from workers. In order to incentivize a worker to do overtime, the firm must satisfy a participation constraint

[2] $\overline{U}$, as a measure of the worker's expectations, incorporates the uncertainty that the worker faces and the worker's fear of equilibrium unemployment, a phenomenon modeled extensively by Stiglitz and Weiss (1981) and also incorporated in the Rebitzer and Taylor model. A given amount of income may be less valuable in the worker's calculation of $\overline{U}$ than as current earnings if that alternative is characterized by uncertainty and transaction costs of job transition.

as well as an incentive compatibility condition such that the worker expects greater utility from choosing to work overtime than from not doing so, or $U_{OTI} > U_N$. Using $U_{OTI}$ from Equation 2' and $U_N$ from Equation 4' yields Equation 5:

$$\frac{\left[(I_B + I_{OT}) - H_{OT}^b - (V_{OTI} - 1)^c\right][1+r]}{r} > \frac{\left[(I_B)^a - (V_N - 1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right][1+r]}{r+D} \tag{5}$$

Solving Equation 5 for $I_{OT}$ yields:

$$I_{OT} > \left(\frac{\left[(I_B)^a - (V_N - 1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D} + H_{OT}^b + [V_{OTI} - 1]^c\right)^{\frac{1}{a}} - I_B \tag{5'}$$

*Incentive compatibility condition*

The incentive compatibility condition states that in order for a worker to choose to do overtime, the overtime income must be at least equal to the expression on the right-hand side of Equation 5'. To see what the incentive compatibility condition means for wage rates, $W_{OT}H_{OT}$ is substituted for $I_{OT}$, and both sides are divided by $H_{OT}$ to isolate wage rates on the left-hand side. This results in Equation

$$W_{OT} > \frac{\left(\frac{\left[(I_B)^a - (V_N-1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D} + H_{OT}^b + [V_{OTI} - 1]^c\right)^{\frac{1}{a}} - I_B}{H_{OT}} \tag{5''}$$

From Equation 5", the relationship between $H_{OT}$ and $W_{OT}$ is unclear. Taking the derivative of $W_{OT}$ with respect to $H_{OT}$ results in Equation 6:

$$\frac{\partial W_{OT}}{\partial H_{OT}} > \frac{I_B - \left(\frac{\left[(I_B)^a - (V_N-1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D} + H_{OT}^b + [V_{OTI} - 1]^c\right)^{\frac{1}{a}}}{H_{OT}^2} + \frac{\frac{1}{a}\left(\frac{\left[(I_B)^a - (V_N-1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D} + H_{OT}^b + [V_{OTI} - 1]^c\right)^{\frac{1}{a}-1} bH_{OT}^{b-1}}{H_{OT}} \tag{6}$$

Equation 6 is not particularly helpful, since the response of $W_{OT}$ to changes in $H_{OT}$ is ambiguous. Wages and hours may be positively related because of the substitution effect, or negatively related because of the income effect. The net effect depends on which of these effects is dominant. Economic theory states that at low levels of income, the substitution effect will dominate. However, the theory derived here does not make that clear and thus does not supply any prior on that question. The empirical question of interest will be whether firms using dismissal threats are associated with a different net effect of wages on hours than the control group such that dismissal threats lead to relatively higher hours.

The firm must also satisfy a participation constraint such that the worker expects greater utility from continuing in his or her current position than from quitting. The participation constraint will depend on whether the worker's position is best described by Case OTI, Case OTF, or Case N. The utility in each case is derived in Section 3.1. The utility that the worker expects upon quitting is given by the worker's perception of the next-best alternative available, or the reservation utility, which includes any distortions of perception induced by $\theta$.[3]

In Case OTI, the participation constraint is: $U_{OTI} > (\theta\overline{U})^a$. Using $U_{OTI}$ from Equation 2', the constraint is:

$$\frac{\left[(I_B + I_{OT})^a - H_{OT}^b - (V_{OTI} - 1)^c\right][1 + r]}{r} > (\theta\overline{U})^a \tag{7}$$

Solving Equation 7 for $I_{OT}$ yields:

$$I_{OT} > \left[\frac{(\theta\overline{U})^a r}{1 + r} + H_{OT}^b + (V_{OTI} - 1)^c\right]^{\frac{1}{a}} - I_B \tag{7'}$$

*Participation constraint with incentivized overtime (Case OTI)*

The incentivized overtime participation constraint states that in evaluating the utility of employment with the factory versus the reservation utility, overtime and regular income can be traded off one-to-one. Implicitly, the worker should select hours in response to wage rates to attain the desired income level. This analysis suggests that along the participation constraint, an income effect should be the net effect visible in the data. To make the relationship between hours and income along the participation constraint more explicit, $W_{OT}H_{OT}$ is substituted for $I_{OT}$ in Equation 7' and $W_{OT}$ is isolated on the left-hand side, shown in Equation 7":

$$W_{OT} > \frac{\left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI} - 1)^c\right]^{\frac{1}{a}} - I_B}{H_{OT}} \tag{7''}$$

Equation 7" shows that as overtime hours increase relative to base income, the wage rate must decrease by progressively less in order to still meet the incentivized overtime participation constraint. That result makes sense because of the diminishing marginal utility of income.

Taking the derivative of $W_{OT}$ with respect to $H_{OT}$ yields Equation 8:

[3]The exponent $a$ for diminishing marginal utility is included on the right-hand side because diminishing returns are already built into each left-hand side term.

$$\frac{\partial W_{OT}}{\partial H_{OT}} = \frac{I_B - \left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI}-1)^c\right]^{\frac{1}{a}}}{H_{OT}^2} + \frac{\frac{1}{a}\left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI}-1)^c\right]^{\frac{1}{a}-1} bH_{OT}^{b-1}}{H_{OT}} \tag{8}$$

Equation 8 can be compared to Equation 6 to predict the direction of the difference in the relationship between hours on wages along the participation constraint versus the incentive compatibility condition. However, this comparison is left to the empirical analysis, since too many parameters are unknown to develop a helpful theoretical prior.

In Case OTF, the participation constraint is $U_{OTF} > (\theta\overline{U})^a$. Using $U_{OTF}$ from Equation 3', the constraint is:

$$\frac{\left[(I_B + I_{OT})^a - \frac{H_{OT}^b}{g(f)} - (V_{OTF}-1)^c - f\right][1+r]}{r} > (\theta\overline{U})^a \tag{9}$$

Solving Equation 9 for $I_{OT}$ yields:

$$I_{OT} > \left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF}-1)^c + f\right]^{\frac{1}{a}} - I_B \tag{9'}$$

*Participation constraint with forced overtime (Case OTF)*

The analysis for the forced overtime participation constraint is similar to that for the incentivized overtime participation constraint. The main difference is the additional effect $f$, whose net impact is theoretically indeterminate due to the competing compensating differential and cognitive dissonance effects.

In Case N, the participation constraint is: $U_N > (\theta\overline{U})^a$. Using $U_N$ from Equation 4', the constraint is:

$$\frac{\left[(I_B)^a - (V_n-1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right][1+r]}{r+D} > (\theta\overline{U})^a \tag{10}$$

Equation 10 does not contain $I_{OT}$, since in Case N, the overtime wage is not part of the worker's utility calculation. To situate the Case N participation constraint in $I_B - I_{OT}$ space, Inequality 10 is solved for $I_B$, yielding:

$$I_B > \left[\frac{(\theta\overline{U})^a(r+D)}{1+r} + (V_N-1)^c - \frac{D(\theta\overline{U})^a}{1+r}\right]^{\frac{1}{a}} \tag{10'}$$

Equation 10' can be simplified algebraically to the following:

$$I_B > \left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right]^{\frac{1}{a}} \tag{10''}$$

*Participation constraint with no overtime (Case N)*

Note that the probability of dismissal $D$ for refusing to work overtime does not impact the wage required to ensure the worker's participation in regular work hours.

An example configuration of the incentive compatibility condition and the participation constraints is shown in Figure 1. For the employee to work regular hours, incentives must fall to the right of the no-overtime participation constraint, where the utility of working regular hours is greater than the worker's perceived reservation utility. To the left of the no-overtime participation constraint (PCN), the worker leaves the factory if denied overtime income. For the worker to willingly work overtime, incentives must fall above both the incentive compatibility condition (IC) and the incentivized overtime participation constraint (PCOTI) so effectively, the firm is bound by the higher of the two. Above PCOTI, the utility of voluntary overtime is greater than the perceived reservation utility. Above IC, the utility of choosing to work overtime is greater than the utility of not choosing to work overtime. For the worker to work overtime with an incentive configuration below the incentive compatibility condition, the firm has to force the worker using mechanism $f$ while still meeting the forced overtime participation constraint.

[Figure 1 about here.]

The following analysis is specific to the example shown:

- In Region A, the incentive compatibility condition is met and the incentivized overtime participation constraint is met. The worker stays at the factory and works overtime. Notably, the non-overtime participation constraint is not met. The base pay $\alpha$ is not sufficient to keep the worker at the factory if the worker does not have the opportunity to also earn overtime income. Since the incentives are sufficient to induce voluntary overtime, PCOTF is irrelevant.

- In Region B, the incentive compatibility condition is met and the incentivized overtime participation constraint is met. PCOTF is irrelevant. By revealed preferences, Region B is indistinguishable from Region A, since the worker stays at the factory and works overtime. However, in Region B, the non-overtime participation constraint is also met. Thus, the worker stays at the factory and works regular hours even if denied the additional overtime hours and income.

- In Region C, the incentivized overtime participation constraint is met, but the incentive compatibility condition is not met. The worker is not incentivized to take on overtime. Under the worker's own free choice, he or she works normal hours, since the non-overtime participation constraint is met. Crucially, the forced overtime participation constraint is NOT met in this example - if the firm tries to force the worker to do overtime, the worker quits.

- In Region D, the non-overtime participation constraint is met but neither the incentivized nor forced overtime participation constraints nor the incentive compatibility condition are met. The worker works regular hours but quits if forced to work overtime.

- In Region E, no constraints are met. Region E is unobservable because the worker has quit.

- In Region F, the incentive compatibility condition is met but no participation constraint is met. In Region F, the worker would have preferred overtime to no overtime, but still the overtime utility is not greater than the worker's perceived next-best alternative. Region F is unobservable, because the worker has quit.

Figure 1 is illustrated in terms of base and overtime income, rather than wage rates. Ultimately, the location of incentives on that plane is a result of worker decisions about how many hours to work. The firm's problem is to set wage rates anticipating the worker's response in order to end up in the desired location on the plane. The firm's perspective can be illustrated by solving each constraint for wage rates on the left-hand side simply by dividing the right-hand side by overtime hours. Some variations of the resulting diagram are shown in Figure 2. In terms of wage rates, unlike for total income, the tradeoff between base and overtime along the incentivized overtime participation constraint is not one-to-one. The explanation can be seen by varying assumed overtime hours worked. The figure shows that at low hours, overtime wage rates can decrease substantially as regular wage rates increase. However, when overtime hours are higher, overtime wages cannot decrease as much even as regular wage rates increase. This result can be explained by the increasing marginal disutility of hours, because of which more hours require higher compensation.

[Figure 2 about here.]

### 3.3 General profit maximization

Examining the firm's profit-maximization problem for Figure 1 helps to clarify the approaches the firm may take towards incentivizing overtime.

A basic profit function is constructed based on revenues and wage expenses. $P$ is price, $Q_N$ is quantity produced in regular hours, and $Q_{OT}$ is quantity produced in overtime. The firm anticipates earning similar profits in the future and discounts those by rate $\frac{1}{1+r}$. In Case OTI, the firm earns overtime revenues and must pay the incentivizing overtime wage rates, which are subscripted OTI since the incentivized rates may differ from the rates in other cases such as forced overtime:

$$\pi_{OTI} = PQ_N + PQ_{OT} - (I_B)_{OTI} - (I_{OT})_{OTI} + \frac{\pi_{OTI}}{1+r} \tag{11}$$

Solving Equation 11 for $\pi_{OTI}$ yields:

$$\pi_{OTI} = [PQ_N + PQ_{OT} - (I_B)_{OTI} - (I_{OT})_{OTI}] \left[\frac{1+r}{r}\right] \tag{11'}$$

On the $I_B - I_{OT}$ plane, any line with slope equal to -1 is an isocost for the firm. The firm can minimize wage costs by selecting the isocost closest to the origin that satisfies the necessary conditions. In Case OTI, the firm must satisfy the incentive compatibility condition and the incentivized overtime participation constraint, or equivalently, the greater of the two, which can be expressed as in Equation 12 (from Equations 5' and 7').

The point where the incentivized overtime participation constraint crosses from above to below the incentive compatibility condition is derived in Appendix A. Using that point, Equation 12 can be expressed as a discontinuous function, as in Equation 12'.

Equation 12' gives the cost-minimizing level of $I_{OT}$. Substituting that into the profit function, Equation 11', yields Equation 13. Along the isocost, $I_B$ and $I_{OT}$ are jointly determined. Consequentially, the ultimate cost in terms of wages is determined by the variable $V_{OTI}$, which shifts the locus of the diagram closer or further from the origin. Holding $V_{OTI}$ constant, costs are minimized on the closest feasible isocost to the origin, which coincides with the incentivized overtime participation constraint. This result can be seen by algebraically simplifying Equation 13 to obtain Equation 13'.

*[Equations 12, 12', 13, and 13' on following page]*

In Case N, the firm only earns revenues from the quantity produced during regular hours and only bears the corresponding wage expense. Profits are given by Equation 14:

$$\pi_N = PQ_N - (I_B)_N + \frac{\pi_N}{1+r} \tag{14}$$

Solving Equation 14 for $\pi_N$ yields:

$$\pi_N = [PQ_N - (I_B)_N]\left[\frac{1+r}{r}\right] \tag{14'}$$

In Case N, the firm must only satisfy the no overtime participation constraint. From Equation 10", the cost minimizing $I_B$ is:

$$\left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N - 1)^c\right]^{\frac{1}{a}} \tag{15}$$

Substituting 15 into the profit function, Equation 14', yields:

$$\pi_N = \left(PQ_N - \left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N - 1)^c\right]^{\frac{1}{a}}\right)\left(\frac{1+r}{r}\right) \tag{16}$$

*Profits with no overtime (Case N)*

### 3.4 Strategic incentive schemes - dismissal threats

In the example shown in Figure 1, the dismissal threat perceived by the worker is equal to zero. In other words, the worker is not concerned that he or she will be fired upon refusing to work overtime. Imposing a dismissal threat causes the incentive compatibility condition to pivot clockwise around the locus, as illustrated in Figure 3. At levels of base pay above the no-overtime participation constraint, that strategy brings the incentive compatibility condition closer to the incentivized overtime participation constraint and the origin and hence lowers the cost of overtime.

[Figure 3 about here.]

$$max\left\{\ \left(\frac{\left[(I_B)^a-(V_N-1)^c+\frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D}+H_{OT}^b+[V_{OTI}-1]^c\right)^{\frac{1}{a}}-I_B,\left[\frac{(\theta\overline{U})^a r}{1+r}+H_{OT}^b+(V_{OTI}-1)^c\right]^{\frac{1}{a}}-W_BH_B\ \right\} \tag{12}$$

$$\begin{cases}\left[\frac{(\theta\overline{U})^a r}{1+r}+H_{OT}^b+(V_{OTI}-1)^c\right]^{\frac{1}{a}}-I_B & I_B<\left[\frac{(\theta\overline{U})^a r}{1+r}+(V_N-1)^c\right]^{\frac{1}{a}}\\ \left(\frac{\left[(I_B)^a-(V_N-1)^c+\frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D}+H_{OT}^b+[V_{OTI}-1]^c\right)^{\frac{1}{a}}-I_B & I_B>\left[\frac{(\theta\overline{U})^a r}{1+r}+(V_N-1)^c\right]^{\frac{1}{a}}\end{cases} \tag{12'}$$



$$\begin{cases}\pi_{OTI}=\left(PQ_N+PQ_{OT}-(I_B)_{OTI}-\left(\left[\frac{(\theta\overline{U})^a r}{1+r}+H_{OT}^b+(V_{OTI}-1)^c\right]^{\frac{1}{a}}-(I_B)_{OTI}\right)\right)\left(\frac{1+r}{r}\right) & I_B<\left[\frac{(\theta\overline{U})^a r}{1+r}+(V_N-1)^c\right]^{\frac{1}{a}}\\ \pi_{OTI}=\left(PQ_N+PQ_{OT}-(I_B)_{OTI}-\left[\left(\frac{\left[(W_BH_B)^a-(V_N-1)^c+\frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D}+H_{OT}^b+[V_{OTI}-1]^c\right)^{\frac{1}{a}}-(I_B)_{OTI}\right]\right)\left(\frac{1+r}{r}\right) & I_B>\left[\frac{(\theta\overline{U})^a r}{1+r}+(V_N-1)^c\right]^{\frac{1}{a}}\end{cases} \tag{13}$$

$$\begin{cases}\pi_{OTI}=\left(PQ_N+PQ_{OT}-\left[\frac{(\theta\overline{U})^a r}{1+r}+H_{OT}^b+(V_{OTI}-1)^c\right]^{\frac{1}{a}}\right)\left(\frac{1+r}{r}\right) & I_B<\left[\frac{(\theta\overline{U})^a r}{1+r}+(V_N-1)^c\right]^{\frac{1}{a}}\\ \pi_{OTI}=\left(PQ_N+PQ_{OT}-\left(\frac{\left[(W_BH_B)^a-(V_N-1)^c+\frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D}+H_{OT}^b+[V_{OTI}-1]^c\right)^{\frac{1}{a}}\right)\left(\frac{1+r}{r}\right) & I_B>\left[\frac{(\theta U)^a r}{1+r}+(V_N-1)^c\right]^{\frac{1}{a}}\end{cases} \tag{13'}$$

*Profits with incentivized overtime (Case OTI)*

### 3.5 Strategic incentive schemes - intimidation and coercion

In the example shown in Figure 1, there is no region below the incentive compatibility condition that satisfied the forced overtime participation constraint, meaning that there is no region in which forcing overtime is cost-minimizing. However, this is not true for the general case. There is a region below the incentive compatibility condition and above the forced overtime participation constraint if and only if there exists at least one value of $I_B$ that satisfies the following inequality (from Equation 5' for the incentive compatibility condition and Equation 9' for the forced overtime participation constraint):

$$\left(\frac{\left[(I_B)^a - (V_N - 1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right] r}{r+D} + H_{OT}^b + [V_{OTI} - 1]^c\right)^{\frac{1}{a}} - I_B > \left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF} - 1)^c + f\right]^{\frac{1}{a}} - I_B \quad (17)$$

Equation 17 can be algebraically simplified:

$$\frac{\left[(I_B)^a - (V_N - 1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right] r}{r+D} + H_{OT}^b + [V_{OTI} - 1]^c > \frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF} - 1)^c + f \quad (17')$$

When Inequality 17 is true, there exists a region in which the participation constraint for forced overtime labor is met, but the incentive compatibility condition is not met. If the incentive configuration falls within such a region, the worker does not voluntarily work overtime, but the firm can force overtime labor without the worker quitting. Such an incentive configuration may be located in Region C or D, or in Region E or F, which are infeasible in the example of Figure 1 but could be possible in a different example depending on the location of the forced overtime participation constraint.

In Case OTF, the firm still earns overtime revenues. However, wages are likely different in the forced case, since the firm must only satisfy the forced overtime participation constraint. Profits are given by Equation 13:

$$\pi_{OTF} = PQ_N + PQ_{OT} - (I_B)_{OTF} - (I_{OT})_{OTF} + \frac{\pi_{OTF}}{1+r} \quad (13)$$

Solving Equation 13 for $\pi_{OTF}$ yields:

$$\pi_{OTF} = [PQ_N + PQ_{OT} - (I_B)_{OTF} - (I_{OT})_{OTF}]\left[\frac{1+r}{r}\right] \quad (13')$$

From Equation 9', the cost-minimizing $I_{OT}$ for all $I_B$ in forced overtime is:

$$I_{OT} = \left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF}-1)^c + f\right]^{\frac{1}{a}} - I_B \tag{19}$$

Substituting 19 into the profit function, Equation 13', yields:

$$\pi_{OTF} = \left[PQ_N + PQ_{OT} - (I_B)_{OTF} - \left(\left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF}-1)^c + f\right]^{\frac{1}{a}} - (I_B)_{OTF}\right)\right] \left[\frac{1+r}{r}\right] \tag{20}$$

As in the incentivized overtime case, $I_B$ and $I_{OT}$ are jointly determined. Algebraic simplification of Equation 20 yields:

$$\pi_{OTF} = \left(PQ_N + PQ_{OT} - \left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF}-1)^c + f\right]^{\frac{1}{a}}\right)\left(\frac{1+r}{r}\right) \tag{20'}$$

*Profits with forced overtime (Case OTF)*

### 3.6 Profit maximization

Assuming that there are no external regulations on wages, the firm can choose to incentivize overtime, forego overtime, or force overtime. The firm should choose the profit-maximizing option. Comparing the profit functions before substituting the optimal choices of $I_B$ and $I_{OT}$ clarifies the intuitive basis of the problem. Firstly, the comparison of profits in Case OTI (Equation 11') with Case N (Equation 14') is expressed as follows:

$$(PQ_N + PQ_{OT} - (I_B)_{OTI} - (I_{OT})_{OTI})\left(\frac{1+r}{r}\right) \gtreqless (PQ_N - (I_B)_N)\left(\frac{1+r}{r}\right) \tag{21}$$

Algebraic simplification of Equation 21 yields:

$$PQ_{OT} - (I_B)_{OTI} - (I_{OT})_{OTI} \gtreqless -(I_B)_N \tag{21'}$$

Holding $I_B$ constant so that $(I_B)_N$ is equal to $(I_B)_{OTI}$, Equation 21' can be simplified to the following:

$$PQ_{OT} - (I_{OT})_{OTI} \gtreqless 0 \tag{21''}$$

It follows from Equation 21" that incentivizing overtime is profitable if the additional revenue generated in overtime exceeds the cost of overtime wages. This conclusion is consistent with the marginal revenue equals marginal costs principle for profit maximization.

Analyzing the comparison with the optimal choices of $I_B$ and $I_{OT}$ substituted into the profit functions shows that the profit-maximizing choice is theoretically ambiguous. The analog of Equation 21 is shown in Equation 22 (from Equations 13' and 16). Algebraic simplification of Equation 22 yields Equation 22'.

The direction of the inequality depends on several parameters and variables that affect wages. The amount of abuse $V$, for instance, has a consequence for the wage on both sides of the equality, although the magnitude and direction of the effect of $V$ is theoretically ambiguous. The price of output is also unknown as it is externally determined, so theory does not establish whether incentivizing overtime is profitable for the firm in all cases. However, Equation 22' provides a framework for such an empirical analysis.

*[Equations 22 and 22' on following page]*

The firm may compare the costs of incentivizing overtime to forcing overtime. Assuming that forced and incentivized overtime are equally productive, or $Q_{OTI} = Q_{OTF}$, and holding all else constant, the less costly choice in terms of wages should also unequivocally be the more profitable. As a result, it is shown that forced overtime is only more profitable than incentivized overtime if there is a region below the incentive compatibility condition but above the forced overtime participation constraint. Psychological effects may lower the forced overtime participation constraint and create such a region (an increased prevalence of abuse during overtime would be consistent with such a theory). This result can be seen by comparing profits in Case OTI to profits in Case OTF, or (from Equations 11' and 13'):

$$(PQ_N + PQ_{OT} - (I_B)_{OTI} - (I_{OT})_{OTI})\left(\frac{1+r}{r}\right) \gtreqless \\ \pi_{OTF} = (PQ_N + PQ_{OT} - (I_B)_{OTF} - (I_{OT})_{OTF})\left(\frac{1+r}{r}\right) \quad (23)$$

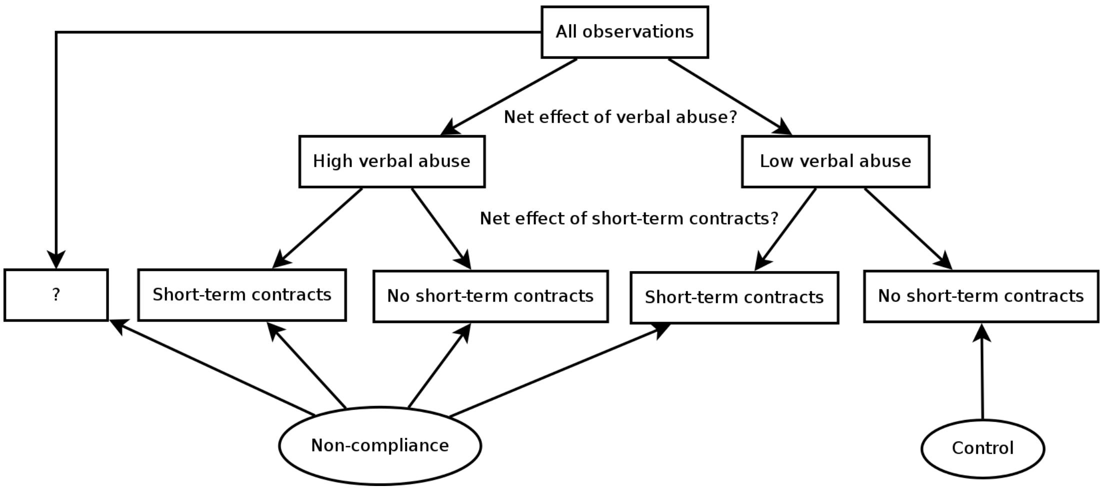
The difference in profits will depend on the difference between $(I_B, I_{OT})_{OTI}$ and $(I_B, I_{OT})_{OTF}$, or the difference in wages needed to satisfy the conditions for each case, which is theoretically indeterminate due to the ambiguous effects of $V$ and $f$.

$$\begin{cases} \left(PQ_N + PQ_{OT} - \left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI}-1)^c\right]^{\frac{1}{a}}\right)\left(\frac{1+r}{r}\right) & I_B < \left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right]^{\frac{1}{a}} \\ \gtreqless \left(PQ_N - \left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right]^{\frac{1}{a}}\right)\left(\frac{1+r}{r}\right) & \\ \left(PQ_N + PQ_{OT} - \left(\frac{\left[(I_B)^a - (V_N-1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D} + H_{OT}^b + [V_{OTI}-1]^c\right)^{\frac{1}{a}}\right)\left(\frac{1+r}{r}\right) & I_B > \left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right]^{\frac{1}{a}} \\ \gtreqless \left(PQ_N - \left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right]^{\frac{1}{a}}\right)\left(\frac{1+r}{r}\right) & \end{cases} \tag{22}$$

$$\begin{cases} PQ_{OT} - \left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI}-1)^c\right] \gtreqless -\left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right] & I_B < \left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right]^{\frac{1}{a}} \\ PQ_{OT} - \left(\frac{\left[(I_B)^a - (V_N-1)^c + \frac{D(\theta\overline{U})^a}{1+r}\right]r}{r+D} + H_{OT}^b + [V_{OTI}-1]^c\right)^{\frac{1}{a}} \gtreqless -\left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right] & I_B > \left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right]^{\frac{1}{a}} \end{cases} \tag{22'}$$

### 3.7 Model implications

The model reveals various combinations of incentives that a firm could use to elicit overtime, illustrated in Figure 4. The following chart summarizes the possibilities.




Assuming the price of output is greater than the marginal cost of production during overtime in any case, profit maximization requires a firm to locate incentives on the incentivized overtime participation constraint by offering low base pay with opportunities for high overtime income (Point A). However, if the firm is paying a base wage higher than the no-overtime participation constraint, which may result from minimum wage regulations, then it will bound by either the incentive compatibility condition (Point B1) or the forced overtime participation constraint (which is shown as Point C, but could theoretically be located anywhere on the plane). The firm can alter the slope of the incentive compatibility condition by manipulating the dismissal threat. If the firm threatens dismissal as a consequence for refusing overtime, Point B2 will newly satisfy the incentive compatibility condition. Thus, the firm may strategically offer high base pay combined with a dismissal threat. As the third possibility, the firm may be on the forced overtime participation constraint and use force and intimidation, although the net effect of those tactics and exact location of the corresponding region is theoretically ambiguous. The fourth option for the firm is to locate incentives on the incentive compatibility constraint without manipulating it using a dismissal threat. As in a competitive labor market, high overtime wages would be necessary to incentivize additional overtime hours.

Verbal abuse may be combined with any of these strategies intentionally or unintentionally, with an ambiguous net effect. The profit-maximizing level of abuse depends on the relative effects of lowering the worker's reservation utility through $\theta$ and imposing disutility on the worker (proof in Appendix B).

The model also has implications for the impact of minimum wage laws. Along any of the participation constraints, the value of $I_B$ is trivial, since $I_{OT}$ and $I_B$ are jointly determined one-to-one. However, $I_B$ is not trivial in the incentivized overtime case, following from the profit function in Equation 13'. By Equation 13', for $I_B$ greater than $\left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N - 1)^c\right]^{\frac{1}{a}}$, the binding constraint is the incentive compatibility condition and not the participation constraint, leading to reduced profits. A reduction of profits in Case OTI increases the relative attractiveness of Case OTF and gives the firm incentive to use dismissal threats to lower the cost of meeting the incentive compatibility constraint.

[Figure 4 about here.]

# 4 Empirical strategy

## 4.1 Observing wage configuration patterns

The empirical analysis begins by recreating the theoretical diagram of Figure 1 using data, distinguishing between the control group and the various subsamples. The theoretical model shows that a firm pays the lowest wage possible while meeting whichever constraint binds. If one could observe an individual worker's response to many possible pay configurations under a single incentive scheme, it would be possible to diagram the binding constraints for that individual's employer. It would subsequently be possible to identify a set of incentive configurations that would result in the worker working a given number of overtime hours and measure the contribution of non-wage variables to that outcome.

However, it is not possible to observe more than one incentive configuration for a single worker, which complicates the analysis because the exact position of the constraints will vary based on several worker-level variables, such as reservation utility and preferences.[4] As a result, when aggregating data across workers and factories, a picture of wage incentives falling cleanly in a pattern predicted by the theoretical model is unlikely. To address this limitation, when constructing a diagram similar to the theoretical model, a regression is performed to verify that, when including controls for individual characteristics, the direction of the coefficient on the horizontal axis variable is consistent with the diagram. This step helps to confirm that the image produced is not coincidence due to variation in exogenous variables such as worker preferences.

Furthermore, factories may be bound by different constraints. Some firms may choose to meet the incentive compatibility condition, while other firms may use coercion and be bound by the forced overtime participation constraint, instead. Finally, factories can change the slope of the incentive compatibility condition by manipulating the worker's perceived probability of dismissal or punishment for refusing overtime. Consequently, it is necessary to observe whether pay configurations tend to differ by strategy.[5]

The empirical strategy to estimate involuntary hours will depend on identifying the counterfactual for workers who are affected by non-wage incentives. At first glance, it appears possible to estimate parameters for each type of incentive and re-estimate hours, setting the value of the variable equal to 0. However, an essential implication of the theoretical model is that firms will structurally adjust their incentive schemes as the options available to them are limited by regulation. It is possible that in manipulated groups, it is not just the form

[4] This result can be seen in Equations 5', 7', 9', and 10'.

[5] Note that the diagrams and corresponding regressions are limited to workers who do some overtime, since their wage structure is the one that should reveal the binding constraints for a firm trying to incentivize overtime (for a worker doing no overtime, only the regular wage is relevant).

of manipulation itself (i.e., verbal abuse or dismissal threats) that change worker behavior, but a difference in the effectiveness of pay rates and a change in context that makes other forms of incentives operate differently. For example, base pay may have a different effect when combined with a dismissal threat. To clarify the general point, observe Figure 4. The firm has a variety of incentive configurations available. Measuring the effect of one strategy does not mean that the remaining effects represent the counterfactual of interest. If one strategy is made unavailable to the firm, the firm will shirt to whichever point satisfies the next-lowest isocost, although the counterfactual representing workers' desired outcomes is around Point B1.

With that in mind, a control group is defined as all workers who do not have a dismissal threat and are in firms with low prevalence of intimidation. Dismissal threats are operationalized through contract duration. Workers who report anything other than a stable 1-3 year contract are designated as affected by dismissal threats. A measure of intimidation is based on verbal abuse, where workers in factories with higher than average reports of verbal abuse are considered to face intimidation. Because each firm strategy relies on a structurally different combination of incentives, it is necessary to compare each group to the control case, which is the counterfactual of interest. This comparison is conducted by estimating a nested model that includes parameters for possible firm strategies and the control.

### 4.2 Econometric model

The empirical strategy is based on the equation:

$$H_{actual} = H_{desired} + H_{involuntary} \tag{24}$$

With actual hours given in the data, the estimation aims to separate the desired component of hours from the involuntary component. The theoretical model establishes factors that contribute to involuntary hours. This enables estimates of the quantitative impact of each particular tactic or combination of tactics. That estimation enables the prediction of hours in the absence of tactics considered illegitimate, which can be interpreted as desired hours.

The basis for the model is the following:

$$H_{OT_i} = \alpha + \beta_1 W_{OT_i} + \beta_2 W_{B_i} + \beta_3 P_i + \beta_4 P_i W_{B_i} + \varepsilon_i \tag{25}$$

$H_{OT}$ is overtime hours, and $W_{OT}$ and $W_B$ are overtime and base wage rates, respectively. $P$ is a dummy variable equal to 1 if $W_{B_i}$ is below the no-overtime participation constraint. $P_i W_{B_i}$ is an interaction term that allows the base wage to have a different coefficient if is under the no-overtime participation constraint. Those two terms allow for the possibility of a difference in outcomes for relatively high base-wage workers and low base-wage workers. $\alpha$ is a constant, and $\varepsilon_i$ is a random error term. Since the wage data is derived by factory-group, standard errors are clustered on that level. Observations are indexed by worker.

The question of how many hours workers really want to work will be answered by a comparison of the effects of wage rates and incentives across groups. One approach to comparing the groups would be to estimated the model separately for distinct groups and compare estimated parameters. However, designing a nested model has several advantages over that approach. Firstly, the model reveals whether the difference in coefficients across groups is statistically significant. Secondly, the model allows the estimation procedure to distinguish the effects of various strategies when more than one strategy may be used. Thirdly, the model allows for more intuitive interpretation as the difference in effects across groups is visible without subtracting equations.

The nested model is designed to allow comparison of the control group to groups characterized by higher than average verbal abuse or short-term contracts. To that end, dummy variables are used to enable the intercept to differ for the two latter groups. The dummy variables are interacted with each of the independent variables in Equation 25 to allow all parameters to differ across groups. The model can be written as follows:

$$\begin{aligned} H_{OT_i} = {} & \alpha_1 + \beta_{1,1} W_{OT_i} + \beta_{1,2} W_{B_i} + \beta_{1,3} P_i + \beta_{1,4} P_i W_{B_i} + \\ & \alpha_2 VA_i + \beta_{2,1} VA_i W_{OT_i} + \beta_{2,2} VA_i W_{B_i} + \beta_{2,3} VA_i P_i + \beta_{2,4} VA_i P_i W_{B_i} + \\ & \alpha_3 STC_i + \beta_{3,1} STC_i W_{OT_i} + \beta_{3,2} STC_i W_{B_i} + \beta_{3,3} STC_i P_i + \beta_{3,4} STC_i P_i W_{B_i} + \\ & \varepsilon_i \end{aligned} \tag{26}$$

More simply, Equation 26 can be expressed as a matrix of coefficient vectors multiplied by a matrix of the independent variables:

$$H_{OT_i} = \begin{bmatrix} \boldsymbol{\alpha} & \boldsymbol{\beta_1} & \boldsymbol{\beta_2} & \boldsymbol{\beta_3} & \boldsymbol{\beta_4} \end{bmatrix} \begin{bmatrix} 1 & VA_i & STC_i \\ W_{OT_i} & VA_i W_{OT_i} & STC_i W_{OT_i} \\ W_{B_i} & VA_i W_{B_i} & STC_i W_{B_i} \\ P_i & VA_i P_i & STC_i P_i \\ P_i W_{B_i} & VA_i P_i W_{B_i} & STC_i P_i W_{B_i} \end{bmatrix} + \varepsilon_i \tag{27}$$

The estimated coefficients on the first column of the independent variable matrix correspond to the control group. Using parameters $\hat{\alpha}$ and $\hat{\beta}_1$ through $\hat{\beta}_5$, $\hat{H_{OT_i}}$ is imputed for workers not in the control sample. Assuming that the parameters on the control sample represent workers' desired response to incentives, imputing $\hat{H_{OT_i}}$ based on those parameters amounts to estimating desired hours, which are compared to actual hours. Alternatively, using the parameters for the manipulated groups, it is possible to predict involuntary hours, on the worker level, by each incentive scheme and estimate the impact of each strategy.

When looking at the subsamples, it is important to check how correlated each method is. A lack of variation could reduce the significance of each strategy's estimated impact. However, the relationship estimated by a regression of a dummy for short-term contracts on a dummy for higher-than-average verbal abuse, clustered by factory-year, is slightly negative and not statistically significant.

Low base pay is not a cause of involuntary overtime as defined here, but is considered as the model allows for a structural break in the effect of wages on hours at the no-overtime participation constraint. Two versions of the model will be estimated, one treating low base pay as a form of incentive manipulation.

# 5 Data

## 5.1 Overview, demographics, and work history

The data consists of worker surveys and compliance evaluations gathered by the Better Work initiative of the International Labor Organization in Vietnam, Indonesia, Jordan, Haiti, and Nicaragua. For each survey, a random sample of about 30 workers is selected to complete a questionnaire covering topics including work history, work hours and compensation, and complaints and grievances, among others. Each worker observation is paired with the corresponding data from surveys of their firm's financial manager, human resource manager, general manager, and industrial engineer. This analysis uses the Vietnam data, which includes 192 factory-year combinations and 5,074 worker-level observations.

Demographic data for workers in Vietnam is shown in Table 1. 81% of the sample is female. The average worker is 28 years old with 9 years of schooling.

[Table 1 about here.]

Table 2 shows statistics on work history and hours. Data on worker hours is constructed from worker-reported daily start and end times. The survey for Vietnamese workers asks respondents to report their start time and end time on Monday, Friday, Saturday, and Sunday. Some data cleaning is necessary, details of which are available in Appendix C.

[Table 2 about here.]

## 5.2 Wage data

The survey asks workers to report the amount that they are usually paid, in VND, and the frequency of payment. From this information, weekly earnings in USD are calculated using an exchange rate of 21000 VND to 1 USD. Details of income data cleaning are available in Appendix C.

The data does not distinguish between base wages and overtime wages, making it necessary to construct estimates. The procedure begins by recognizing the following relationship:

$$TP = wh^{PO} + \frac{w}{1+p}h \tag{28}$$

$TP$ is total pay, $w$ is overtime wage, $h^{PO}$ is paid overtime hours, and $h$ is regular hours. $p$ is equal to the pay premium on overtime hours, so that $\frac{w}{1+p}$ is equal to the base hourly wage. Stewart and Swaffield (1997) use a similar equation to distinguish between base and overtime earnings in a sample of British workers. Their procedure relies on assuming that $p$ is consistently equal to the legally mandated rate, so they are able to solve for $w$ for each worker by substituting total pay, paid overtime hours, and regular hours into Equation 28. In this case, such a method is impossible since the enforcement of the mandated overtime premium cannot be assumed. Consequently, it is necessary to estimate overtime versus regular wages using regressions. The available data allows estimation based on the following model:

$$TP_i = \alpha + \beta h_i^{PO} + \varepsilon_i \tag{29}$$

$\hat{\alpha}$ should be equal to $\frac{w}{1+p}h$, from which the base hourly wage can be derived by dividing by $h$.[6] $\hat{\beta}$ should be equal to the overtime hourly wage $w$. $\varepsilon_i$ is a random error term. This model does not impose any restrictions on the relationship between regular wage and overtime wage.

The model should provide reasonable wage estimates for any group of workers earning relatively similar wages. When estimating the model, it is essential to recognize that wage rates are likely to vary across factories, as well as within factories across groups with different characteristics. Different levels of productivity also may add substantial noise to estimates. For example, if the least productive workers are paid the least and also tend to work the most overtime, there may be a negative $\hat{\beta}$ measuring relationship between overtime and total pay, although it does not make sense for workers to earn a negative wage during overtime. Accordingly, the coefficients are estimated separately for each factory-group, where groups are designed to pool workers presumably earning similar wages, and include a worker-level measure of productivity as a control. The individual-level productivity control is based on the worker-reported time to reach his or her daily production target. The control is a dummy equal to 1 if the worker's time is greater than the factory average.[7] Furthermore, Sunday hours are distinguished from overtime hours, since according to Vietnamese labor law, Sunday hours are to be compensated at a different rate than regular hours and other forms of overtime hours. The model is modified, as shown in Equation 29', where $h^S$ are hours worked on Sunday, and $P$ is the productivity control.

$$TP_i = \alpha + \beta_1 h_i^{PO} + \beta_2 h_i^S + \beta_3 P_i + \varepsilon_i \qquad (29')$$

To identify the dimensions along which wage rates tend to differ and thereby construct the estimation groups, total pay is regressed on several possible dimensions, controlling for hours. The variables included are gender, whether promoted, and pay structure, where pay structure refers to whether the worker is paid by the hour, by the piece, by a combination, or does not know. The regression is shown in Table 3. Gender, promotion, and pay structure are significant and are consequently used to separate groups. When those variables are included, job type is not significant, so it may not be necessary to distinguish groups based on job type. However, there are sufficient observations to distinguish between sewers and non-sewers in order to achieve more precision while still maintaining a sizable sub-sample. The groups used are shown in Table 4.[8]

By the original procedure, for about 38% of observations, the coefficient on overtime hours is negative, which indicates a de facto negative overtime wage. This result could occur if the number of overtime hours worked is negatively related to wages for non-productivity related reasons, assuming that the procedure adequately accounts for productivity effects. Other underlying variables may jointly determine an increase in overtime hours and decrease in wage rates. For example, intimidation may be used to lower the worker's reservation utility and enable the firm to pay lower rates, and it may also drive workers to work more overtime

[6] To avoid unnecessary estimation error, if a worker reports zero overtime hours, $TP_i/h_i$ is used as the base hourly wage, rather than $\hat{\alpha}/h_i$.

[7] Some weekly productivity data can't be used because there is often only one worker per factory that has a weekly quota, making comparison to the factory average impossible.

[8] Workers who did not identify their pay structure are included in the "does not know" category.

hours. For the purposes of this analysis, it is appropriate to replace all negative overtime wages rates with 0. If overtime hours do not contribute enough to total income to produce a positive coefficient, then overtime wage rates as an incentive of hours are irrelevant.

To check that the procedure is accurate, total weekly pay is reconstructed using the estimated wage rates and compared to the worker-reported weekly pay. The average difference between reconstructed and reported pay is -5.6, showing that the estimation procedure tends to underestimate wage rates. To avoid using the estimated wage rates for poorly-fitting observations, wage estimates are dropped if the difference between reconstructed weekly pay and reported weekly pay is more than two standard deviations away from the mean. Prior to dropping those estimates, the standard deviation of the difference between reconstructed and reported pay is 13. After dropping those estimates, the standard deviation is 6.2, which is low enough for the estimations to be taken as reasonable approximations of the worker's experience. To avoid including general outliers in the analysis, the top percentile of the hourly base wage is dropped, eliminating 13 observations.

If the base-overtime pay configuration is similar across firms and estimation groups, there could be a spurious negative correlation between base and overtime wage rates, since for similar data, a lower intercept would be offset by a higher slope in estimating the best-fit line. However, that spurious correlation should not exist under the assumption that work hours and wage configurations differ across firms and estimation groups.

The constructed wage data is shown in Table 5. The average overtime hourly pay is 1.7 US dollars per hour, while the average base hourly rate is 0.75 dollars per hour. The maximum weekly pay according to the reconstructed estimates is 430.8, compared to the reported 4232.8. This difference probably exists because at higher levels of pay, the discrepancy between the reported and estimated pay widens, so those observations are likely dropped from the reconstruction. Table 5 also shows summary statistics for the ratio of overtime to regular wages. The mean ratio is 3, which meets the legal requirement for overtime wage rates at 150% of base wage rates. However, it is essential to note that the average is affected by some extreme outliers. 87% of observations can be characterized by a ratio of less than 1.5, suggesting de facto non-compliance with the minimum wage rate regulations (see Figure 5 for the cumulative distribution function). It is possible that firms are either not paying for overtime or paying non-compliant rates. It is also possible that the de facto overtime wage rate is reduced by firms not paying for overtime hours until a worker's production quota has been met. This possibility appears likely in light of information on worker productivity shown in Table 2. On average, workers report that it takes them 9 hours to reach their daily production target. The patterns in the wage data are consistent with the hypothesis that workers may be paid 150% of base wage rates for overtime, but are not paid for overtime until they have met their production quota. If true, this hypothesis would mean that workers are generally not paid for the first hour they work beyond the standard 8-hour workday.

[Table 3 about here.]

[Table 4 about here.]

[Table 5 about here.]

[Figure 5 about here.]

### 5.3 Variable definition and construction

Table 6 provides an overview of the variables included in the regressions. Table 7 displays summary statistics for all variables not previously presented.

[Table 6 about here.]

[Table 7 about here.]

## 6 Empirical analysis

### 6.1 Income configuration

The analysis begins by recreating the theoretical diagram. The control group is compared to the manipulated group overall as well as to sub-groups, shown in Figures 6 (allowing for a structural break at the no-overtime participation constraint) and 7 (using a polynomial fit generated by STATA). Corresponding regressions are shown shown in Table 7.

The relationship between regular and overtime income is negative, as the theoretical model predicts along the participation constraints. Table 7, Column 1 shows that for the control group, a 1-dollar increase in base income is associated with a statistically significant decrease of 0.024 dollars in overtime income, holding hours constant. The regressions also support the hypothesis that there is a structural break in the relationship between regular and overtime pay near the no-overtime participation constraint. If firms are bound by the incentive compatibility constraint, the model predicts a steeper slope to the left of the no-overtime participation constraint and a smaller effect of total regular pay on total overtime pay to the right of the no-overtime participation constraint. The appropriateness of a quadratic fit, shown in Column 2 with a statistically significant coefficient on the square of base income, is consistent with the existence of such a structural break. To more precisely evaluate whether that structural break exists, a linear fit is estimated separately for the subsamples to the left and right of the no-overtime participation constraint and illustrated in Figure 6a. The no-overtime participation constraint is approximated by the 25th percentile of total regular income for all workers working no overtime hours. The division is inherently somewhat arbitrary, but based on the assumption that firms are unable to identify the exact location of the constraint and tend to pay higher than the bare minimum rather than lower, since if they pay lower, that worker would not be observed working at the factory. Using the 25th percentile locates the no-overtime participation constraint at \$23.53. Since these figures are weekly, the monthly pay can be approximated as 23.53*4.35, which is 102.36. The minimum wage in Vietnam ranges regionally from \$90 to \$138. It is consistent with one's intuition that the no-overtime participation constraint falls within – and particularly, towards the bottom of – that range, since the constraint represents the minimum income at which the worker would be willing to remain employed by the firm.

Column 3 of Table 8 performs the regression only for the 330 observations to the left of the no-overtime participation constraint. The result is a statistically significant coefficient of -1.127, which is consistent with the model's prediction of an approximately one-to-one trade-off of regular and overtime income along the incentivize-overtime participation constraint.

Column 4 shows the estimation for the 869 observations to the right of the no-overtime participation constraint. For that subsample, the coefficient on regular pay drops in magnitude to -0.0574 and is not statistically significant at conventional levels. The tradeoff between regular and overtime pay, then, is less pronounced to the right of the no-overtime participation constraint, as the theoretical model predicts if firms are bound by the incentive compatibility condition.

The significance of the difference in the effect of base income across the no-overtime participation constraint is tested by performing the estimation for the entire control sample with interaction terms to allow for a different coefficient to the left of the no-overtime participation constraint. The regression also includes a dummy variable equal to 1 if the observation falls to the left of the no-overtime participation constraint to allow for flexibility in the intercept. The results, shown in Column 5, verify the findings in Columns 3 and 4.

Due to differences between workers, controls for individual characteristics must be included to verify that the diagram is not a result of variation in exogenous variables, which would shift the constraints across workers. Column 6 includes controls for gender, age, level of education, whether promoted, parenthood status, and job category (not shown). The results are similar to the previous findings, supporting the interpretation that there is a non-spurious relationship between base and overtime income.

In summary, for the control group, there is approximately a one-to-one tradeoff between base and overtime pay. Beyond the no overtime participation constraint, the relationship flattens out. These results, visible in the diagram with a discrete break shown in Figure 6, are also visible in the polynomial fit shown in Figure 7. These estimation results are consistent with the theoretical model.

[Table 8 about here.]

Greater precision can be attained by distinguishing strategies within the manipulated group. The subsample diagrams are shown in the remaining panels of Figures 6 and 7, with the corresponding regressions in Table 9.

[Table 9 about here.]

[Figure 6 about here.]

[Figure 7 about here.]

### 6.2 Determinants of hours estimation

Similarly to the analysis of determinants of overtime income, the hours estimation can be conducted in two levels of precision. Firstly, controls can be included only to distinguish between only control and manipulated observations. Secondly, controls can allow effects to vary by each form of manipulation. The comparison to the control groups rests on the assumption that the control group provides the best possible approximation of workers' optimizing behavior in the absence of non-wage pressures. As the group provides an approximation, it is likely that the estimates of the difference between control and non-control outcomes are conservative – if the control group is working more hours than desired, the discrepancy between real desired and manipulated outcomes is larger than estimated here. That is likely the case, since the control group is characterized by low but not nonexistent levels of verbal abuse, which could influence worker decisions.

Table 10 shows the estimated determinants of hours for control versus manipulated observations.

[Table 10 about here.]

A similar estimation with manipulated observations separated by subsample is shown in Table 11. To determine how many undesired hours result from each firm strategy, the drivers of hours for each group are compared to the main control group.

Desired hours are estimated to decrease by 0.245 with each one-dollar increase in the overtime wage. Hours decrease by 6.248 with each dollar increase in the base. Hours are also 3.125 higher below the no-overtime participation constraint, holding wages constant, although statistical significance is lacking. This observation is consistent with the theoretical model's prediction that below the no-overtime participation constraint, the incentivized overtime participation constraint rather that the incentive compatibility condition is binding, resulting in overtime at lower levels of total income. The coefficients thus support the hypothesis of a structural break and the idea that low base wages contribute to overtime decisions. Both high verbal abuse and short-term contract strategies reduce the decrease in hours associated with higher overtime wage rates, although the effect is only statistically significant for the short-term contract strategy. The most significant implication of the estimation for the hypothesized strategies is that the combination of short-term contracts and increased base wages has a positive net effect on hours. While it is not clear that the measure of intimidation effectively captures a dimension of worker motivation, the short-term contract measure is capturing an element of worker behavior.

[Table 11 about here.]

The prediction of voluntary hours is carried out in two versions. Version A treats intimidation and dismissal threats, but not low base pay, as determinants of involuntary hours. Version B treats low base pay (specifically, below the no-overtime participation constraint) as a form of incentive manipulation leading to involuntary hours. The estimations are summarized in the following table.

| Version | Is low pay considered manipulation? | Method | Approach |
|---|---|---|---|
| A | No | Direct | Estimate determinants of desired hours |
| A | No | Delta | Estimate determinants of involuntary hours |
| B | Yes | Direct | Estimate determinants of desired hours |
| B | Yes | Delta | Estimate determinants of involuntary hours |

### 6.3 Involuntary hours, version A: direct method

Based on the coefficients from the estimation including subsample coefficients, desired hours can be predicted using the following formula:

$$\hat{H}_{desired_i} = \left[ \begin{array}{ccccc} \hat{\alpha}_1 & \hat{\beta_{1,1}} & \hat{\beta}_{1,2} & \hat{\beta}_{1,3} & \hat{\beta}_{1,4} \end{array} \right] \left[ \begin{array}{c} 1 \\ W_{OT_i} \\ W_{B_i} \\ P_i \\ P_i W_{B_i} \end{array} \right] \tag{30}$$

Substituting in the estimated coefficients from Table 11, Formula 30 can be written:

$$\hat{H}_{desired_i} = \left[ \begin{array}{ccccc} 12.46 & -0.245 & -6.248 & 3.125 & -5.613 \end{array} \right] \left[ \begin{array}{c} 1 \\ W_{OT_i} \\ W_{B_i} \\ P_i \\ P_i W_{B_i} \end{array} \right] \tag{30'}$$

Formula 30' is used to construct desired hours on the worker level. Involuntary hours are then calculated by the following formula:

$$\hat{H}_{involuntary_i} = H_{actual_i} - \hat{H}_{desired_i} \tag{40}$$

Summary statistics for the estimates are shown in Table 12. By the direct method, workers in the manipulated group work an average of over two undesired overtime hours weekly and a similar median. For the non-compliant subsample, the mean of undesired weekly overtime hours is 5 hours, showing that the compliance measure derived by Better Work is consistent with worker experience. Verbal abuse and short-term contracts are associated with 1 and 3 involuntary hours, respectively.

The proportion of hours that are involuntary are also calculated on the worker level as $\hat{H}_{involuntary_i}/H_{actual_i}$. For the sample overall, the average proportion is 4%, but it is as high at 19% for the subsample of workers in noncompliant firms. The median proportion is 28%, suggesting that strong outliers drag the mean down.

The proportion of total overtime hours that are involuntary can be calculated by summing Formula 40 over individuals $i$. The direct method calculates that involuntary overtime hours are 2,729.711. For the same subsample of workers, actual overtime hours are 12,526, showing that 22% of overtime hours worked are involuntary.

[Table 12 about here.]

### 6.4 Involuntary hours, version A: delta method

By the delta method, involuntary hours rather than desired hours are predicted, using Equation 41:

$$\hat{H}_{involuntary_i} = \left[ \begin{array}{ccccc} \hat{\alpha}_2 & \hat{\beta}_{2,1} & \hat{\beta}_{2,2} & \hat{\beta}_{2,3} & \hat{\beta}_{2,4} \\ \hat{\alpha}_3 & \hat{\beta}_{3,1} & \hat{\beta}_{3,2} & \hat{\beta}_{3,3} & \hat{\beta}_{3,4} \end{array} \right] \left[ \begin{array}{cc} VA_i & STC_i \\ VA_i W_{OT_i} & STC_i W_{OT_i} \\ VA_i W_{B_i} & STC_i W_{B_i} \\ VA_i P_i & STC_i P_i \\ VA_i P_i W_{B_i} & STC_i P_i W_{B_i} \end{array} \right] \tag{41}$$

Substituting in the estimated coefficients from Table 11, Formula 41 can be written:

$$\hat{H}_{involuntary_i} = \begin{bmatrix} -1.127 & 0.0454 & 1.044 & -1.280 & 2.866 \\ -0.479 & 0.110 & 1.092 & -3.750 & 8.644 \end{bmatrix} \begin{bmatrix} VA_i & STC_i \\ VA_iW_{OT_i} & STC_iW_{OT_i} \\ VA_iW_{B_i} & STC_iW_{B_i} \\ VA_iP_i & STC_iP_i \\ VA_iP_iW_{B_i} & STC_iP_iW_{B_i} \end{bmatrix} \tag{41'}$$

Using involuntary hours as calculated by Formula 41', Formula 40 is used to calculate desired hours.

By the delta method, workers in the manipulated group work an average of 0.1 undesired overtime hours weekly. For the non-compliant subsample, the mean of undesired weekly overtime hours is negative, which means workers would rather work more overtime hours and is inconsistent with expectations. The delta method calculates that on average, almost all overtime hours are desired, although fewer for the workers with short-term contracts, suggesting some efficiency wage strategies. Looking at the total proportion of desired hours for the sample yields a similar result.

The direct method is believed to provide a more accurate approximation than the delta method for reasons discussed in Section 6.7.

[Table 13 about here.]

### 6.5 Involuntary hours, version B: direct method

By the direct method, version B, the following formula is used to predict desired hours:

$$\hat{H}_{desired_i} = \begin{bmatrix} \hat{\alpha} & \hat{\beta}_1 & \hat{\beta}_2 \end{bmatrix} \begin{bmatrix} 1 \\ W_{OT_i} \\ W_{B_i} \end{bmatrix} \tag{42}$$

Substituting in the estimated coefficients from Table 11, Formula 42 can be written:

$$\hat{H}_{desired_i} = \begin{bmatrix} 12.46 & -0.245 & -6.248 \end{bmatrix} \begin{bmatrix} 1 \\ W_{OT_i} \\ W_{B_i} \end{bmatrix} \tag{42'}$$

Table 14 shows that workers work an average of almost three involuntary overtime hours weekly. The median is two. For the non-compliant subsample, the mean of undesired weekly overtime hours is 5 hours, which, like in version A, supports the accuracy of the compliance evaluations. Verbal abuse and short-term contracts are associated with 2 and 3 involuntary hours, respectively. The average proportion of hours that are involuntary is 7% for the entire sample, but 12% for workers with a short-term contract and 22% in firms rated as noncompliant. The median proportion for the entire sample is 31%, suggesting that like in version A, outliers affect the mean. For the sample overall, the total proportion of hours that are involuntary is 3,064.323, out of a total of 12,550 hours, or 24%.

[Table 14 about here.]

### 6.6 Involuntary hours, version B: delta method

By the delta method, version B, Formula 41 is modified by adding the following:

$$\hat{\beta}_{1,3}P_i + \hat{\beta}_{1,4}P_iW_{B_i} \tag{43}$$

The coefficients from Table 11 are substituted to obtain:

$$3.125P_i - 5.613P_iW_{B_i} \tag{43'}$$

[Table 15 about here.]

Comparing the non-compliant group to the compliant group show that the group rated as compliant has a significant difference below the no-overtime participation constraint. That result could be explained by the forced overtime participation constraint, which has a steeper slope than the incentive compatibility constraint. If the compliant subsample contains firms that are on the incentive compatibility constraint, rather than the participation constraints, total overtime income should be relatively less responsive to regular income, holding hours constant – or equivalently, hours should be less responsive to regular income, holding total overtime income constant.

### 6.7 Synthesis

In both version A and B, the direct method calculates a considerable difference between desired and actual hours, while by the delta method, the difference is minimal. The direct method, however, is probably the most accurate. The direct method bases calculations off of the coefficients on wage rates for the control group, which are statistically significant at the 1% level. The coefficients used in the delta method are generally less statistically significant. Although they are used in the delta calculations as a best possible approximation, the lack of statistically significance calls their accuracy into question. The implications of the difference in significance are that some factors drive workers off of their labor supply curves, but the model has limited success in identifying the significant ones. For that reason, the direct method is probably the most accurate way of distinguishing voluntary and involuntary overtime hours. However, the difference between the direct and delta results suggest that the model is omitting an important non-wage determinant of hours and raises concern of omitted variable bias.

The exception to that interpretation is that the coefficients associated with short-term contracts are generally significant. However, the evidence suggests that verbal abuse is not used to change worker decisions about working overtime. A different variable may be necessary to measure the extent of coercion or intimidation. It is also possible that the variable is flawed because of inconsistencies in reporting verbal abuse among workers. Alternatively, it is possible that intimidation does not play a role in the incentive schemes of Vietnamese firms.

By all estimation methods, the non-compliance rating is associated with the most significant difference between desired and actual hours, which is evidence for the accuracy of the compliance evaluations. Efficiency wage strategies are associated with the next-largest discrepancy between desired and actual hours. There is evidence that at low levels of base pay, workers work more overtime, which may be considered an additional strategy if firms deliberately keep base pay down in order to elicit more work from employees.

Within the direct method, version B shows the impact of low base pay. If base pay below the no-overtime participation constraint is considered a component of involuntary overtime, the estimated proportion of hours that are involuntary increases by two percentage points. Version B treats hours as involuntary if they are related to workers responding differently to changes in base pay than they would at higher levels of base pay. However, although the difference in response at low and high levels of pay is not consistently statistically significant, workers have a strong tendency to increase overtime hours when base pay decreases, at all income levels. If that tendency, when workers are earning low base income, is considered a driver of involuntary overtime, the estimates of involuntary overtime presented here are understated.

Figure 8 shows the kernel and cumulative density functions for desired overtime hours versus actual for the direct estimation method, version B. The density of estimated desired hours is more concentrated than actual hours, which can partly be explained by the estimation technique, since the estimates are constructed using fewer explanatory variables and thus are less varied than actual outcomes. However, observing the median confirms that the distribution of desired hours does not only have a lower variance, but is to the left of, actual hours. The median of actual overtime hours is 10, while the median of desired hours is 8.4.

The desired and actual labor supply curves, using a quadratic fit, are compared in Figure 9. The shape of the desired hours is not inconsistent with a backwards-bending labor supply curve. It is difficult to conclude much about the true shape, however. An estimation of the quadratic fit does not yield statistically significant coefficients (Table 16).

Actual hours, however, follow a downwards-sloping labor supply curve, which suggests a dominating income effect. The corresponding estimation verifies the statistical significance of that assessment (Table 17). An income effect is consistent with the theoretical model of hours outcomes, by which incentives satisfy a participation constraint that allows workers to earn a certain desired income. The theoretical model predicts that if non-wage forms of manipulation are not used, increased hours should be associated with increased overtime wages, which would undermine the income effect. The desired hours supply curve is not inconsistent with that hypothesis.

[Figure 8 about here.]

[Figure 9 about here.]

[Table 16 about here.]

[Table 17 about here.]

## 7 Discussion

This paper studies the effect of factors that characterize non-competitive labor markets. The question of how many hours workers really want to work depends on how one defines "want." In this paper, standard economic models are used to inform the definition of voluntary and involuntary economic behavior. This paper proposes that hours of labor caused by employer-driven shifts of the labor supply curve are involuntary. Accordingly, workers' desired hours are assumed to be those hours incentivized by wage rates in the absence of employer behaviors that may shift the labor supply curve. Specifically, desired overtime hours are considered all hours that result from incentives on the incentive compatibility constraint with no dismissal threat. This paper finds that between 22% of overtime hours worked by garment employees in the Vietnamese factories surveyed are undesired hours that are elicited by non-wage incentive schemes.

It is critical to note that the definition of involuntary hours used here excludes excessive overtime that workers "want" to do because base wages are set so low that overtime is necessary in order to earn an acceptable income. Even if pay incentives are the determinants of hours outcomes in that case, program evaluators may consider whether those hours fall under their criteria for voluntary hours. If a different response of workers to changes in pay rates at low levels of income is considered a driver of involuntary hours, estimates of involuntary hours rise to 24%.

This paper provides an empirical component to the evidence, thus far anecdotal, that firms manipulate wages, contracts, and treatment of workers to incentivize overtime in apparel factories. Specifically, there is support for the theory that firms keep base wages low in order to make overtime more attractive to employees. As an alternative, some firms pay high base wages but relatively low overtime wages, combined with dismissal threats, to implement an efficiency-wage strategy where hours worked are the analogue to the work effort emphasized in more traditional models. The difference in strategies may explain tradeoffs between minimum wage compliance and compliance with contract regulations.

The empirical results support the hypothesis that workers are driven off of their labor supply curves, but it is not clear that the model successfully identifies the cause. There is evidence that low base wages and efficiency wage situations are important, but these do not appear to capture a significant amount of the variation from the supply curve based on wage rates alone. Consequently, further investigation is necessary to identify other predictors of worker behavior. It is possible that a different measurement of intimidation and coercion is necessary. It is also possible that factors not considered here play a significant role. For example, Smyth et. al. show that worker awareness of how to refuse overtime is a crucial predictor of hours worked. Future analyses may incorporate into the model similar variables and aspects of firm culture and worker training as predictors of involuntary hours.

Finally, theory suggests that unless there is a compensating differential for harsh treatment, harsh management strategies are profit-maximizing. Subsequent analyses could investigate firm profitability and its relationship to overtime. It remains to be determined empirically how overtime incentive schemes relate to worker productivity and the cost of compensating differentials. Buyer behavior may also be critical, as price per piece will affect firms' marginal revenue-marginal cost calculation as it determines whether or how to elicit overtime from employees. Further research can determine how the results found here fit into the context of firm profitability, worker welfare, and the development of competitive labor markets.

## References


[1] H&M supplier can't say why workers feel faint. *The Toronto Star*, NEWS:A31, September 1 2011.

[2] Olympic stress for Indonesian labourers who allege they endure sweatshop conditions. *The National*, April 29 2012.

[3] JC Magee AD Galinsky, DH Gruenfeld. From power to action. *J Pers Soc Psychol.*, 85(3):453–66, Sep 2003.

[4] George A. Akerlof and William T. Dickens. *The Economic Consequences of Cognitive Dissonance*. Oxford and New York: Oxford University Press, 2005.

[5] George A. Akerlof and Janet L. Yellen eds. *Efficiency wage models of the labor market*. Cambridge; New York and Melbourne: Cambridge University Press, 1986.

[6] Randal C. Archibold, Steven Greenhouse, Randal C.Archibold reported from Mexico City, and Steven Greenhouse from New York. Group says Haitian garment workers are shortchanged on pay. *The New York Times*, A; Foreign Desk:10, October 16 2013.

[7] Orley C. Ashenfelter, Henry Farber, and Michael R. Ransom. Labor market monopsony. *Journal of Labor Economics*, 28(2):203–210, Apr 2010.

[8] Hans G. Bloemen. Job search, hours restrictions, and desired hours of work. *Journal of Labor Economics*, 26(1):137–179, January 2008.

[9] Alison L. Booth and Pamela Katic. Estimating the wage elasticity of labour supply to a firm: What evidence is there for monopsony? *Economic Record*, 87(278):359–369, Sep 2011.

[10] Mark L. Bryan. Workers, workplaces and working hours. *British Journal of Industrial Relations*, 45(4):735–759, Dec 2007.

[11] Sarah Butler. Clothes industry: Workers in Bangladesh 'locked in for 15 hours'. *The Guardian (London) - Final Edition*, Guardian Financial Pages:29, September 24 2013.

[12] Lin Chung-cheng. The shortage of registered nurses in monopsony: A new view from efficiency wage and job-hour models. *American Economist*, 46(1):29–35, Spring 2002.

[13] Peter E. Earl. *On the Complementarity of Economic Applications of Cognitive Dissonance Theory and Personal Construct Psychology*. Aldershot, U.K.: Elgar; distributed in the U.S. by Ashgate, Brookfield, Vt., 1992.

[14] Richard B. Freeman and Morris M. Kleiner. The last American shoe manufacturers: Decreasing productivity and increasing profits in the shift from piece rates to continuous flow production[dagger]. *Industrial Relations*, 44(2):307–330, Apr 2005.

[15] Subir Ghosh. Garment workers demand 'living wage' as basic right; combination of long working hours and low wages is amounting to bonded and forced labour practices in the country. *Dna*, November 26 2012.

[16] Arthur H. Goldsmith. The labor supply consequences of perceptions of employer discrimination during search and on-the-job: Integrating neoclassical theory and cognitive dissonance. *Journal of Economic Psychology*, 25(1):15–39, Feb 2004 2004.

[17] Marco Guerrazzi. A dynamic efficiency-wage model with continuous effort and externalities. *Economic Issues*, 13(2):37–58, Sep 2008.

[18] Joni Hersch. Compensating differentials for sexual harassment. *American Economic Review*, 101(3):630–634, May 2011.

[19] Jun Ji-hye. Cambodian workers suffer overtime, low wages. *Korea Times*, January 20 2014.

[20] Shulamit Kahn and Kevin Lang. Hours constraints and the wage/hours locus. *Canadian Journal of Economics*, 29:S71–S75, Apr 1996.

[21] John Knight and Shi Li. Wages, firm profitability and labor market segmentation in urban China. *China Economic Review*, 16(3):205–228, 2005.

[22] Mom Kunthear. Overtime boycott under way. *The Phnom Penh Post (Cambodia)*, February 25 2014.

[23] Mom Kunthear and Sean Teehan. Workers 'locked inside' during overtime strike. *The Phnom Penh Post (Cambodia)*, March 4 2014.

[24] Sachiko Kuroda and Isamu Yamamoto. Firms' demand for work hours: Evidence from matched firm-worker data in Japan. *Journal of the Japanese and International Economies*, 29:57–73, Sep 2013.

[25] Stephen E. G. Lea, Paul Webley, and Brian M. Young eds. *New directions in economic psychology: Theory, experiment and application.* Aldershot, U.K.: Elgar; distributed in the U.S. by Ashgate, Brookfield, Vt., 1992.

[26] Stephen Machin, Alan Manning, and S. Woodland. Are workers paid their marginal product? Evidence from a low wage labour market. *Centre for Economic Performance, LSE, CEP Discussion Papers, 1993*, 1993.

[27] Malcolm Moore and The Daily Telegraph. Giants accused of creating sweatshops; Apple, HP, Dell and others share responsibility for suicides: report. *National Post's Financial Post & FP Investing (Canada)*, FINANCIAL POST:FP3, July 22 2011.

[28] Roxana Ng. Freedom for whom? Globalization and trade from the standpoint of garment workers. *Canadian Woman Studies*, pages 74–81, Spring/Summer 2002.

[29] James B. Rebitzer and Lowell J. Taylor. The consequences of minimum wage laws: Some new theoretical ideas. *Journal of Public Economics*, 56(2):245–255, Feb 1995.

[30] Carl Shapiro and Joseph E. Stiglitz. Equilibrium unemployment as a worker discipline device. *American Economic Review*, 74(3):433–444, Jun 1984.

[31] Yusuf Munir Sidani. Gaps in female labor participation and pay equity: the impact of cultural variables. *Gender in Management*, 28(7):424–440, 2013.

[32] Russell Smyth, Xiaolei Qian, Ingrid Nielsen, and Ines Kaempfer. Working hours in supply chain Chinese and Thai factories: Evidence from the Fair Labor Association's 'Soccer Project'. *British Journal of Industrial Relations*, 51(2):382–408, Jun 2013.

[33] Richard Spencer and The Daily Telegraph. Exploited workers rebel in China: Tensions rise in factories as employees are allegedly worked to death. *The Vancouver Sun (British Columbia)*, NEWS:A13, December 22 2004.

[34] Mark B. Stewart and Joanna K. Swaffield. Constraints on the desired hours of work of british Men. *Economic Journal*, 107(441):520–535, Mar 1997.

[35] Jon Strand. Unemployment as a discipline device with heterogeneous labor [equilibrium unemployment as a worker discipline device]. *American Economic Review*, 77(3):489–493, Jun 1987.

[36] Ferdinand A. von Siemens. Heterogeneous social preferences, screening, and employment contracts. *Oxford Economic Papers*, 63(3):499–522, Jul 2011.

## A The general case

For the purpose of illustration, Figure 1 uses the following arbitrarily-assigned parameters and exogenous variables:

- $a = 0.7$
- $H_{OT} = 3$
- $b = 1.1$
- $V_{OTI} = 3$
- $V_{OTF} = 3$
- $c = 1.2$
- $r = 0.2$
- $\overline{U} = 10$
- $f = 4$
- $\theta = \frac{1}{V}$

- $D = 0.5$

The relationships shown in Figure 1 are examined algebraically in this appendix.

Solving Equation 7' (PCOTI) and Equation 9' (PCOTF) for the $I_{OT}$-intercepts and comparing them yields:

$$\left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI}-1)^c\right]^{\frac{1}{a}} \gtreqless \left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF}-1)^c + f\right]^{\frac{1}{a}} \tag{A1}$$

The direction of the relationship in A1 is theoretically ambiguous. In Figure 1, the net effect of $f$ is a loss of worker utility, holding wages constant. However, since the firm can choose $V_{OTF}$ independently from $V_{OTI}$, and possibly introduce cognitive dissonance through the function $g(f)$, the placement of PCOTF could be above or below PCOTI. $V_{OTF}$ has a positive effect through $(V-1)^c$ but a negative effect through $\theta$ and $V^d$. PCOTF will lie below POCTI if the net effect of $V_{OTF}$ and $g(f)$ is negative and large enough to counter the positive effect of $f$.

Solving Equation 5' (IC) for the $W_{OT}H_{OT}$-intercept and comparing it to the $I_{OT}$-intercept for PCOTI is expressed as follows:

$$\left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI}-1)^c\right]^{\frac{1}{a}} \gtreqless \left(\frac{\left[\frac{D(\theta\overline{U})^a}{1+r} - (V_N-1)^c\right] r}{r+D} + H_{OT}^b + [V_{OTI}-1]^c\right)^{\frac{1}{a}} \tag{A2}$$

An algebraic simplification of Equation A2 results in:

$$\frac{(\theta\overline{U})^a r}{1+r} - \frac{D(\theta\overline{U})^a r}{(1+r)(r+D)} + \frac{(V_N-1)^c r}{r+D} \gtreqless 0] \tag{A2'}$$

It can be demonstrated that the expression on the left-hand side of the Inequality A2' is positive, since $\frac{D}{r+D} < 1$ and $V \geq 1$. It follows that the $I_{OT}$-intercept of PCOTI always lies above that of IC.

Comparing the $I_{OT}$-intercepts of PCOTF and IC is expressed as follows:

$$\left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF}-1)^c + f\right]^{\frac{1}{a}} \gtreqless$$
$$\left(\frac{\left[\frac{D(\theta\overline{U})^a}{1+r} - (V_N-1)^c\right] r}{r+D} + H_{OT}^b + [V_{OTI}-1]^c\right)^{\frac{1}{a}} \tag{A3}$$

The direction of the relationship is theoretically ambiguous. Consequentially, the PCOTF may intercept the $I_{OT}$-axis above or below IC.

The analysis of the $I_{OT}$-intercept applies to the $I_B$-intercept, a consequence of the fact that the slopes of both PCOTI and PCOTF are equal to $-1$. PCOTF may intercept the $I_B$-axis before or after PCOTI.

Solving Equation 7' (PCOTI) and Equation 5' (IC) for the $I_B$-intercepts and comparing them yields:

$$\left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI}-1)^c\right]^{\frac{1}{a}} \gtreqless \left(\left[(\theta\overline{U})^a - \frac{(V_N-1)^c}{D}\right] r + \left[H_{OT}^b + (V_{OTI}-1)^c\right]\left[\frac{r+D}{D}\right]\right)^{\frac{1}{a}} \tag{A4}$$

The direction of the relationship is theoretically indeterminate, so IC may intercept the $I_B$-axis before or after PCOTI.

Solving PCOTF for the $I_B$-intercept and comparing it to the $I_B$-intercept for IC is expressed:

$$\left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF}-1)^c + f\right]^{\frac{1}{a}} \gtreqless \left(\left[(\theta\overline{U})^a - \frac{(V_N-1)^c}{D}\right] r + \left[H_{OT}^b + (V_{OTI}-1)^c\right]\left[\frac{r+D}{D}\right]\right)^{\frac{1}{a}} \tag{A5}$$

The direction of the relationship is ambiguous, so IC may intercept the $I_B$-axis before or after IC.

In summary, on the $I_{OT}$-axis, IC lies below PCOTI but PCOTF may be anywhere relative to the other two. The relative placement of the constraints along the $I_B$-axis is theoretically indeterminate.

Finally, it is worth noting that IC, PCOTI, and PCN intersect at the same point. Setting Equation 5' (IC) equal to Equation 7' (PCOTI) yields:

$$W_B H_B = \left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N-1)^c\right]^{\frac{1}{a}} \tag{A6}$$

Equation A6 is the same as Equation 10" (PCN).

# B Abuse outcomes

For Case OTI, the first-order condition is used to find the profit-maximizing level of abuse, $V$:

$$\frac{\partial \pi_{OTI}}{\partial V_{OTI}} = -\left[\frac{1+r}{r}\right]\left[\frac{1}{a}\right]\left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI}-1)^c\right]^{\frac{1}{a}-1} \left[\frac{r\overline{U}a\theta^{a-1}\frac{\partial\theta}{\partial V_{OTI}}}{1+r} + c(V_{OTI}-1)^{c-1}\right] = 0 \quad \text{(B1)}$$

An algebraic simplification of Equation B1 shows that to maximize profits, either Equation B2.a or B2.b must be true:

$$\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI}-1)^c = 0 \quad \text{(B2.a)}$$

$$\frac{r\overline{U}^a a\theta^{a-1}\frac{\partial\theta}{\partial V_{OTI}}}{1+r} + c(V_{OTI}-1)^{c-1} = 0 \quad \text{(B2.b)}$$

Consequentially, the profit-maximizing level of abuse depends on the relative effects of lowering the worker's reservation utility through $\theta$ and imposing disutility on the worker.

This result holds for Case OTF and Case N as well. Taking the first-order condition for profits in Case OTF with respect to $V$ gives:

$$\frac{\partial \pi_{OTF}}{\partial V_{OTF}} = -\left[\frac{1+r}{r}\right]\left[\frac{1}{a}\right]\left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF}-1)^c + f\right]^{\frac{1}{a}-1} \left[\frac{r\overline{U}^a a\theta^{a-1}\frac{\partial\theta}{\partial V_{OTF}}}{1+r} + c(V_{OTF}-1)^{c-1}\right] = 0 \quad \text{(B3)}$$

For profit maximization, one of the following must be true:

$$\left[\frac{(\theta\overline{U})^a r}{1+r} + \frac{H_{OT}^b}{g(f)} + (V_{OTF}-1)^c + f\right]^{\frac{1}{a}-1} = 0 \quad \text{(B4.a)}$$

$$\left[\frac{r\overline{U}^a a\theta^{a-1}\frac{\partial\theta}{\partial V_{OTF}}}{1+r} + c(V_{OTF}-1)^{c-1}\right] = 0 \quad \text{(B4.b)}$$

In Case OTF, the effect of $f$ is also relevant. The net effect of $f$ depends on the relative effects of introducing cognitive dissonance through $g(f)$ and imposing disutility on the worker. Equation B4.a shows that the net effect of $f$ may have consequences for the optimal choice of $V$.

To show the same result for Case N, taking the first-order condition for profits with respect to $V$ gives:

$$\frac{\partial \pi_N}{\partial V_N} = \left[\frac{1+r}{r}\right]\left[\frac{1}{a}\right]\left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N - 1)^c\right]^{\frac{1}{a}-1}\left[\frac{r\overline{U}^a a\theta^{a-1}\frac{\partial\theta}{\partial V_N}}{1+r} + c(V_N-1)^{c-1}\right] = 0 \tag{B5}$$

An algebraic simplification of Equation B5 shows that to maximize profits, either Equation B6.a or B6.b must be true:

$$\left[\frac{(\theta\overline{U})^a r}{1+r} + (V_N - 1)^c\right]^{\frac{1}{a}-1} = 0 \tag{B6.a}$$

$$\left[\frac{r\overline{U}^a a\theta^{a-1}\frac{\partial\theta}{\partial V_N}}{1+r} + c(V_N-1)^{c-1}\right] = 0 \tag{B6.b}$$

Assume that an external penalty is imposed on factories that abuse workers, such that each unit of $V$ lowers profits by $s$. The profit function for Case OTI can be expressed:

$$\pi_{OTI} = \left(PQ_N + PQ_{OT} - \left[\frac{(\theta\overline{U})^a r}{1+r} + H_{OT}^b + (V_{OTI} - 1)^c\right]^{\frac{1}{a}} - s(V_{OTI} - 1)\right)\left(\frac{1+r}{r}\right) \tag{B7}$$

It is trivial to show that $s$ lowers the profit-maximizing choice of $V$.

A similar result applies in Case OTF. A penalty applied to $V$ lowers the profit-maximizing choice of $V$. If the penalty is also applied to $f$, there may be consequences for the firm's decision whether or not to force overtime rather than incentivizing it. The profit function with the penalty applied for both behaviors is expressed:

$$\pi_{OTF} = PQ_N + PQ_{OT} - (I_B)_{OTF} - (I_{OT})_{OTF} - s(V_{OTF} - 1) - sf + \frac{\pi_{OTF}}{1+r} \tag{B8}$$

The profitability of forced overtime relative to incentivized overtime will no longer depend only on the difference between wages in either case, but on the magnitude of the penalty imposed in Case OTF. Intuitively and algebraically, the larger the penalty on forced overtime, the less profitable forced overtime is relative to incentivized overtime.

# C Data cleaning

## C.1 Hours

From the hours data given, subtracting start time from end time in some cases yields odd results, including negative hours. It is conceivable that workers made errors while entering hours, for example, by incorrectly entering AM and PM values as the opposite of what they intended.

If worker reports working fewer than 4 hours, starting in the afternoon before 4:00 PM and ending before 12:00 noon, it is assumed that he or she incorrectly input PM end time as AM, and 12 is added to the end time.

If a worker reports fewer than 4 hours starting after 4:00 PM and ending before 12:00 noon, it is treated as an overnight shift.

If a worker reports fewer than 4 hours, starting and ending after 12:00 noon, it is assumed that he or she incorrectly input AM start time as PM, and 12 is subtracted from the start time.

### C.2 Income

The income data given contained a wide range of values, some far too small to be realistic. It is reasonable to believe that some workers may have omitted 0's when entering compensation.

The procedure used to correct erroneous values is the following: if reported hourly pay is less than 10 US cents, multiply by 10. If reported hourly pay is still less than 1 cent, multiply by 10 again. If reported hourly pay is still less than 0.1 cent, multiply by 10 again. If reported hourly pay is still less than 0.01 cent, multiply by 10 again.

Table 1: Demographics

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| female | 0.809 | 0.393 | 0 | 1 | 5045 |
| age* | 28.187 | 7.181 | 17 | 65 | 5041 |
| years of schooling | 8.929 | 2.715 | 0 | 16 | 5035 |
| married** | 0.584 | 0.493 | 0 | 1 | 5045 |
| has children | 0.105 | 0.307 | 0 | 1 | 5039 |

**Age is approximate, as exact date of birth is not available. Age is calculated by subtracting year born from the year of survey.*

***The variable "married" is a dummy equal to 1 if the worker is married or has been married, including separated or divorced, and 0 if the worker has never been married.*

Table 2: Work history

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| promoted | 0.154 | 0.361 | 0 | 1 | 5042 |
| years at factory | 4.443 | 3.318 | 0 | 20 | 5037 |
| weekly hours | 58.256 | 10.161 | 8 | 120 | 4885 |
| regular hours | 47.048 | 5.156 | 8 | 48 | 5042 |
| overtime hours | 10.776 | 7.398 | 0 | 72 | 5042 |
| Sunday hours | 0.12 | 1.07 | 0 | 12 | 4887 |
| has production target | 0.918 | 0.275 | 0 | 1 | 1823 |
| hours to reach daily target | 8.984 | 2.23 | 0 | 14.667 | 1612 |

*Workers who did not answer the question about promotion are assumed to not have been promoted. There are 43 such respondents.*

Table 3: Dimensions affecting pay rates

| | (1) |
|---|---|
| female | -8.397*** |
| | (-3.02) |
| promoted | 14.05*** |
| | (4.74) |
| 1b.pay structure | 0 |
| | (.) |
| 2.pay structure | 5.793** |
| | (2.13) |
| 3.pay structure | 3.594 |
| | (0.92) |
| 4.pay structure | 45.18*** |
| | (6.59) |
| not sewer | 0.551 |
| | (0.25) |
| weekly hours | 0.542*** |
| | (5.21) |
| Constant | 14.31** |
| | (2.09) |
| Observations | 4819 |
| $R^2$ | 0.023 |

$t$ statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Wage regression groups

| Group | Job | Gender | Pay Structure | Promoted |
|---|---|---|---|---|
| 1 | Sewer | Female | By hour | Never |
| 2 | Sewer | Female | By hour | At least once |
| 3 | Sewer | Female | By piece, by hour and piece, or unknown | Never |
| 4 | Sewer | Female | By piece, by hour and piece, or unknown | At least once |
| 5 | Sewer | Male | By hour | Never |
| 6 | Sewer | Male | By hour | At least once |
| 7 | Sewer | Male | By piece, by hour and piece, or unknown | Never |
| 8 | Sewer | Male | By piece, by hour and piece, or unknown | At least once |
| 9 | Non-sewer | Female | By hour | Never |
| 10 | Non-sewer | Female | By hour | At least once |
| 11 | Non-sewer | Female | By piece, by hour and piece, or unknown | Never |
| 12 | Non-sewer | Female | By piece, by hour and piece, or unknown | At least once |
| 13 | Non-sewer | Male | By hour | Never |
| 14 | Non-sewer | Male | By hour | At least once |
| 15 | Non-sewer | Male | By piece, by hour and piece, or unknown | Never |
| 16 | Non-sewer | Male | By piece, by hour and piece, or unknown | At least once |

Table 5: Wage data

| **Variable** | **Mean** | **Std. Dev.** | **Min.** | **Max.** | **N** |
|---|---|---|---|---|---|
| reported weekly pay, USD | 44.275 | 72.714 | 0 | 4232.804 | 4972 |
| reconstructed weekly pay, USD | 35.23 | 22.681 | -4.989 | 430.839 | 1212 |
| base income | 32.295 | 21.994 | 0 | 430.839 | 1212 |
| OT income | 2.889 | 9.348 | 0 | 144.162 | 1212 |
| OT wage | 1.658 | 24.603 | 0 | 596.372 | 1212 |
| base wage | 0.748 | 0.684 | 0 | 10.025 | 1212 |
| Sunday wage | 0.145 | 1.796 | -6.642 | 31.696 | 1212 |
| ratio of OT wage to base wage | 3.092 | 41.932 | 0 | 1364.138 | 1207 |

Table 6: Variable definition and construction

| Name | Definition | Construction |
|---|---|---|
| base income | Weekly non-overtime income in USD | For workers who report 0 overtime hours, equal to weekly reported income; for workers who report some overtime, equal to the constant $\alpha$ estimated from Equation 29 |
| base wage | Non-overtime hourly wage rate | For workers who report 0 overtime hours, equal to weekly reported income divided by weekly hours; for workers who report some overtime, equal to the constant $\alpha$ estimated from Equation 29' divided by weekly hours |
| OT wage | Overtime hourly wage rate | Equal to estimated $\beta$ from Equation 29' if greater than 0; replaced with 0 if less than 0 |
| under PCN | Indicates whether base income is below no-overtime participation constraint | Dummy equal to 1 if base income is below no-overtime participation constraint, which is constructed as 25th percentile of weekly income for workers who report 0 overtime hours; 0 otherwise |
| base income if under PCN | Non-overtime income if below no-overtime participation constraint, 0 otherwise | Base income interacted with a dummy indicating whether base income is below no-overtime participation constraint |
| base wage if under PCN | Non-overtime wage rate if below no-overtime participation constraint, 0 otherwise | Non-overtime wage rate interacted with a dummy indicating whether base income is below no-overtime participation constraint |
| VA | Level of verbal abuse | Factory-level average of a dummy equal to 1 if worker expresses some concern about verbal abuse and 0 otherwise; workers who did not respond to the question are assumed to have some concern (41 respondents) |
| STC | Indicates whether worker has a short-term contract | Dummy equal to 1 if worker has no contract, training or probationary contract, temporary or less than one-year contract, indefinite or open-ended contract, or does not know; equal to 0 if worker has definite or term contract for one to three years |
| base wage if STC | Base wage if a worker has a short-term contract, 0 otherwise | Base wage interacted with a dummy indicating whether base income is below no-overtime participation constraint |
| forced OT | Indicates whether overtime is forced | Factory-level dummy equal to 1 if compliance evaluation determines that overtime is not voluntary; 0 otherwise |

Table 7: Summary statistics on regression variables

| Variable | Mean | Std. Dev. | N |
|---|---|---|---|
| under PCN | 0.066 | 0.248 | 5074 |
| base income if under PCN | 4.561 | 8.056 | 1212 |
| base wage if under PCN | 0.105 | 0.213 | 1212 |
| under PCN | 0.066 | 0.248 | 5074 |
| VA | 0.077 | 0.098 | 5074 |
| STC | 0.592 | 0.491 | 5033 |
| base wage if STC | 0.458 | 0.646 | 1204 |
| forced OT | 0.145 | 0.352 | 4157 |

Table 8: Determinants of overtime income for control vs. manipulated

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| base income | -0.0240** | -0.889*** | -1.127*** | -0.0574 | -0.0574 | -0.112 |
| | (-2.35) | (-2.84) | (-3.46) | (-1.00) | (-0.99) | (-1.49) |
| Manipulated | 3.141 | -7.179 | -7.670 | -1.250 | -1.250 | -3.044 |
| | (0.94) | (-1.30) | (-1.05) | (-0.56) | (-0.56) | (-1.07) |
| base income if manipulated | -0.0487 | 0.518* | 0.435 | 0.0414 | 0.0414 | 0.0943 |
| | (-0.72) | (1.67) | (1.15) | (0.71) | (0.71) | (1.21) |
| square of base income | | 0.0108** | | | | |
| | | (2.50) | | | | |
| square of base income if manipulated | | -0.00799* | | | | |
| | | (-1.86) | | | | |
| base income if under PCN | | | | | -1.070*** | -0.711*** |
| | | | | | (-3.25) | (-3.27) |
| under PCN | | | | | 21.56*** | 14.54*** |
| | | | | | (3.27) | (3.14) |
| under PCN if manipulated | | | | | -6.420 | 1.409 |
| | | | | | (-0.86) | (0.80) |
| Constant | 1.006*** | 18.38*** | 25.14*** | 3.583 | 3.583 | 0.383 |
| | (2.78) | (3.32) | (3.97) | (1.60) | (1.60) | (0.09) |
| Observations | 1199 | 1199 | 330 | 869 | 1199 | 1186 |
| $R^2$ | 0.002 | 0.072 | 0.118 | 0.001 | 0.108 | 0.123 |

$t$ statistics in parentheses

$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

*Standard error clustered by factory-year-wage group.*

*Column (6) includes controls for gender, education level, parenthood status, age, job title, whether promoted, and wage structure.*

Table 9: Determinants of overtime income by subsamples

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| base income | -0.0342 | -0.422*** | -0.582* | -0.0279 | -0.0279 | -0.0344 |
| | (-1.25) | (-2.69) | (-1.85) | (-1.48) | (-1.48) | (-1.41) |
| high VA (over mean) | 5.916 | 0.897 | 0.982 | 0.495 | 0.495 | 1.201 |
| | (0.98) | (0.19) | (0.12) | (0.32) | (0.32) | (0.66) |
| base income if high VA | -0.110 | -0.0862 | -0.169 | -0.0279 | -0.0279 | -0.0398 |
| | (-0.92) | (-0.45) | (-0.41) | (-0.67) | (-0.67) | (-0.79) |
| STC | -0.816 | 0.431 | 4.759 | -0.0111 | -0.0111 | -0.390 |
| | (-0.61) | (0.11) | (0.59) | (-0.01) | (-0.01) | (-0.30) |
| base income if STC | 0.0380 | 0.0666 | -0.192 | 0.0265 | 0.0265 | 0.0352 |
| | (0.89) | (0.40) | (-0.46) | (0.76) | (0.76) | (0.84) |
| square of base income | | 0.00358** | | | | |
| | | (2.52) | | | | |
| square of base income if high VA | | 0.000833 | | | | |
| | | (0.49) | | | | |
| square of base income if STC | | -0.00100 | | | | |
| | | (-0.68) | | | | |
| base income if under PCN | | | | | -0.554* | -0.476 |
| | | | | | (-1.77) | (-1.50) |
| under PCN | | | | | 13.48** | 12.20* |
| | | | | | (2.16) | (1.92) |
| base income if under PCN if high VA | | | | | -0.141 | -0.182 |
| | | | | | (-0.35) | (-0.42) |
| under PCN if high VA | | | | | 0.487 | 0.727 |
| | | | | | (0.06) | (0.08) |
| base income if under PCN if STC | | | | | -0.218 | -0.319 |
| | | | | | (-0.53) | (-0.73) |
| under PCN if STC | | | | | 4.770 | 6.886 |
| | | | | | (0.60) | (0.82) |
| Constant | 1.358 | 11.42*** | 15.81** | 2.327** | 2.327** | -2.193 |
| | (1.65) | (3.06) | (2.50) | (2.50) | (2.50) | (-0.71) |
| Observations | 1191 | 1191 | 327 | 864 | 1191 | 1178 |
| $R^2$ | 0.005 | 0.077 | 0.132 | 0.007 | 0.117 | 0.135 |

$t$ statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

*Standard error clustered by factory-year-wage group.*

*Column (6) includes controls for gender, education level, parenthood status, age, job title, whether promoted, and wage structure.*

Table 10: Determinants of overtime hours, control versus manipulated

| | (1) | (2) |
|---|---|---|
| OT wage | -0.0190*** | -0.245*** |
| | (-3.02) | (-3.49) |
| base wage | -3.645 | -6.654* |
| | (-0.79) | (-1.98) |
| under PCN | -2.339 | -0.111 |
| | (-0.47) | (-0.02) |
| base wage if under PCN | 0.635 | -1.073 |
| | (0.06) | (-0.07) |
| OT wage if manipulated | 0.104*** | 0.116*** |
| | (2.91) | (4.00) |
| base wage if manipulated | -1.102 | 1.554 |
| | (-0.24) | (0.46) |
| under PCN if manipulated | 1.961 | 0.300 |
| | (0.40) | (0.05) |
| base wage if under PCN if manipulated | -1.620 | 1.360 |
| | (-0.16) | (0.09) |
| Constant | 15.45*** | 13.18*** |
| | (4.68) | (4.23) |
| Observations | 1199 | 1017 |
| $R^2$ | 0.101 | 0.162 |

$t$ statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

*Standard error clustered by factory-year-wage group.*

*Column (2) includes controls for gender, education level, parenthood status, age, job title, whether promoted, wage structure, and the number of nearby competing apparel factories.*

Table 11: Determinants of overtime hours by subsamples

| | (1) | (2) |
|---|---|---|
| OT wage | -0.0151** | -0.245*** |
| | (-2.42) | (-3.61) |
| base wage | -6.412*** | -6.248*** |
| | (-6.90) | (-7.28) |
| under PCN | 0.250 | 3.125 |
| | (0.12) | (1.40) |
| base wage if under PCN | -1.846 | -5.613 |
| | (-0.67) | (-1.62) |
| high VA (over mean) | -3.559* | -1.127 |
| | (-1.71) | (-0.61) |
| OT wage if high VA | 0.0229 | 0.0454 |
| | (0.33) | (0.60) |
| base wage if high VA | 2.482 | 1.044 |
| | (1.55) | (0.64) |
| under PCN if high VA | 1.751 | -1.280 |
| | (0.70) | (-0.44) |
| base wage if under PCN if high VA | -3.383 | 2.866 |
| | (-1.06) | (0.62) |
| STC | -0.0345 | -0.479 |
| | (-0.03) | (-0.40) |
| OT wage if STC | 0.0747** | 0.110*** |
| | (2.04) | (3.47) |
| base wage if STC | 0.734 | 1.092 |
| | (0.59) | (0.91) |
| under PCN if STC | -1.757 | -3.750* |
| | (-0.87) | (-1.68) |
| base wage if under PCN if STC | 3.493 | 8.644** |
| | (1.25) | (2.19) |
| Constant | 15.49*** | 12.46*** |
| | (11.39) | (5.76) |
| Observations | 1191 | 1009 |
| $R^2$ | 0.104 | 0.168 |

$t$ statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

*Standard error clustered by factory-year-wage group.*

*Column (2) includes controls for gender, education level, parenthood status, age, job title, whether promoted, wage structure, and the number of nearby competing apparel factories.*

Table 12: Summary of results, version A direct

(a) All

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 8.337 | 2.598 | -6.444 | 14.315 | 1175 |
| involuntary hours | 2.323 | 7.176 | -14.315 | 31.103 | 1175 |
| proportion of hours involuntary | 0.038 | 0.862 | -12.532 | 1.586 | 1013 |

(b) Manipulated

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 8.238 | 2.73 | -6.444 | 14.315 | 982 |
| involuntary hours | 2.042 | 7.099 | -14.315 | 30.748 | 982 |
| proportion of hours involuntary | 0.076 | 0.689 | -6.545 | 1.586 | 820 |

(c) Non-compliant

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 8.497 | 3.192 | -6.076 | 14.179 | 148 |
| involuntary hours | 4.939 | 8.128 | -14.179 | 22.15 | 148 |
| proportion of hours involuntary | 0.187 | 0.768 | -5.966 | 1.586 | 132 |

(d) High verbal abuse

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 8.66 | 2.617 | -3.518 | 14.27 | 463 |
| involuntary hours | 1.117 | 7.341 | -14.179 | 30.748 | 463 |
| proportion of hours involuntary | 0.009 | 0.694 | -5.966 | 1.586 | 385 |

(e) Short-term contracts

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 8.118 | 2.517 | -6.444 | 14.27 | 692 |
| involuntary hours | 2.76 | 6.812 | -13.931 | 25.698 | 692 |
| proportion of hours involuntary | 0.099 | 0.690 | -6.545 | 1.586 | 618 |

Table 13: Summary of Results, version A: delta

(a) All

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 10.466 | 7.464 | -3.134 | 42.979 | 1167 |
| involuntary hours | 0.102 | 0.8 | -3.207 | 3.856 | 1167 |
| proportion of hours involuntary | 0.014 | 0.096 | -0.534 | 0.643 | 1000 |

(b) Manipulated

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 10.038 | 7.443 | -3.134 | 42.979 | 973 |
| involuntary hours | 0.123 | 0.875 | -3.207 | 3.856 | 973 |
| proportion of hours involuntary | 0.017 | 0.107 | -0.534 | 0.643 | 806 |

(c) Noncompliant

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 13.302 | 8.749 | -1.8 | 30.519 | 144 |
| involuntary hours | -0.139 | 0.959 | -3.207 | 3.856 | 144 |
| proportion of hours involuntary | -0.002 | 0.135 | -0.534 | 0.643 | 128 |

(d) High verbal abuse

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 9.885 | 7.638 | -3.134 | 42.979 | 461 |
| involuntary hours | -0.168 | 0.931 | -3.119 | 3.856 | 461 |
| proportion of hours involuntary | -0.011 | 0.126 | -0.52 | 0.643 | 380 |

(e) Short-term contracts

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 10.405 | 7.051 | -2.898 | 34.927 | 684 |
| involuntary hours | 0.322 | 0.904 | -3.207 | 3.856 | 684 |
| proportion of hours involuntary | 0.038 | 0.112 | -0.534 | 0.643 | 607 |

Table 14: Summary of results, version B: direct

(a) All

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 8.073 | 2.148 | -4.014 | 11.767 | 1175 |
| involuntary hours | 2.608 | 7.121 | -11.719 | 31.823 | 1175 |
| proportion of hours involuntary | 0.069 | 0.837 | -12.532 | 1.586 | 1014 |

(b) Manipulated

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 7.98 | 2.271 | -4.014 | 11.767 | 982 |
| involuntary hours | 2.324 | 7.055 | -11.719 | 31.823 | 982 |
| proportion of hours involuntary | 0.104 | 0.673 | -6.545 | 1.586 | 821 |

(c) Noncompliant

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 8.233 | 2.552 | -3.518 | 11.719 | 147 |
| involuntary hours | 5.294 | 8.134 | -11.719 | 22.15 | 147 |
| proportion of hours involuntary | 0.217 | 0.759 | -5.966 | 1.586 | 132 |

(d) High verbal abuse

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 8.265 | 2.202 | -3.518 | 11.767 | 466 |
| involuntary hours | 1.5 | 7.3 | -11.719 | 31.823 | 466 |
| proportion of hours involuntary | 0.049 | 0.673 | -5.966 | 1.586 | 386 |

(e) Short-term contracts

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 7.874 | 2.195 | -4.014 | 11.767 | 694 |
| involuntary hours | 3.007 | 6.761 | -11.589 | 25.698 | 694 |
| proportion of hours involuntary | 0.123 | 0.677 | -6.545 | 1.586 | 619 |

Table 15: Summary of results, version B: delta

(a) All

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 10.237 | 7.376 | -2.898 | 41.904 | 1167 |
| involuntary hours | 0.374 | 0.748 | -1.57 | 4.082 | 1167 |
| proportion of hours involuntary | 0.043 | 0.095 | -0.215 | 0.821 | 1003 |

(b) Manipulated

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 9.825 | 7.334 | -2.898 | 41.904 | 973 |
| involuntary hours | 0.386 | 0.778 | -1.57 | 4.082 | 973 |
| proportion of hours involuntary | 0.044 | 0.095 | -0.215 | 0.643 | 809 |

(c) Noncompliant

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 12.907 | 8.616 | -1.688 | 30.519 | 144 |
| involuntary hours | 0.257 | 0.787 | -1.115 | 3.856 | 144 |
| proportion of hours involuntary | 0.032 | 0.115 | -0.112 | 0.643 | 128 |

(d) High verbal abuse

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 9.612 | 7.508 | -1.421 | 41.904 | 460 |
| involuntary hours | 0.184 | 0.789 | -1.57 | 3.856 | 460 |
| proportion of hours involuntary | 0.026 | 0.107 | -0.215 | 0.643 | 381 |

(e) Short-term contracts

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| desired hours | 10.22 | 7.011 | -2.898 | 34.927 | 687 |
| involuntary hours | 0.532 | 0.814 | -1.57 | 4.082 | 687 |
| proportion of hours involuntary | 0.059 | 0.1 | -0.215 | 0.643 | 610 |

Table 16: Desired hours supply curve

| | (1) | (2) |
|---|---|---|
| desired hours | -0.150 | -0.240 |
| | (-0.55) | (-0.97) |
| square of desired OT hours | 0.00977 | 0.0187 |
| | (0.49) | (1.09) |
| Constant | 0.980 | 1.954 |
| | (1.02) | (1.05) |
| Observations | 1171 | 995 |
| $R^2$ | 0.008 | 0.056 |

$t$ statistics in parentheses

$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

*Standard error clustered by factory-year-wage group.*

*Column (2) includes controls for gender, education level, parenthood status, age, job title, whether promoted, wage structure, and the number of nearby competing apparel factories.*

Table 17: Actual hours supply curve

| | (1) | (2) |
|---|---|---|
| actual OT hours | -0.848 | -0.223* |
| | (-1.26) | (-1.93) |
| square of OT hours | 0.0243 | 0.00613* |
| | (1.24) | (1.87) |
| Constant | 6.507 | 2.362 |
| | (1.34) | (1.62) |
| Observations | 1199 | 1017 |
| $R^2$ | 0.010 | 0.053 |

$t$ statistics in parentheses

$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

*Standard error clustered by factory-year-wage group.*

*Column (2) includes controls for gender, education level, parenthood status, age, job title, whether promoted, wage structure, and the number of nearby competing apparel factories.*

Figure 1: Basic incentive compatibility and constraints

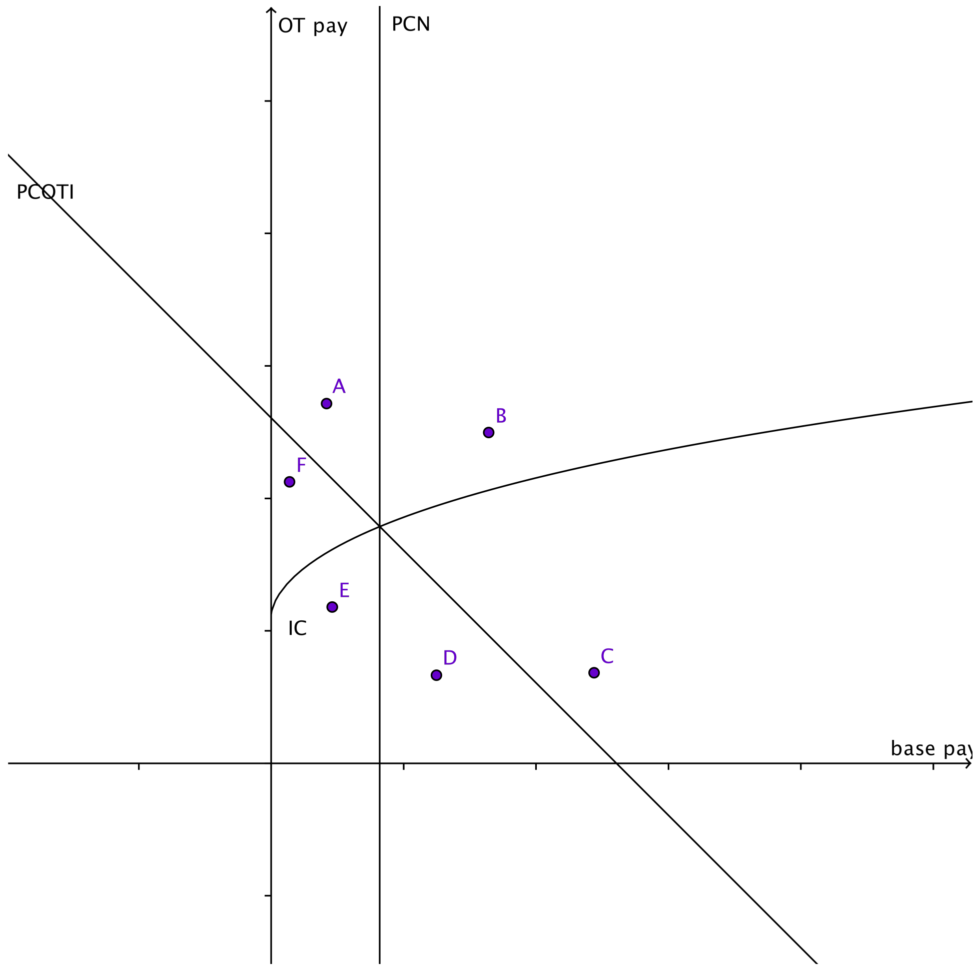
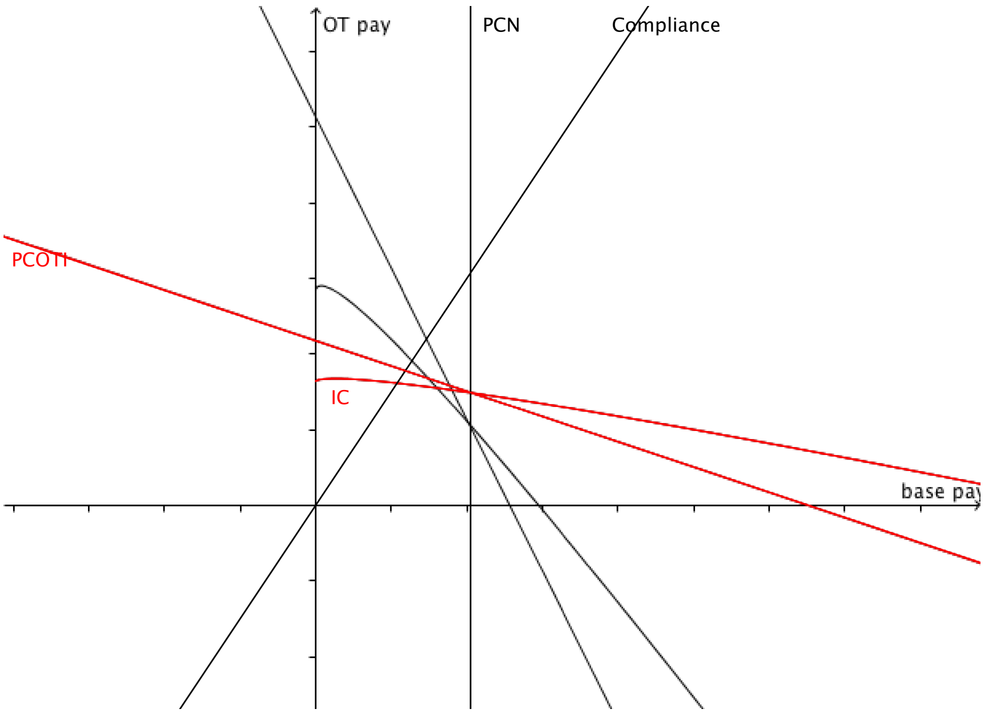


Figure 2: Employer's perspective




*The configuration illustrated in red illustrates an increase in overtime hours from 0.5 to 3.*

Figure 3: Using dismissal threats

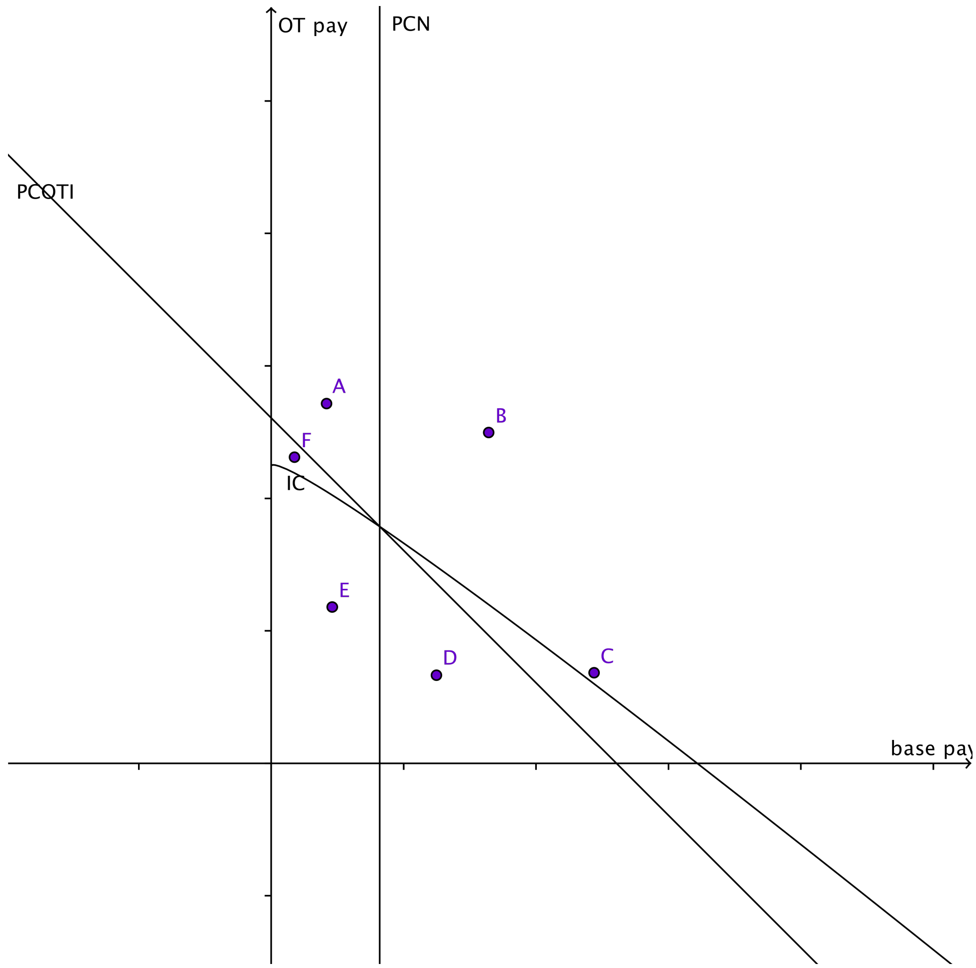


Figure 4: Model synthesized

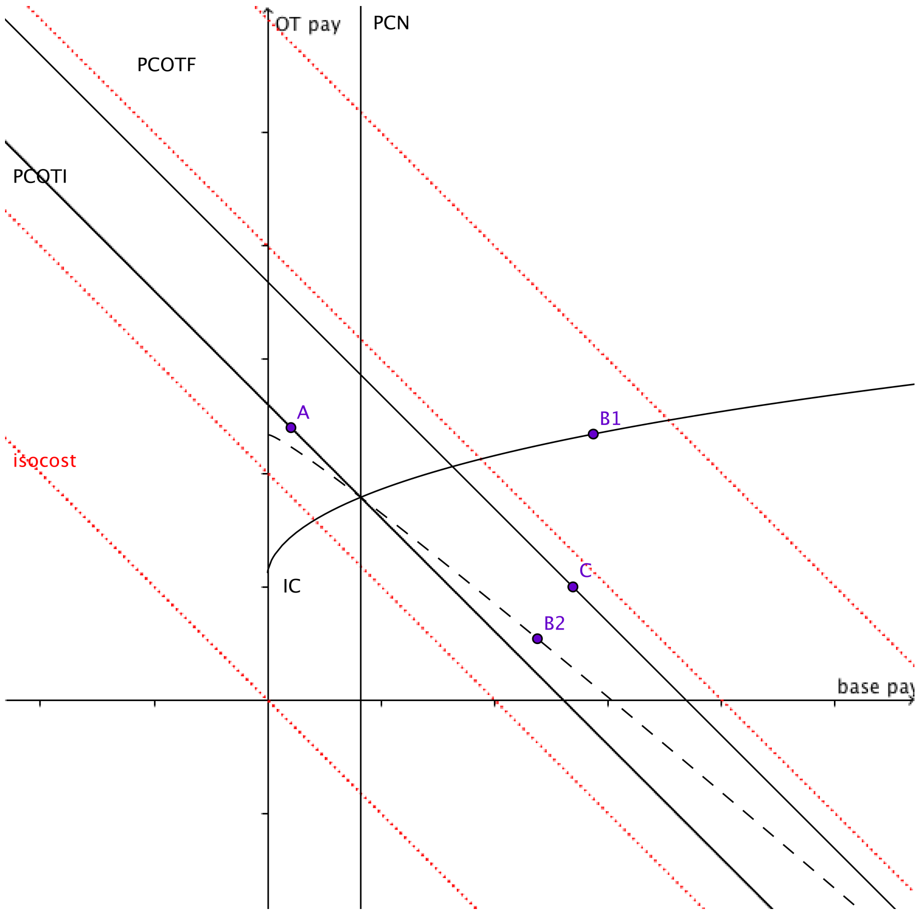
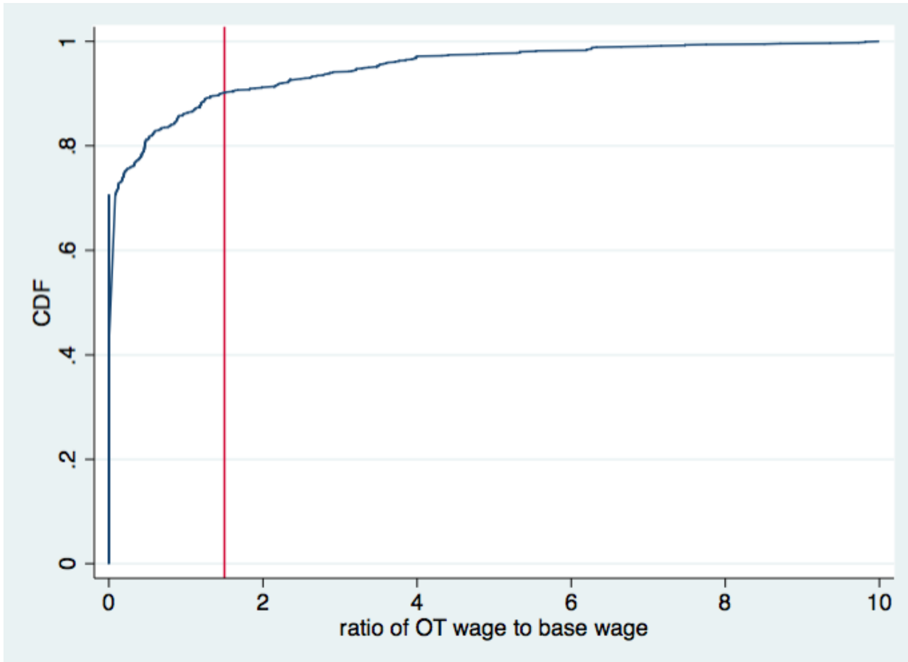


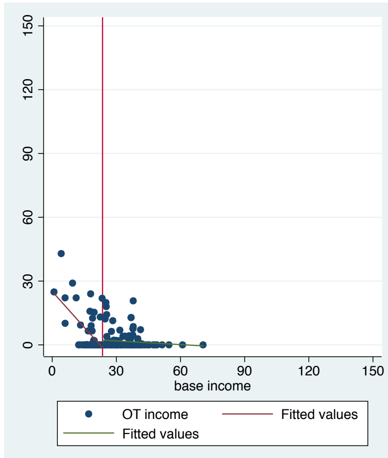
Figure 5: Cumulative distribution function: overtime to base wage ratio



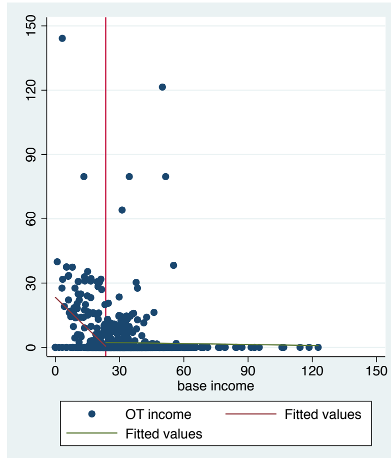

*The vertical line is at 1.5. Observations below the vertical line are non-compliant on the 150% wage requirement during overtime.*

Figure 6: Determinants of overtime income

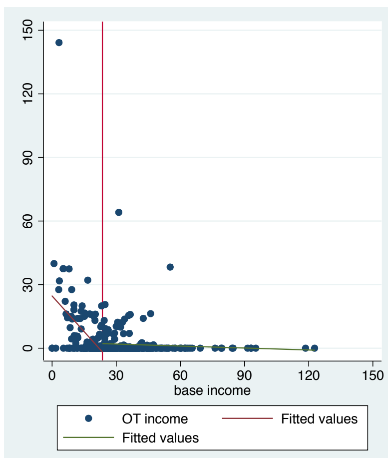
(a) Control




(b) Manipulated




(c) High verbal abuse




(d) Short-term contracts

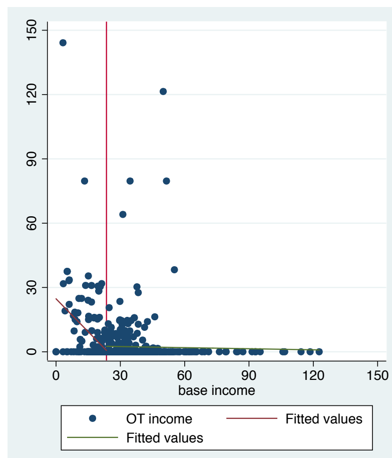


Figure 7: Polynomial fit

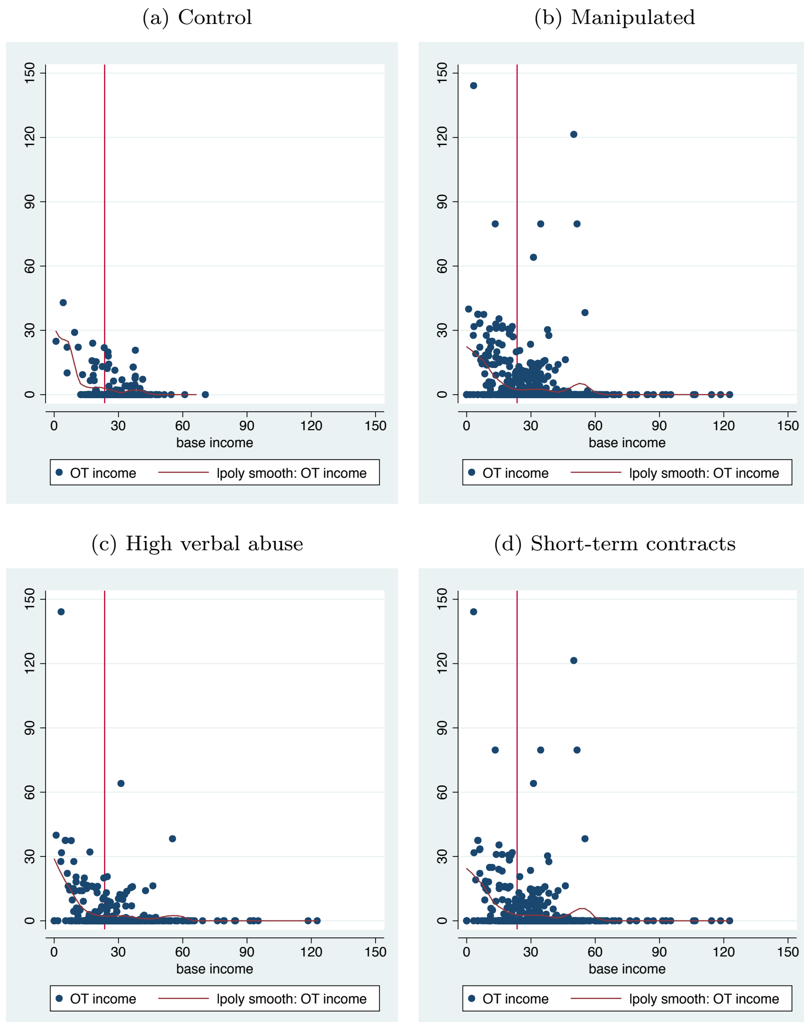
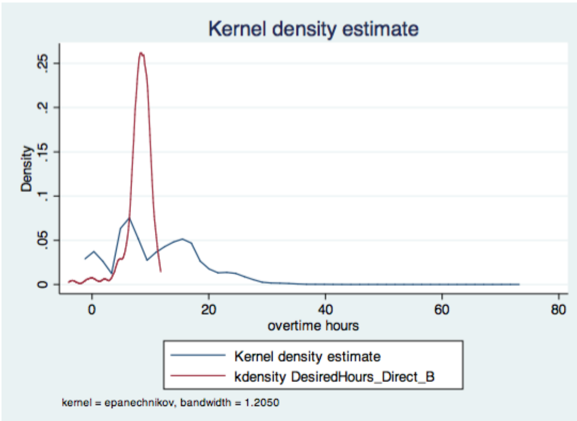


Figure 8: Density functions

(a) Kernel density estimation, direct B




(b) CDF, direct B

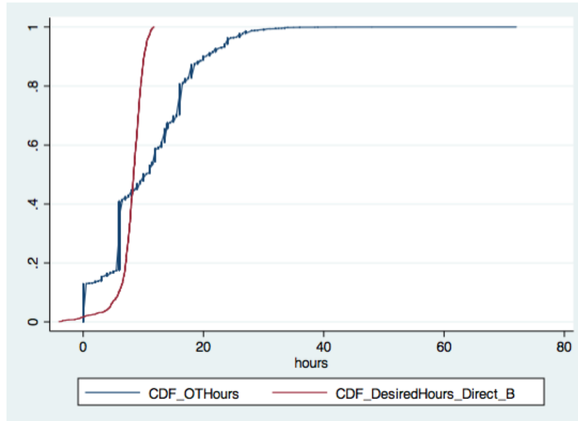
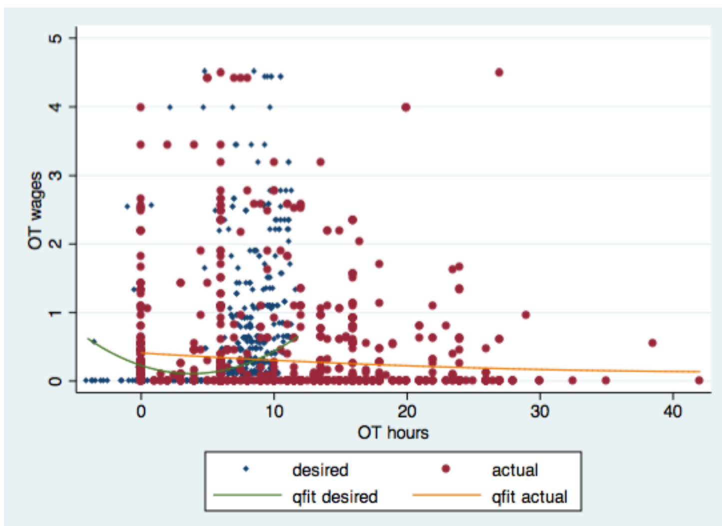



Figure 9: Labor supply curves




*Overtime wage rates under the 99th percentile (7.9 dollars) are shown.*