When Labor Supply is not Self-determined: A New Perspective to Understand the Determinant of Wage and Overtime Work

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Abstract

This paper builds a model to depict the labor market which makes a distinction between number of workers and working hours. In this context, supply of the number of workers is inelastic and each firm will propose a bundle composed of wage rate and working hours to attract laborers. The equilibrium is achieved by the competition about the utility reflected by the bundles among firms. The results demonstrate that such a market structure will reveal the actual determinants of wage and working hours, reversing the impacts of labor demand side shock and firm's productivity. Based on the individual work schedule data and job posting data collected from several online platforms, an econometric testing is conducted to verify the theory. Also, firms can therefore make use of overtime as a valve of labor input to respond to various economic conditions as the costs of frequent hiring and layoffs are significantly trimmed.

Keyword: overtime work · wage · labor market · productivity

1 Introduction

Overtime appears to be a common phenomenon in the process of economic development of modern states, especially during industrialization. A large amount of literature regarding overtime focus on Germany, Japan, and South Korea, which rebuilt from ruins after World War II and eventually achieved economic takeoff. The cases of those countries provide important evidence for clarifying some crucial issues, such as how the overtime and unemployment rate or how the overtime and utility of workers are related with each other.

To this day, regulation of working hours has been effectively implemented in most of the developed countries, and overtime is gradually fading from people's view. However, for billions of people still struggling at low or middle income levels in developing countries, overtime is their status quo or future. In April 2019, Jack Ma, the founder of a company valued at about 200 billion US dollars, declared at an internal company meeting that the 996 work schedule [1]is a blessing. This statement provoked a huge controversy in China, leading to intense discussions and opposition to the long-existing social reality of overtime

[1]The meaning is working from 9 am to 9 pm six days a week.

especially among programmers and engineers. People commonly attribute overtime to the exploitation of firms. It's an outburst of public anger, but should not be regarded as the credible main cause of overtime.

From the perspective of economics, it seems that overtime work can be simply explained as a result of labor market equilibrium, where workers are willing to work for more than 8 hours a day given the equilibrium wages. However, if overtime cannot be distinguished from so-called "free choice" then criticism of overtime will never be convincing enough. This also explains why people can only blame excessively long working hours for inhumanity or the violation of other morality but cannot bring forward a comprehensive and strong critique.

Nevertheless, this proposition should not be laid aside. In fact, when people regard the CRS production function and homogeneous labor as the default framework for analysis, they may already fall into the danger of a disconnect between theory and reality. For example, a canonical setting is that a representative worker decides his/her consumption and labor supply based on the given wage. The limitations of this setting are: 1. It does not make a distinction between laborers and working hours, that is, firms do not care about how many workers contribute to the labor input in production. In reality, more employees generates higher management costs, which makes firms tend to reduce the total number of employees. Such a fact can also serve as one of the reasons why companies hope to replace more employees with overtime work. 2. It does not consider the utility jump between the status of unemployment and employment of workers. The representative agent is hired in default. But once a firm can get the labor input collected from several workers from one worker instead, other workers will face the risk of unemployment. At this time, they'll never be able to simply make optimal decisions along a continuous utility function.

Due to the two shortcomings mentioned above, this paper proposes a new model to depict the labor market. The main progress of this new model is to make a distinction between the number of workers and working hours. The supply of the number of workers is inelastic and each firm proposes a package composed of wage and working hours. Workers will choose a company that maximizes their utility to work for, rather than freely determining working hours. And as the management cost is a linear function of the number of employees with positive slope, firms have the motivation to reduce the number of employees and extend overtime hours until the two marginal benefits are equal.

This model provides a new and meaningful perspective to understand the labor market. At this time, the competition among firms changes from wage competition to utility competition brought by the combination of wages and working hours. Under such a circumstance, the statistical relationship between wage and working hours cannot reflect the preference of workers, but the results of the optimization of firms. For example, the labor supply curve estimated using traditional methods like IV at this time will be completely opposite to the actual situation. At the same time, this paper also points out that shocks on the demand side of firms, the productivity of firm, and other factors will have different impacts on equilibrium wage and labor compared to the well-known results.

This study also analyzes the impact of such market structure on firms' responses to various economic conditions. Firms can make use of overtime work as a valve for labor input, reducing costs that would otherwise arise from frequent hiring and layoffs.

The remainder of this paper is organized as follows. Section 2 is a literature review.

Section 3 explains the construction and equilibrium of the theoretical model. Section 4 verifies the theory proposed in Section 3 through econometric methods. Section 5 further discusses the benefits of firms brought by overtime and provides empirical evidence. Section 6 summarizes the whole paper.

2 Literature Review

[Franz and König, 1986] emphasizes the distinction between persons employed and hours worked from two perspectives, which are the employment aims of labor unions and the contribution of reducing working hours to creating substantial new jobs. The paper follows the idea and decompose labor into number of workers and working hours.

A series of literature concentrate on the impact of regulations and policies about overtime work. [Golden, 1998] explores the potential effects of U.S. legislation allowing employers and employees to agree on compensatory time off instead of premium pay for overtime. It points out that such scheme will lead employers to adjust work hours more in line with output demand fluctuations rather than aligning them with workers' needs for work-life balance, causing a net loss for workers. [Pagés and Márquez, 1998] contributes to the topic by the evidence from Latin America. Both [Ehrenberg and Schumann, 1982] and [Costa, 2000] evaluates the effect of Fair Labor Standards Act (FLSA). [Hamermesh et al., 2017] proves that the labor market legislation in Japan and Korea can increase workers' utility. And [Hunt, 2022] conducts a similar research in the background of Germany.

[Zimmermann and Bauer, 1999] studies overtime work and compensation in Germany, doubting the reduction of overtime work as a way to increase overall employment. The research finds that the unskilled workers, who are more likely to become unemployed, face with a much lower probability of working overtime compared to the skilled workers. As those two types of workers complement with each other generally, reducing overtime work can incur the undesired unemployment of unskilled workers.

The causes of overtime work are indeed important. [Pannenberg, 2002] reveals one of the them, which is the association between unpaid overtime and significant long-term labor earnings gains. Also, such effects vary across gender. [Engellandt and Riphahn, 2003] presents another explanation from the perspective of temporary contracts in the labor market, because temporary workers are likely to work overtime without being paid in exchange for permanent employment. [Engellandt and Riphahn, 2011] points out that surprise bonuses and flexible performance evaluations also serve as incentives for employees to work overtime. [Sánchez, 2013] exploits the reduction of weekly working hours in Chile to estimate its effect on employment transitions.

People also care about the consequences arising from overtime work. Geurts et al. [2009] focuses on worktime control and its impact on work-family interference (WFI) by dividing the worktime demands into three types and one of them is overtime work. [Golden and Wiens-Tuers, 2006] highlights that working extra hours is always associated with greater unhappiness and worse mental healthiness and higher level of work–family interference.

Besides, there are several interesting topics like the response of overtime wage to economic conditions [Ito, 1989] and economic analysis of employment law [Jolls, 2007].

3 Theory

3.1 Model Environment

Consider an economy composed of L identical households and N firms of two types. Each household is endowed with one unit of labor. In order to make the concepts clear, I refer to the total number of households as "aggregate labor supply" and use the term "working hours" to denote the labor supplied by a single household in the following paragraphs. There are N_i firms belonging to type i and each of them is equipped with productivity $A_i,\ i \in \{1, 2\}$. A firm should propose a package comprised of "wage rate" and "working hours", i.e. a (w, t) bundle for each of its employees and also determine the number of households to employ. A household can not determine his/her labor supply freely but just chooses a firm with the bundle maximizing his/her utility to work for.

3.1.1 Preference

All the households have the same utility function

$$u(w, t) = (wt)^{\delta} - \gamma t^{\beta}$$

where $w > 0$ is wage rate and $t \in (0, 1)$ denotes working hours. Other parameters are subject to the common rules: $\delta \in (0, 1),\ \gamma > 0,\ \beta > 1$. What's more, households always prefer to have a job rather than become unemployed.

3.1.2 Technology

The production function for a firm of type i is

$$Y = A_i(l_i t_i)^{\alpha},\ \alpha \in (0, 1)$$

where A_i is productivity and labor input $l_i t_i$ is the only production factor. And the profit can be written as

$$\pi = A_i(l_i t_i)^{\alpha} - w_i t_i l_i - c l_i$$

where c is the constant marginal cost of hiring one more unit of worker. Such a cost motivates the firms to adjust the composition of labor input, i.e. substituting longer working hours for a higher number of employees.

3.1.3 Market Structure

Although firms of different types are equipped with distinct productivity, they use the same form of production function and product the same good. In fact, such a labor market can be regarded as a variation of a perfectly competitive market.

1. The aggregate labor supply is inelastic.
2. Each firm believes that there is a market utility threshold and takes it as given. If the firm proposes a bundle with the utility for households lower than the threshold, then there will be no household willing to work for it. In a word, the role of utility here is similar to the "price" in a canonical model.

3.2 Market Equilibrium

3.2.1 Firm's Problem

As there is no space for households to carry out optimization actively, the equilibrium can be depicted by a game among all the firms. For a firm of type i, its goal is to maximize the profit π and the constraint comes from the utility threshold mentioned above. Therefore, the firm's problem can be written in this way:

$$\max \ \pi = A_i(t_i l_i)^{\alpha} - w_i t_i l_i - c l_i$$

$$s.t. \ (w_i t_i)^{\delta} - \gamma t_i^{\beta} \geq M$$

where M is a given utility threshold. The solutions of $\{l_i, w_i, t_i\}$ can be determined by the following equations through Lagrangian multiplier method.

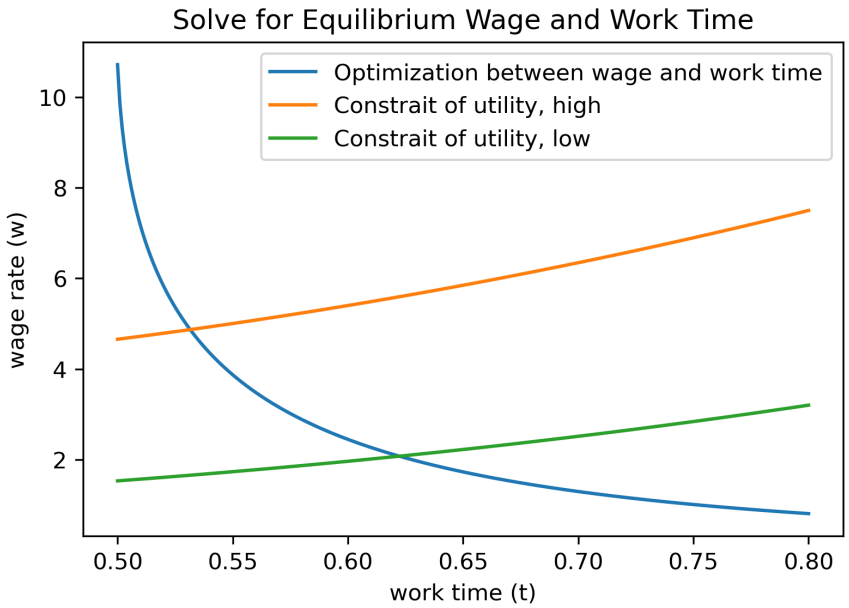
$$l_i = \left(\frac{\alpha A_i t_i^{\alpha}}{w_i t_i + c}\right)^{\frac{1}{1-\alpha}} \tag{1}$$

$$\frac{\gamma\beta}{\delta} t_i^{\beta+1-\delta} w_i^{1-\delta} - w_i t_i = c \tag{2}$$

$$(w_i t_i)^{\delta} - \gamma t_i^{\beta} = M \tag{3}$$

Equation 2 implies that if firms can employ as many workers as they need, they will always propose a (w, t) bundle locating on a w-t curve, which is not related to productivity A_i. And under certain parameter settings, such curve has negative slope at each derivable point.

Figure 1: Simulated Equilibrium Wage Rate and Working Hours



Note: Parameters for simulation are set as follows. $\alpha = 0.25,\ \delta = 0.25,\ \beta = 1.25,\ \gamma = 1,\ c = 2.$

3.2.2 Refinement

Before obtaining the final results, we can try to exclude some complicated but impossible cases to make the equilibrium more concise.

First, all the bundles proposed by firms must have the same utility as each firm is faced with the same threshold, i.e. the same constraint in optimization process.

Second, the optimal choice of wage rate and working hours are the solutions of the equation systems composed of 2 and 3. Under the assumption that the system of equations only has one set of solutions like what showed in figure 1, each firm regardless of productivity, must propose the same (w, t) bundle.

Finally, the equilibrium (w, t) should guarantee that each firm of type i employs workers of number l_i as indicated in equation 1. If the total demand for the number of workers exceeds the total number of households L, a slight increase in the utility of bundle will help the firm attract as many workers as it needs, implying an upward trend. And vice versa.

3.2.3 Solve the Equilibrium

According to the discussion in 3.2.2, the equilibrium $\{l_1, l_2, w, t\}$ can be depicted by the following equations:

$$l_1 = (\frac{\alpha A_1 t^\alpha}{wt + c})^{\frac{1}{1-\alpha}} \tag{4}$$

$$l_2 = (\frac{\alpha A_2 t^\alpha}{wt + c})^{\frac{1}{1-\alpha}} \tag{5}$$

$$\frac{\gamma\beta}{\delta} t^{\beta+1-\delta} w^{1-\delta} - wt = c \tag{6}$$

$$l_1 N_1 + l_2 N_2 = L \tag{7}$$

The only new equation 7 comes from labor market clearing condition.

3.3 Takeaways

The main difference between this model and the canonical models lies in the inelastic labor supply in terms of number of workers and the competition regarding utility among firms, which offers a completely distinct perspective on many issues.

3.3.1 The Fake Labor Supply Curve

It's easy to derive the conventional labor supply curve by taking the partial derivative of the utility function $u(w, t)$ with respect to t, which is

$$t = (\frac{\delta}{\gamma\beta} w^\delta)^{\frac{1}{\beta-\delta}}$$

, exhibiting a positive derivative throughout its domain. However, if the data generation process of the real world is subject to model of this paper, we will have an opposite result. For example, while making use of an exogenous impact on labor demand as instrument variable

to estimate the labor supply curve, higher demand for labor implies a higher equilibrium utility. As what showed in equation 2 and figure 1, higher equilibrium should be realized by proposing higher wage rate and lower working hours. Therefore, the estimated labor supply curve seems to exhibit a negative correlation between wage and working hours.

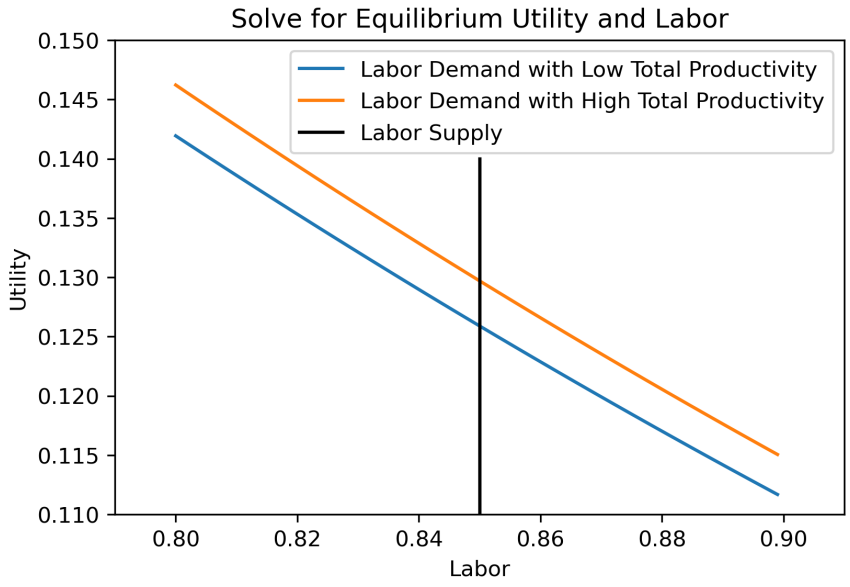
The contradiction results from the determinant of wage and working hours, which is no longer the equilibrium between employers and employees but the competition among firms. What the wage-working hours curve reflects is the set of optimal choices of firms but not the preference of workers.

3.3.2 Productivity and Working Hours

The model predicts that all the firms will propose the same (w, t) bundle. The productivity of a single firm will therefore affect the number of workers employed but not contribute to the wage directly. However, when it comes to the overall productivity, the circumstances differ because the productivity also plays a role in the results of competition.

Let $A_1 > A_2$, then given $N_1 + N_2 = N$, higher N_1 means higher overall productivity of all the firms. In the canonical models, higher overall productivity makes the labor demand curve move rightward and leads to a new equilibrium with higher wage rate and more labor input. Nevertheless, the model scenario of this paper converts the increase in overall productivity to a higher equilibrium utility, i.e. the labor demand curve will move upward along the vertical labor supply curve as showed in figure 2. As a result, similar to the explanation in 3.3.1, higher overall productivity should reduce the working hours.

Figure 2: Simulated Equilibrium Utility and Labor



Note: Parameters for simulation are set as follows. $\alpha = 0.25,\ \delta = 0.25,\ \beta = 1.25,\ \gamma = 1,\ c = 2.$

4 Econometric Testing

The goal of this section is to demonstrate the validity of the theory by verifying the hypothesis proposed in 3.3.2, which is higher overall productivity resulting in lower working hours and higher wage rate.

4.1 Data

The working hours data are collected from an open source github project named WorkerLivesMatter [2], which is an individual-level cross-sectional online questionnaire survey conducted in 2021. Most respondents work in the IT industry, echoing the outcry among programmers against the "996" work schedule.

I also collect millions of pieces of job postings from Tianyancha [3], a commercial corporate information disclosure platform through web crawling and about 4 million of them are typical technical jobs of IT industry. The corresponding information of firms which issue those job postings is merged to the job posting data.

4.2 Construct Variables

The individual survey data serves as the main dataset, which includes everyone's work schedule, job, firm and city. As the reported start work time and off work time are always time ranges, the working hours are defined as the average off work time minus the average start work time.

The jobs are classified into several categories which conforms to the general classification of IT industry [4]. It should be noted that such a classification can't guarantee the disjointness. For example, a software engineer can also be an App development engineer. But it doesn't matter if both the employers and employees are using the same set of terms to label the jobs.

The personal wage is estimated based on the following steps. First, if the individual (city, firm, job) tuple can be found in the job posting data, then wage is calculated by averaging all the wages of matched postings. Second, if the tuple can't be well matched, wage is the predicted value of a Machine Learning model trained on the job posting dataset.

The main explanatory variable is the city-job level overall productivity of firms, which is estimated in the following way.

$$y_i = \beta_0 + \beta_1 Edu_i + \beta_2 Work\ Experience_i + \psi_t + \epsilon_i$$

1. First, for each type of job, run the regress above, where Edu_i and $Work\ Experience_i$ are the education requirement and work experience requirement of the $i\ th$ piece of job post and y_i is the logged wage. The year-month time fixed effect is also included.

[2] You can visit link to get the raw data

[3] https://www.tianyancha.com

[4] They're engineers of: Android, iOS, product, full stack, fore-end, back-end, security, app, flushboarding, tech support, data related work, test, research, algorithm, system, hardware, software, design and operation

2. Second, calculate $\hat{e}_i = y_i - \hat{y}_i$. As the education and work experience requirement capture the quality of human resource and are orthogonal to $\hat{e}_i$, what represented by $\hat{e}_i$ is the city and firm-specific information which contributes to production.

3. Finally, average $\hat{e}_i$ at city level to obtain the estimated city-job overall productivity.

4.3 Regression Design

The regression equation should be constructed like:

$$y_{i,\ jfc} = \beta_0 + \beta_1 Overall\ Productivity_{jc} + \beta_2 X_{jc} + \delta_j + \lambda_f + \phi_c + \psi_i$$

where $y_{i,\ jfc}$ is either the working hours or hourly wage of individual i who works in firm f of city c as job j. X_{jc} are the control variables at city-job level, which includes the total number of job postings, ratio of the jobs belonging to IT industry and number of IT firms. $\delta_j,\ \lambda_f,\ \phi_c,\ \psi_i$ are the job, firm, city level fixed effect and error term.

The standard error is calculated within the clusters of cities.

4.4 Results

The regression results regarding working hours and hourly wage are showed in table 1 and 2. For every one standard deviation increase in estimated productivity, daily working hours will increase by 0.147 hours significantly, i.e. about 0.76 hours a week as the weekly average working days are 5.2 days. Also, such an increase in productivity leads to the rise of RMB 7.35 in hourly wage. Combined with the weekly average working hours, 53 hours, workers earn an additional RMB 390 per week.

The results above are robust with the control variables. Also, the pattern remains unchanged if the firms which only appear twice are dropped as showed in table A2 and table A3, implying that the results are not driven by the overflowing firm fixed effects.

In short, the regression results furnish compelling evidence in support of the validity of the model, which attaches importance to realizing how the equilibrium labor and wage are determined in the real world.

Table 1: Effects on Working Hours

	(1) Daily Work Hours b/se	(2) Daily Work Hours b/se	(3) Daily Work Hours b/se	(4) Daily Work Hours b/se
Estimated Productivity	-0.697**	-0.752**	-0.782**	-0.784**
	(0.339)	(0.346)	(0.364)	(0.368)
Log # of Job Adv.		0.0395	0.0331	0.143
		(0.067)	(0.066)	(0.811)
Ratio of IT firms			-0.190	-0.201
			(0.332)	(0.329)
Log # of IT firms				-0.111
				(0.808)
Firm FE	Yes	Yes	Yes	Yes
Job FE	Yes	Yes	Yes	Yes
Base FE	Yes	Yes	Yes	Yes
Cluster Base	Yes	Yes	Yes	Yes
R-squared	0.713	0.713	0.713	0.713
Obs.	4313	4313	4313	4313

Table 2: Effects on Hourly Wage

	(1) Hourly Wage (yuan) b/se	(2) Hourly Wage (yuan) b/se	(3) Hourly Wage (yuan) b/se	(4) Hourly Wage (yuan) b/se
Estimated Productivity	39.15**	42.82*	39.63**	39.31**
	(19.168)	(21.840)	(19.116)	(18.549)
Log # of Job Adv.		-2.836	-3.304	10.55
		(2.737)	(3.014)	(28.627)
Ratio of IT firms			-20.22	-22.65
			(16.788)	(20.852)
Log # of IT firms				-14.00
				(30.898)
Firm FE	Yes	Yes	Yes	Yes
Job FE	Yes	Yes	Yes	Yes
Base FE	Yes	Yes	Yes	Yes
Cluster Base	Yes	Yes	Yes	Yes
R-squared	0.771	0.771	0.771	0.771
Obs.	4782	4782	4782	4782

5 Firm and Overtime Work

It seems not clear that whether the firms are benefited from such a labor market structure. On the one hand, firms can ask for longer working hours as the supply of the amount of workers is inelastic. On the other hand, firms should consider the competition about utility from the other ones, which limit them from putting forward unreasonable demands. Nevertheless, one benefit is undoubtedly certain.

5.1 Valve of Labor Input

In real world, firms are faced with a constantly changing market environment, which can be viewed as a transition from one equilibrium to a new equilibrium. For example, the firm's business has distinct peak and off-peak seasons. During this process, firms need to adjust their labor input. However, due to the protection of workers' rights, firms often need to incur additional costs when dismissing employees, which serves as the "friction" in adjusting labor input. The decision-making power over working hours allows firms to address this issue to some extent.

When the marginal production of labor decreases, firms can reduce the total working hours and wages of employees. This not only saves costs but also forces some employees who are unwilling to accept 'low pay-low working hours' to leave voluntarily, indirectly achieving the purpose of layoffs. Conversely, firms prefer to force employees to work overtime during busy periods. This is both due to the higher management costs associated with more employees mentioned in the above model, and to avert the pressure on potential future layoffs imposed by hiring too many workers.

All in all, overtime work can be regarded as the valve of labor input, which makes it more economic and convenient for firms to adjust their production strategies.

5.2 Some Evidence

In the third quarter of 2021, some Chinese internet companies successively announced the abolition of the "big and small week" work schedule [5]. Clearly, such measures were not taken to provide better treatment for employees, but as a contraction strategy in response to a saturated market. After the implementation of this reform, the overall salaries of employees significantly decreased, leading to a group of employees choosing to resign voluntarily.

To quantify what mentioned above, I collect a series of information of working hours and wages from Duibiao.com through web crawling, which is a public forum for people to report and compare working conditions. By setting such a reform as the treatment, we are able to explore the treatment effects on working hours, wage and recruitment. Time window of the sample for regression ranges from the third quarter of 2020 to the fourth quarter of 2022. The DiD regression is organized as follows

$$y_{i,fct} = \beta_0 + \beta_1 Treatment + \beta_2 X_i + \lambda_f + \phi_c + \gamma_t + \epsilon_i$$

[5] The meaning is that people need to work on Saturday biweekly

where $y_{i,fct}$ indicates the dependent variable of individual i from firm f of city c at time t. X_i are the individual level control variables. $\lambda_f, \phi_c, \gamma_t$ are firm, city and time level fixed effects and ϵ_i is the error term. The event study regression equation is similar except that the $Treatment$ is replaced with the interactions of times and indicators of treatment group.

Figure 3 demonstrates that such a reform indeed shorten the working hours by around 3.2 hours a week and the effects are consistent across times, which implies that working hours are not shifted from weekends to workdays.

At the same time, as showed in table 3, hourly wage decreases by about RMB 22.73, i.e. RMB 1205 a week, though not significant.

Although data of the number of employees are not available, it can be inferred by the number of new job postings. By running a firm level DiD regression on the dataset of job postings mentioned above, table 4 tells us that the number of new job postings of the treated firms drop by about 52% [6].

To sum up, the working hours reform reduces the actually working time significantly and lowers the hourly wage of employees so that the total income decreases, which is in line with the complaints online. Also, the dramatic decline in recruitment implies that those firms are not forced to provide employees with a better working condition but have the contracted demand for labor input. Otherwise, more people will be hired to solve the shortage of labor.

6 Conclusion

This paper builds a model to depict the labor market which makes a distinction between number of workers and working hours. In this context, supply of the number of workers is inelastic and each firm will propose a bundle composed of wage rate and working hours to attract laborers. Workers just choose the favorite the bundles and work for the corresponding firms. The equilibrium is achieved by the competition about the utility reflected by the bundles among firms.

The results demonstrate that under such a market structure, the positive shock of labor demand side and higher overall productivity of firms will reduce the equilibrium working hours, which is opposite to the canonical models. Also, the labor supply curve evaluated by instrument variables is misleading as the correlation between wage rate and working hours can't reflect the preference of workers any more. All of the results remind us that we need to clarify the actual structure of the labor market before the empirical analysis.

What's more, this study points out that overtime can be utilized by firms to achieve a more flexible adjustment of labor input with lower cost. However, the impacts on employees' welfare deserve further research.

[6] It's calculated by: $e^{-0.733} - 1 = -0.5195$

Figure 3: Event Study of Working Hours

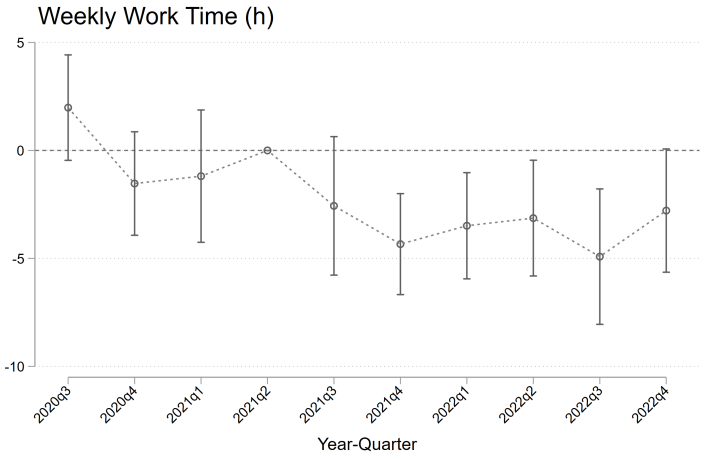


Table 3: Treatment Effects on Hourly Wage

	(1) Hourly Wage b/se	(2) Hourly Wage b/se	(3) Hourly Wage b/se	(4) Hourly Wage b/se
Work Time Reform	6.622	-19.79	-20.30	-22.73
	(11.696)	(18.391)	(16.605)	(17.069)
Total Seniority				10.75***
				(2.551)
Curr. Seniority				3.092*
				(1.473)
Firm FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
Base FE	Yes	Yes	Yes	Yes
Edu FE	No	Yes	Yes	Yes
Job FE	No	No	Yes	Yes
Cluster Base	Yes	Yes	Yes	Yes
R-squared	0.098	0.108	0.109	0.230
Obs.	3117	2204	2177	2177

Table 4: Treatment Effects on New Job Postings

	(1) Log # of Job Postings b/se	(2) Log # of Job Postings b/se
treatment	-25.73***	-0.733***
	(7.014)	(0.068)
Firm FE	Yes	Yes
Year-Quarter FE	Yes	Yes
Cluster Firm	Yes	Yes
R-squared	0.504	0.600
Obs.	54640	54640

Appendix

Table A1: Summary Statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) max	(5) min
Daily Work Hours	6,449	10.26	1.411	14.00	7.100
Ratio of IT firms	6,427	0.754	0.0864	1	0.0204
Hourly Wage (yuan)	6,320	73.27	37.69	605.4	0.383
Log # of Job Adv.	6,427	9.302	1.768	11.85	0
Log # of IT firms	6,427	9.360	1.768	11.91	0
Estimated Productivity	6,417	0.0406	0.188	0.267	-0.924

Table A2: Robustness: Effects on Working Hours

	(1) Daily Work Hours b/se	(2) Daily Work Hours b/se	(3) Daily Work Hours b/se	(4) Daily Work Hours b/se
Estimated Productivity	-0.668*	-0.730**	-0.767**	-0.769**
	(0.335)	(0.340)	(0.361)	(0.365)
Log # of Job Adv.		0.0467	0.0383	0.169
		(0.068)	(0.068)	(0.845)
Ratio of IT firms			-0.233	-0.247
			(0.372)	(0.368)
Log # of IT firms				-0.132
				(0.846)
Firm FE	Yes	Yes	Yes	Yes
Job FE	Yes	Yes	Yes	Yes
Base FE	Yes	Yes	Yes	Yes
Cluster Base	Yes	Yes	Yes	Yes
R-squared	0.693	0.693	0.694	0.694
Obs.	3915	3915	3915	3915

Table A3: Robustness: Effects on Hourly Wage

	(1) Hourly Wage (yuan) b/se	(2) Hourly Wage (yuan) b/se	(3) Hourly Wage (yuan) b/se	(4) Hourly Wage (yuan) b/se
Estimated Productivity	41.10**	44.07*	39.89**	39.71**
	(20.233)	(22.975)	(19.725)	(19.131)
Log # of Job Adv.		-2.363	-2.957	4.986
		(2.901)	(3.220)	(31.142)
Ratio of IT firms			-24.95	-26.34
			(18.390)	(22.684)
Log # of IT firms				-8.025
				(33.462)
Firm FE	Yes	Yes	Yes	Yes
Job FE	Yes	Yes	Yes	Yes
Base FE	Yes	Yes	Yes	Yes
Cluster Base	Yes	Yes	Yes	Yes
R-squared	0.738	0.738	0.738	0.738
Obs.	4342	4342	4342	4342

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