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Three Essays on Flexible Working Arrangements and Labour Market Outcomes

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Abstract

This thesis looks at the effects of flexible working arrangements on workers' labour market outcomes. The particular type of flexible working arrangement analysed in this thesis is called "flexitime". This is an arrangement which gives workers the freedom to choose when to start and end their work. Flexitime provides workers with a new way to cater to their domestic responsibilities and in turn may reduce the costs of participating in the labour market. Therefore, it is closely connected with workers' compensation structure, human capital accumulation process, labour supply and job mobility. The effects of flexitime on workers' labour market outcomes are analysed from three aspects: wage, labour supply, and job mobility.

The first chapter gives an introduction and overview of the thesis. The second chapter is a study on the compensating wage differentials associated with flexitime. In general I do not find convincing evidence showing the existence of compensating wage differentials associated with flexitime. One possible reason might be that flexitime brings additional benefits to firms (such as increased productivity and reduced turnover rate) so that firms may not necessarily need to reduce actual wages in exchange for flexitime provision.In the third chapter, I develop a model describing how flexitime may affect workers' labour supply decisions. The main finding of the model is that flexitime will increase workers' labour supply when the benefit associated with flexitime (increased child care production efficiency) is high relative to the cost of wage reduction (prediction 1). Meanwhile, the model also predicts that flexitime causes high human capital workers to increase their labour supply more than low human capital workers (prediction 2). Empirical findings show that flexitime is positively associated with working mothers' labour market hours, which confirms model prediction 1. However, there is arguably insufficient empirical evidence verifying model prediction 2. The fourth chapter considers the relationship between flexitime and workers' job satisfaction and job mobility. Flexitime is associated with high job satisfaction levels for both male and female workers. It also reduces the probability of quitting for female workers with young children. Male workers' job mobility decisions are not significantly affected by flexitime. The fifth chapter gives the conclusion of the thesis.

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I am grateful to Prof. Andy Snell and Dr. Olga Gorbachev for their valuable comments and suggestions. I am also grateful to all the Edinburgh School of Economics for providing me with an excellent environment to study economics.

Declaration

I declare that this thesis was composed by myself and that the work contained therein is my own. No other person's work has been used without due acknowledgement. This thesis has not been submitted for any other degree or professional qualification.

Jing Li

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Chapter 1

Introduction and Overview

The past several decades have witnessed flexible working arrangements becoming common practice among most developed countries (OECD, 1999). This thesis looks into the effects of flexible working arrangements on workers' labour market outcomes. The particular type of flexible working arrangement analysed in this thesis is called "flexitime". This is an arrangement which gives workers the freedom to choose when to start and end their work. The usual practice for flexitime is that employers choose a certain period of a day as "core hours", during which workers have to stay at work. For the rest of the time, it is up to the workers themselves to decide when to work.

1.1 Flexitime, an International Perspective

With the increase of female participation rates in the past few decades and people's awareness of the importance of work and family balances, how to enhance the labour market flexibility has become an important issue on many developed countries' agenda (Riedmann et al., 2006). Flexible working arrangements, including flexitime, have been regarded as important elements in the strategy to increase Europe's employment rates (Riedmann et al., 2006). OECD (2001) reviews the evidence that family friendly policies–including flexible working arrangements– are vital for increasing of the employment rates of mothers. Chung et al. (2007) argue that in order for Europe to prosper in the future, it has to face the challenge of creating a more flexible labour market environment. In addition, providing workers with flexible working arrangements could also be beneficial to firms. Golden and Altman (2007b) point out that flexitime can help firms promote on the job attachments and workers' commitment to the firms. OECD (1999) reports that firms which provide flexible working practices such

as flexitime tend to enjoy better financial performance and higher productivity than those who do not provide those options. Compared to other types of flexible working arrangements, flexitime is more welcomed by employers. OECD (2001) looks into the family friendly policies in four developed countries–Australia, Japan, the United Kingdom and the United States– and finds that employers in these four countries are more willing to provide part time working and flexitime to their employees than other family friendly policies such as family leave benefits. What is more, flexitime is one of the most welcomed and desired working time arrangements among employees. Using data from Establishment Survey on Working Time 2004 to 2005 (a survey which interviews the establishments about their working time arrangements across 21 countries in the European Union), Riedmann et al. (2006) report that the introduction or extension of flexitime is on the top of employees' "wish list" with regard to the future working time policies. As reported by Riedmann et al. (2006), according to the survey conducted by the European Foundation for the Improvement of Living and Working Conditions, as much as 26% of all employees representatives interviewed named flexitime as the first priority or the most important measure that should be taken in order to improve the balance between work and family responsibilities[1] First developed in Germany in the 1970s, the practice of flexitime now has spread across many countries. Due to data limitations, cross country comparisons of the popularity of flexitime practice are difficult[2]. Tables 1.1 and 1.2 display some basic information on the incidence of flexitime from an international perspective. Table 1.1 reports the incidence of flexitime among employees across major European countries over the period from 1995 to 1996 using data from OECD (2001). According to table 1.1, the practice of flexitime is most popular in the Netherlands, Germany, Sweden and the United Kingdom, and less popular in Luxembourg, Italy and Ireland. Although the incidence of flexitime varies across countries, we can still see that a substantial proportion of employees work with flexitime in those European countries. Even in countries with the lowest figures such as Luxembourg, Italy and Portugal, around 18-19% of employees are working with flexitime.

[1]Figure 27, page 50 of Riedmann et al. (2006) compares the desirability of flexitime with several other flexible working arrangements. Flexitime (or working-time accounts) is the most desired working time arrangement among employees, followed by general reduction in weekly working hours, opportunities for phased retirement or early retirement, reduction of overtime, opportunities of part time working, change from unusual working hours to normal working hours, and long term leave options.

[2]To be more accurate, it is difficult to compare the flexitime incidence across different groups of workers in different countries. Tables 1.1 and 1.2 only provide information on the incidence of flexitime among all employees (or firms) in different countries.

Table 1.1: The Incidence of Employees Working with Flexitime (Cross Country Comparison), 1995-1996

Countries	Percentage of Employees Working with Flexitime
Denmark	25
Finland	22
Sweden	32
Greece	23
Italy	19
Portugal	19
Spain	20
Ireland	19
United Kingdom	32
Austria	22
Germany	33
Netherlands	36
Belgium	26
France	26
Luxembourg	18

Source: the data listed in this table are taken form table 4.8, OECD (2001). The figures displayed in table 1.1 may include certain proportion of employees who work with flexitime that is designed to suit the employers' needs. Unfortunately OECD (2001) does not have information on whether the reported flexitime practice is beneficial to the employees.

Table 1.2 displays the percentage of firms that provide flexitime across major European countries using data from the Establishment Survey on Working Time and Work-Life Balance 2004 to 2005. From table 1.2 it can be seen that in 7 out of 15 major European countries, over half of the establishments interviewed report that they provide flexitime to their employees. In Finland and Sweden, more than 60% of firms offer flexitime opportunities. Even in Greece, where the figure is the lowest, 29% of firms allow their employees to work flexitime.

In summary, both tables 1.1 and 1.2 show that flexitime is a popular practice among many European countries. The United Kingdom ranks among the most "flexible" countries in Europe. In 1995, around 32% of employees in the United Kingdom were working with flexitime. In 2004, around 56% of establishments in the United Kingdom reported that their employees can have access to flexitime.

Table 1.2: Percentage of Firms that Provide Flexitime (Cross Country Comparison), 2004-2005

Countries	Percentage of Firms that Provide Flexitime	No.of obs
Belgium	39	1007
Denmark	51	1024
Germany	51	1500
Greece	29	1000
Spain	43	1500
France	48	1510
Ireland	55	502
Italy	40	1500
Luxembourg	46	352
Netherlands	44	1008
Austria	52	1000
Portugal	23	1119
Finland	62	1006
Sweden	65	1016
United Kingdom	56	1507

Source: Establishment Survey on Working Time and Work-Life Balance, years 2004-2005.
Figures in the second column are in terms of percentages.

1.2 Flexitime in the United Kingdom

The best way to provide workers with a more flexible working environment is a problem which has also attracted much attention from the British Government. Since 2003, the British government has put forward a legislation that helps workers obtain flexible working arrangements. The Employment Act 2002 specified that, starting from April 2003, all workers with children under 6 years old, and parents who have disabled children under the age of 18 can request flexible working from their employers. Later on, the right to request flexitime was extended to employees with children under 17 or those who need to care for other family members. In 2010, the new government promised that they would endeavour to find measures to help all employees work flexibly. This legislation encourages more workers to ask for flexible working arrangements from their employers, and flexitime is one of the most frequently demanded working time patterns. Holt and Grainger (2005) report that 2 years after the 2003 flexible working legislation, flexitime became the second most frequently requested flexible working

pattern[3], with 28% of male employees and 19% of female employees requesting it from their employers. This section displays some descriptive statistics on the incidence of flexitime working using three British data sets: the British Household Panel Survey, the Workplace Employee Relations Survey and the Labour Force Survey.

1.2.1 Flexitime Incidence: Evidence From the British Household Panel Survey

Figures 1.1 to 1.4 give some descriptive statistics on the incidence of flexitime using data from the British Household Panel Survey, years 2001-2007. These figures give the incidence of flexitime among different groups of employees. Figure 1.1 displays the proportion of employees working with flexitime by gender. According to figure 1.1, throughout all seven years, female workers are more likely to work with flexitime than male workers. One possible reason for this gender difference could be that female workers take the main responsibility for home production, and they are more likely to choose jobs that provide flexitime practices.

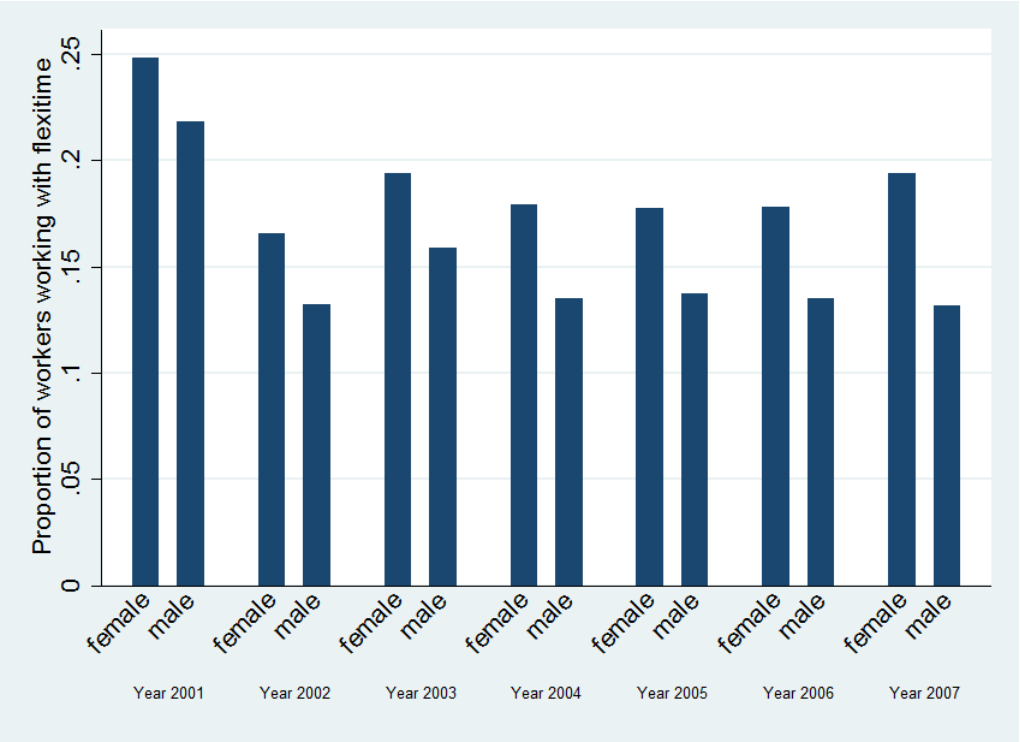
Figure 1.2 compares the proportion of workers working with flexitime by gender and parental status types in different years. According to figure 1.2[4], working mothers are more likely to work with flexitime than childless female workers. The difference in chance of working with flexitime among working fathers and childless male workers is very small. This might suggest that only working mothers use flexitime to help them with child care responsibilities. It is possible that working fathers work with flexitime for reasons other than child care.

Both figures 1.1 and 1.2 reveal the gender differences in the usage of flexitime. Specifically, flexitime seems to be more popular among female workers than male workers. In addition, children seem to play an important role in female workers' choice of flexitime. In other words, child care responsibility is a crucial element in understanding how flexitime may have different effects on male and female workers. The BHPS asks couples with children under 12 years old the question "who is mainly responsible for child care?" There are four possible answers; mainly the respondent, mainly partner, joint with partner, someone else. Figure 1.3 summarizes the answer distribution of female workers and male workers respectively. From figure 1.3, it can be seen that the majority of female workers answer that

[3]Part time work is the most frequently requested flexible working pattern, with 30% female workers requesting it.

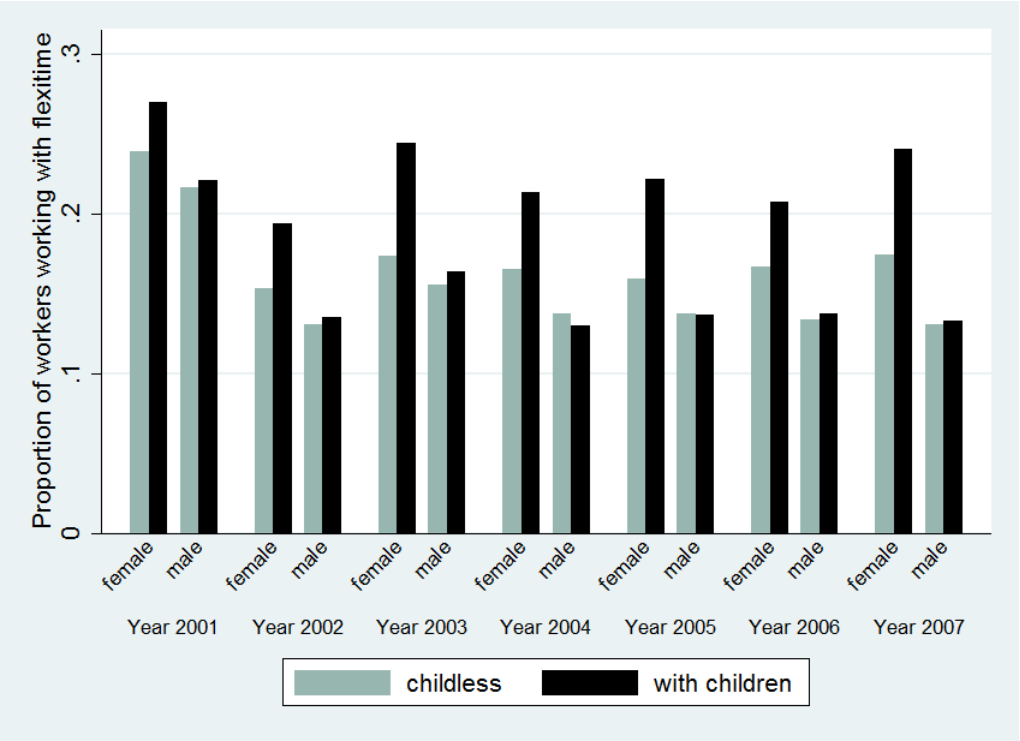
[4]In figure 1.2, "parents" means workers with children under 16, and "childless" refers to workers without children under 16.

Figure 1.1: Flexitime Status by Gender



Source: British Household Panel Survey, years 2001-2007.

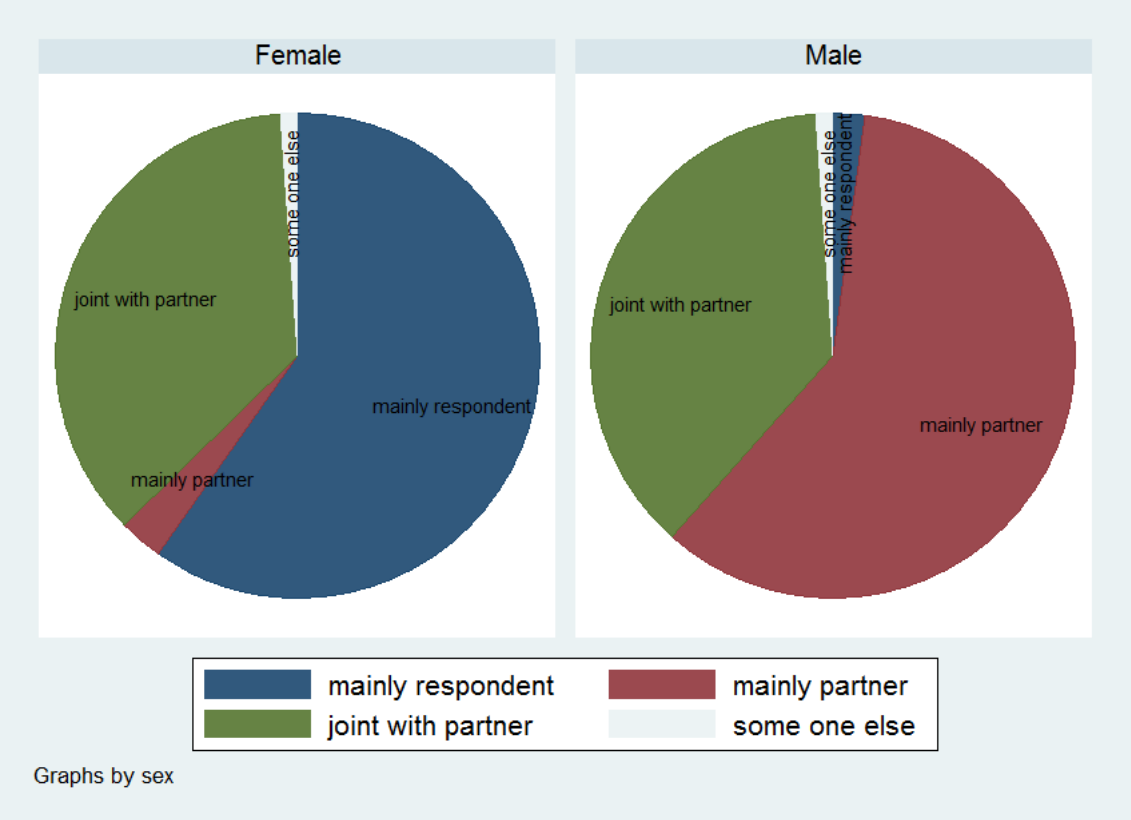
Figure 1.2: Flexitime Status by Parental Status and Gender



Source: British Household Panel Survey, years 2001-2007.

they take the main responsibility for taking care of the children. On the other hand, few male workers take care of children alone. Even including the male workers who report that they are jointly responsible for child care with partners still accounts for less than half of the whole male sample with children. Given the evidence showed by figure 1.3, it is reasonable to expect that female workers may particularly need the help of flexitime since in most households, they take the main responsibility for child care. Consequently, it is not surprising that we observe that flexitime is more popular among female workers in figures 1.1 and 1.2.

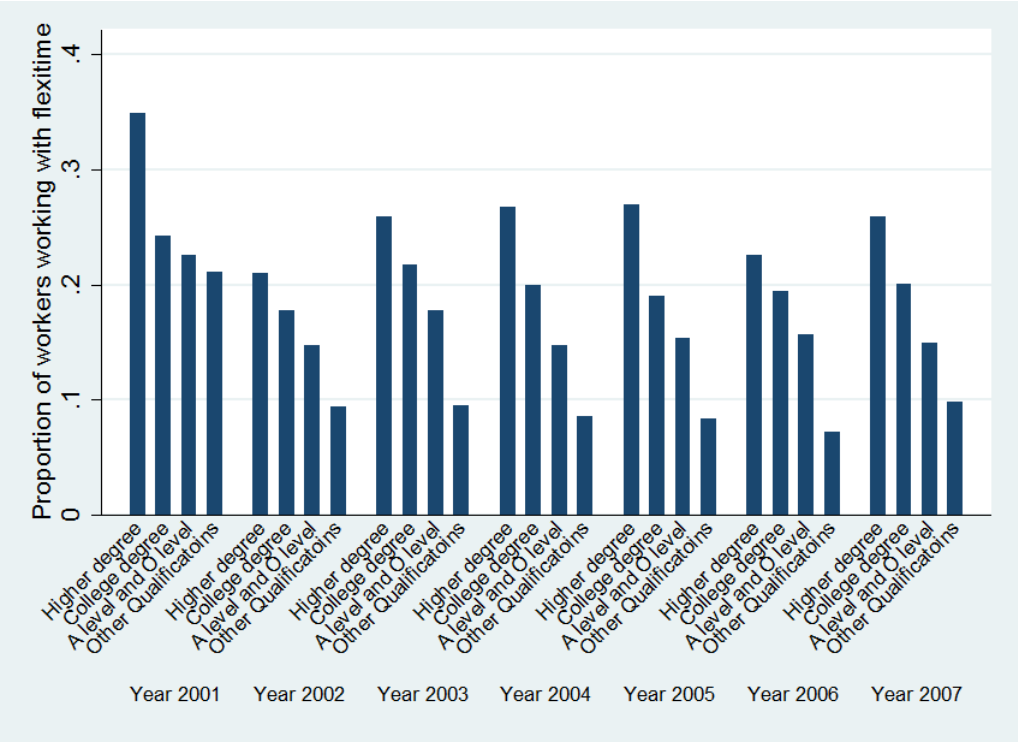
Figure 1.3: Child Care Responsibilities



Source: British Household Panel Survey, years 2001-2007.

Figure 1.4 displays the proportion of workers with flexitime by their education levels. It reveals a positive relationship between flexitime and education. We observe that highly educated workers work with flexitime more often than workers with low education. This is one of the main features that distinguishes flexitime from other flexible working schedules such as part time work. Manning and Petrongolo (2005) find that most part time jobs are located in low human capital occupations such as catering and hospitality. Considering that educational at-

Figure 1.4: Flexitime Status by Education Levels



Source: British Household Panel Survey, years 2001-2007.

"higher degrees" include postgraduate degrees, "college degrees" include first degree, hnd, hnc and teaching degrees. "Other qualifications" include Cse qualifications, no academic qualification at all.

tainment can be regarded as a proxy for workers' human capital or ability levels, this positive relationship could be because high ability workers tend to have high bargaining power when negotiating contracts with their employers. Meanwhile, firms may also be willing to provide high ability workers with flexitime due to their high productivity. High ability workers tend to do complex, multi-tasking jobs involving high levels of human capital investments in job specific and company specific know-how and training. In order to protect sunk investments, firms are more willing to accommodate high ability workers' requests for flexitime and help them with their family responsibilities.

In summary, the descriptive statistics of flexitime incidence among different groups of workers suggests that flexitime is closely connected with workers' demographic characteristics and their educational achievements. As a result, those factors have to be taken into account when analysing the labour market outcomes of flexitime.

1.2.2 Flexitime Incidence at Firm Level: Evidence from Workplace Employee Relations Survey 2004

The above descriptive statistics are calculated using data from the British Household Panel Survey, which is a national survey that interviews individual respondents about their daily activities and labour market outcomes. However, workers' flexitime status not only depends on their own decisions, but also firms' choices. Workers' flexitime decisions are demand constrained. Currently in the United Kingdom labour market, flexitime is still under-supplied (Golden and Altman, 2007b),meaning that there are many workers who would like to work with flexitime but do not have access to it. Firms may provide flexitime only to certain types of workers, such as workers with high human capital, or workers with child care responsibilities. The 2003 flexible working legislation also specifies that firms can choose not to grant employees' flexible working requirements for business reasons. Unfortunately data on firms' flexitime provision decisions are rare. One exception might be the Workplace Employee Relations Survey 2004 (hereafter WERS 2004). It contains some information about firms' characteristics and whether firms offer flexitime opportunities to all their employees. Table 1.3 reports the proportion of firms that provide flexitime to their employees in the United Kingdom.

According to table 1.3, among all the firms that have been interviewed, 43.05 % of them offer employees the flexitime opportunities. Big firms (firms with more than 50 employees) are more likely to offer flexitime than small firms (firms with

Table 1.3: Flexitime by Firm Characteristics

Firm type	Percentage that Provides Flexitime	No.of obs
All firms	43.05	2,295
Big firms ($>$ 50 employees)	48.88	1,299
Small firms ($\leq$ 50 employees)	35.44	996
Female-dominated firms ($>$ 50% employees are female)	44.56	1,205
Male-dominated firms ($\leq$ 50% employees are female)	41.14	1,038

Source: Workplace Employee Relations Survey, year 2004.

50 or fewer employees). One possible explanation for this might be that big firms are more capable of absorbing the costs of providing flexitime than small firms. For instance, additional employees may be needed to cover for the absence of employees who enjoy the benefits of flexitime, or firms may need to adapt new technology to accommodate the flexitime requirements. In addition, flexitime is slightly more common among firms with many female workers. 44.56% of female-dominated firms offer flexitime option, while the number for male-dominated firms is 41.14%. This may be because female employees are self-selected into firms that offer flexible working practices.

The Workplace Employee Relations Survey 1998 (hereafter WERS 1998) also contains information about the flexitime option in each establishment. However, it only asks firms whether they provide flexitime to *non-managerial* employees, and does not contain any information on the restrictions of flexitime options. I have also looked at the incidence of flexitime option using WERS 1998. In 1998, 27.16% firms in the data set provide flexitime to their *non-managerial* employees. Big firms (firms with more than 50 employees) are more likely to provide flexitime than small firms (firms with 50 or fewer employees). 31.33% of big firms provide their *non-managerial* employees with flexitime, while only 17.78% of small firms have flexitime option. Firms with lots of female employees are more likely to offer flexitime than firms with few female employees. The flexitime incidences are 30.55% and 23.32% in female-dominated firms and male-dominated firms respectively. In general, the qualitative relationship between flexitime and firms' characteristics is quite similar to that of table 1.3.

It is worth noting that the descriptive statistics displayed in table 1.3 only tell whether flexitime is available at firm levels. It does not mean that all employees in

those firms which offer flexitime opportunities actually have access to flexitime. In fact, in many firms, the flexitime option is restricted to only some of the employees. The WERS 2004 asks firm managers whether the flexitime option is only available to certain types of employees, and which groups of employees are not allowed to work flexitime. The information is summarized in table 1.4.

Table 1.4: Flexitime Restrictions Within Firms

Whether flexitime option is restricted to some employees:		
Answer	*Percentage*	*No. of obs*
All have the option	56.28	556
Restricted	43.32	428
Do not know	0.40	4
Total	100	988
Which employees are not allowed to work flexitime:		
Employee types	*Percentage*	*Frequency*
Employees without young children	1.92	19
Employees without other caring opportunities	1.52	15
Part-time employees	3.24	32
Full-time employees	3.34	33
Managerial employees	10.12	100
Non-managerial employees	4.65	46
Employees with the establishment for short period of time	3.54	35
Employees not on permanent contract	3.84	38
Any male employees	1.01	10
Other criteria	24.29	240

Source: Workplace Employee Relations Survey, year 2004.

The first panel of table 1.4 displays the proportion of firms that do not allow all their employees to work flexitime. The total number of firms with flexitime options is 988, and 43.32% of them only offer this practice to some of their employees. The second panel of table 1.4 reports on groups of workers that are not allowed to work flexitime. The first column displays employee types, the second column reports the percentage of firms that do not allow the corresponding type of employees to have flexitime, and the last column reports the frequency of such firms. Apart from the criteria otherwise specified, employees that are most likely to be excluded from the flexitime option are managerial employees. Around 10.12% of firms with flexitime options report that they do not allow managerial employees to have flexitime. Possibly this is because in many firms managerial

employees have multiple or complicated obligations, and it is difficult for firms to offer flexitime to them. A further 4.65% firms with a flexitime option do not allow non-managerial staff to work flexitime. Employees with short tenure and those who do not have permanent contracts with the firms are also likely to be denied the access to flexitime. The rationale behind this could be that firms invest in employees with firm-specific training so that workers will accumulate firm-specific human capital. In order to protect their sunk investment in workers, firms are more likely to offer flexitime to workers with long tenure and permanent contract. Therefore, those employees with short tenure and temporary contract are less likely to have access to flexitime than their counterparts.

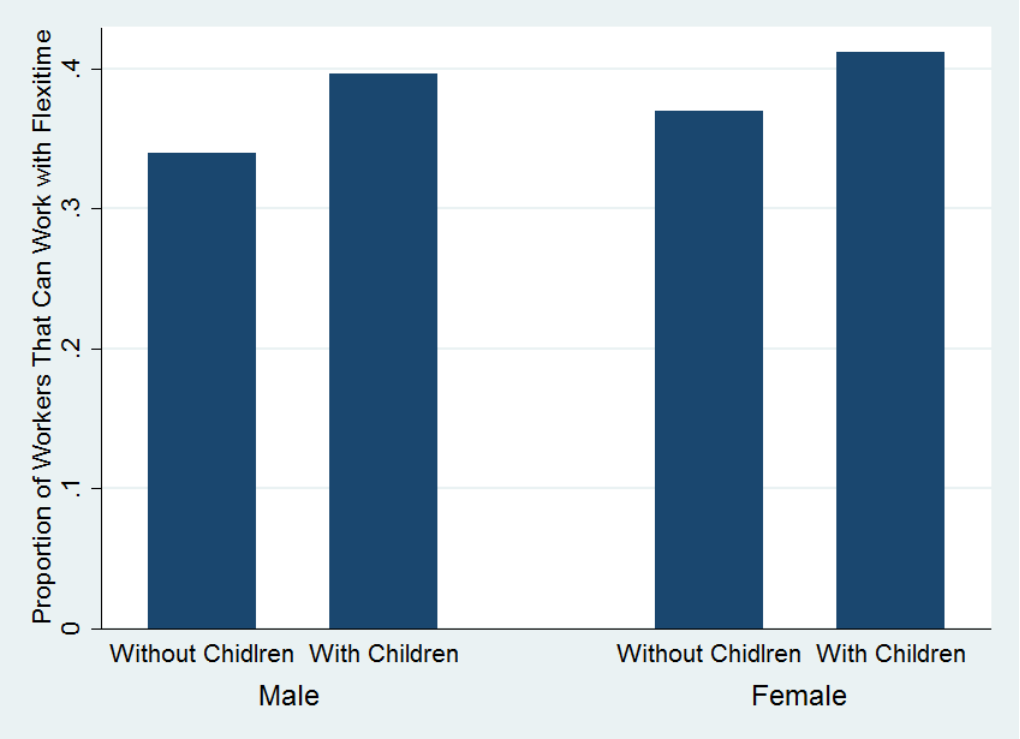
The above statistics are calculated using data from the managers' survey of WERS 2004. The second part of WERS 2004 asks each individual employee whether flexitime is available to them. Therefore, it is also possible to look into the relationship between the availability of flexitime at the work place and employees' characteristics. Figure 1.5 illustrates the percentage of employees that can have access to flexitime by gender and parental status. Figure 1.5 shows that female workers are more likely to have access to flexitime at the workplace than male workers. In addition, for both genders, employees with children are more likely to work in establishments that provide flexitime than employees without children. This suggests that flexitime is closely related to workers' child care obligations.

Figure 1.6 displays the availability of flexitime by employees' education levels. It shows that the availability of flexitime at the workplace has a positive relationship with workers' education levels. Workers with higher academic qualifications are more likely to have access to flexitime than workers with low academic qualifications. Again, this pattern is similar to that of figure 1.4, which is calculated using data from the British Household Panel Survey.

In summary, the descriptive statistics calculated by using data from the WERS 2004 show that many British Firms offer their employees flexible working opportunities. However, in many firms, the provision of flexitime is restricted to some types of employees. This shows that workers' flexitime options are demand constrained. It is not guaranteed that all workers can have access to flexitime working when they want to. In addition, I find that the relationships between flexitime and workers' characteristics are similar to what have been found using data from the British Household Panel Survey[5].

[5]It is worth noting that the BHPS asks individuals whether they actually work with flexitime, while the WERS asks whether individuals can work with flexitime at the workplace if they want to. In other words, the WERS actually records whether employees can have the option

Figure 1.5: Flexitime Availability At Workplace by Parental Status and Gender



Source: Workplace Employee Relations Survey, year 2004.

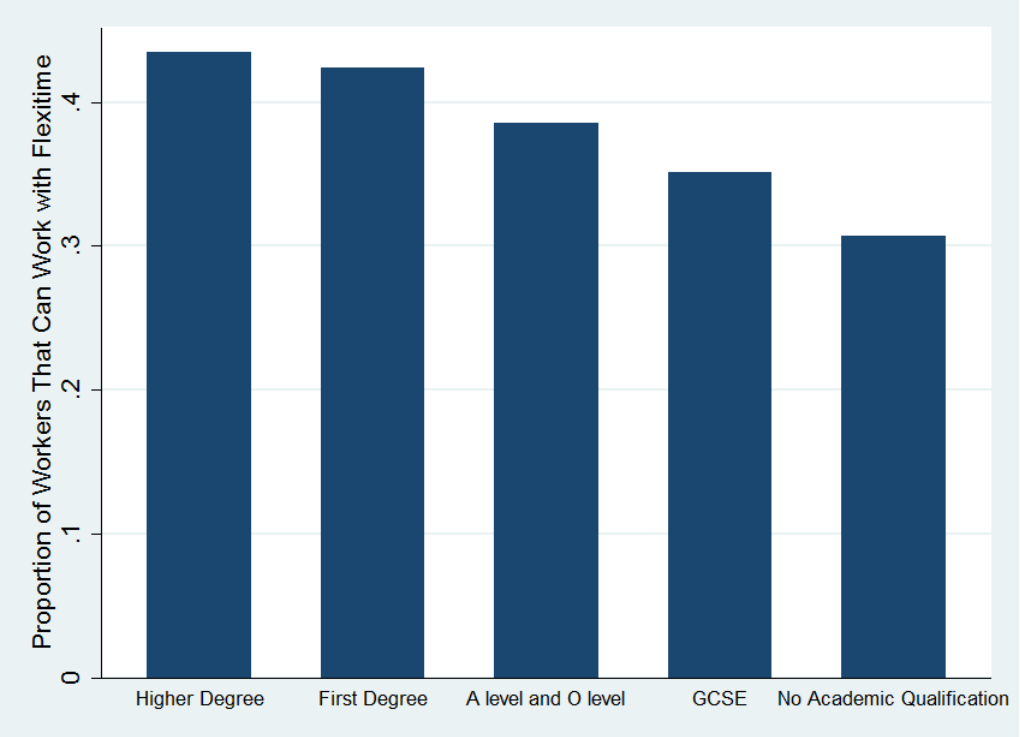
1.2.3 Flexitime Incidence: Evidence From the Labour Force Survey

Another British data set that contains workers' flexitime working information is the Labour Force Survey. It is a national survey that interviews a sample of households living in the United Kingdom in each quarter. It contains comprehensive information about workers' labour market activities. Questions with regard to workers' flexitime status are asked in the Spring quarter (March to May) of the survey. In the following, I show the flexitime incidence across different employee groups using data from the Labour Force Survey. Since 2006, the Labour Force Survey changed the survey time from seasonal year to calendar year. In order to keep consistency, I choose years 2001 to 2005 so that the descriptives can be compared to those of the BHPS.

Figure (1.7) shows the percentage of workers working with flexitime according to their gender and parental status. Throughout all years from 2001 to 2005, flexitime is more popular among female workers than among male workers. Similar to the findings of the other two data sets, working mothers (female workers with

of working with flexitime at the workplace. Therefore, the flexitime incidence differs between these two data sets.

Figure 1.6: Flexitime Availability At Workplace by Education Qualifications



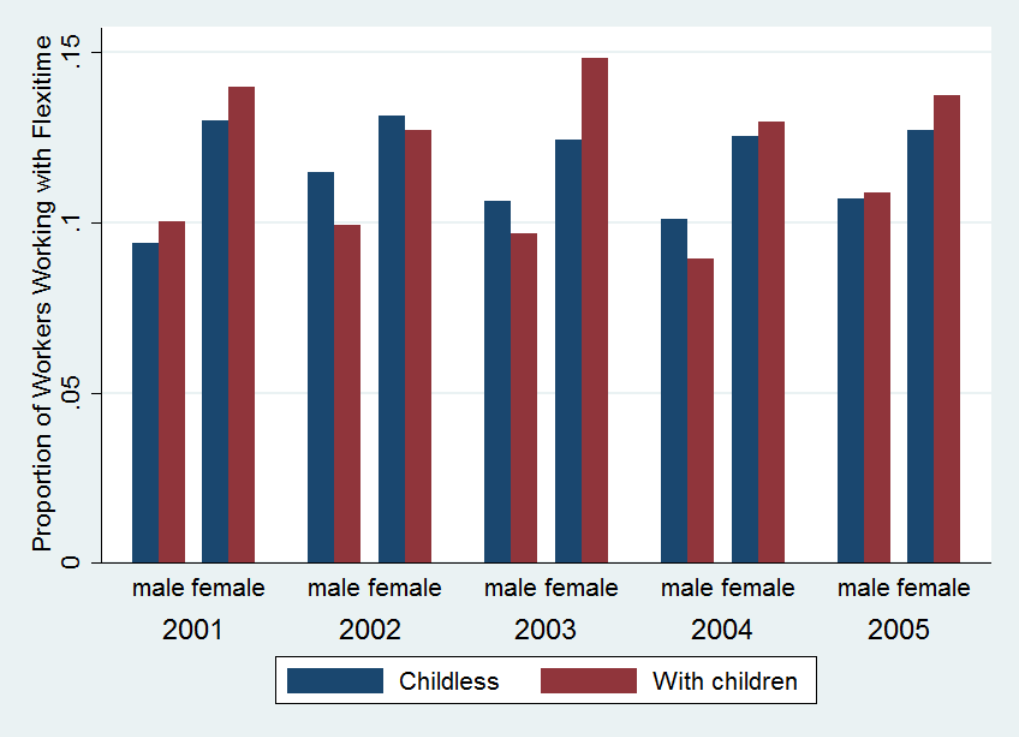
Source: Workplace Employee Relations Survey, year 2004.

children) are more likely to work with flexitime than childless female workers. In summary, the descriptive statistics in figure (1.7) suggests that flexitime is closely related to workers' child care responsibilities. It could be a helpful family friend policy to female workers.

Figure 1.8 displays the incidence of flexitime within education groups. The Labour Force Survey records the highest academic qualifications held by each respondent. Though the survey divides workers' education qualifications in a slightly different way from the BHPS, the general pattern revealed by these two data sets is the same. I find highly-educated workers are more frequently observed to work with flexitime than workers with low-education. For one thing this might be because that high human capital workers are more likely to choose to work with flexitime than low human capital workers. For another this may also imply that firms are more likely to provide flexitime for those high human capital workers than for low human capital workers.

To conclude, combining the descriptive statistics from three different data sets, I find flexitime is closely related to workers' (especially female workers') family duties and their human capital levels (education levels). In addition, the provision of flexitime is also demand-constrained. Many firms restrict the flexitime option

Figure 1.7: Flexitime Incidence by Gender and Parental Status (LFS)



Source: Labour Force Survey Seasonal Datasets, years 2001-2005.

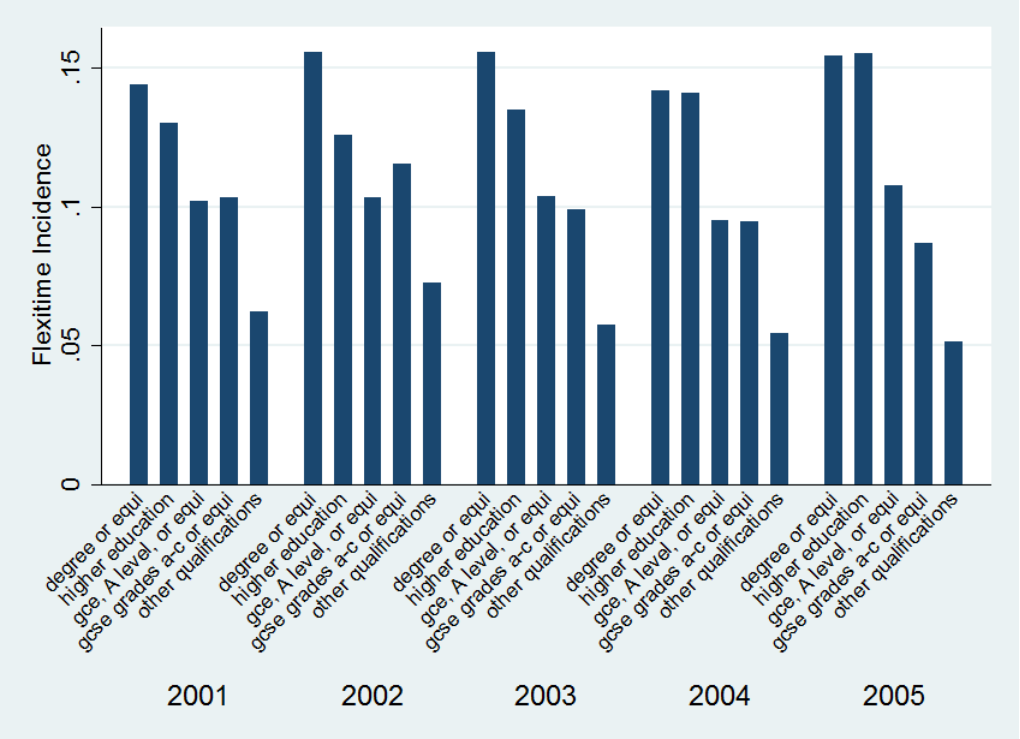
to only part of their employees for various reasons.

1.3 Overview of the Thesis

From the descriptive statistics presented in previous two sections we can see that flexitime is an important working time arrangement for employees. It provides workers with a family friendly working environment, reduces the costs of participating in the labour market, and in turn may alter many other aspects of workers' labour market outcomes. So far studies on the effect of flexitime on workers' labour market outcomes are rare. The conventional approach in labour economics focuses on the number of hours workers spend on market work and home production when studying workers' time allocation decisions. However, most studies ignore the fact that workers not only care about how much time they have left from market work to take care of family responsibilities, but they also care when they are available to cater to family duties. Flexitime enables workers to rearrange their time so that they may feel less conflict between work and home responsibilities.

This thesis contributes to the existing literature by analysing a non-monetary

Figure 1.8: Flexitime Incidence by Education Levels (LFS)



Source: Labour Force Survey Seasonal Datasets, years 2001-2005.

"other qualifications" include "other qualifications" and "no qualification".

job dimension–flexitime–to explain workers' labour market outcomes using data from a British survey. Flexitime provides workers with a new way to cater to their domestic responsibilities and in turn may reduce the costs of participating in the labour market. Therefore, flexitime is closely connected with workers' compensation structure, human capital accumulation process, labour supply and job mobility. The effects of flexitime on workers' labour market outcomes are analysed from three aspects: wage, labour supply, and job mobility.

Throughout all three chapters (chapter 2 to chapter 4), the data used are from the British Household Panel Survey, years 2001-2007. The British Household Panel Survey is a nationwide survey that follows the same individuals over time. The data set contains comprehensive information about workers' labour market activities and their flexitime status. The survey was started in 1991, and information about workers' flexitime status has been included since 1999. I choose to start in 2001 because in that year the survey extended its sample size to include respondents from all over the United Kingdom, and a new coding system recording workers' industry and occupation was also introduced. In addition, the survey also started to separate workers' labour income from their

total income from year 2001. Therefore, waves (years) after 2001 provide more accurate information on workers' labour market outcomes.

The rest of the thesis is organized as the following. The second chapter is a study of compensating wage differentials associated with flexitime. The objective is to estimate the marginal willingness to pay for flexitime in the British labour market. Estimation results using both cross sectional data and panel data are presented. In the cross sectional dimension, when all workers are kept in the sample, I find flexitime does not significantly decrease workers' wages. However, when I focus on high wage workers (top quartile) only, I find that flexitime is associated with lower wages, as predicted by the compensating wage differentials theory. A possible explanation for this is that assuming flexitime is a normal good, then only workers with high incomes would like to sacrifice part of their monetary pay-offs in exchange for it. Workers with relative low incomes may be unable to "afford" to pay for flexitime even if they need the help of flexitime for home production obligations. As a result, it may be that the compensating wage differentials effect of flexitime is only present among high wage workers. In the panel dimension, the workers' wage equation is estimated by a fixed effect model to control for individual unobserved heterogeneity. I also try to adopt an instrumental variable approach to correct for the endogeneity of flexitime, since workers' wages and their flexitime status might be jointly determined. After controlling for individual unobserved heterogeneity and the endogeneity of flexitime, I find working with flexitime is not correlated with any changes in workers' wages. However, the instruments chosen are only weakly correlated with the endogenous variable so estimation results using the panel dimension data are only suggestive. Several possible reasons from the demand side are proposed to explain the insignificant relationship between wage and flexitime when all workers are kept in the sample. Firms may be willing to provide flexitime to workers at a low price if they can benefit from flexitime. For instance, flexitime may increase workers' productivity, so the wage expressed by per efficiency unit of labour is lower, and firms do not need to reduce the actual wage offer when providing flexitime. I also test whether flexitime explains part of the gender wage gap. In most households, female workers take the main responsibility of child care. They may need the help of flexitime more than male workers. Consequently, they may be willing to pay a higher price for flexitime than male workers. So the existing gender wage gap may be narrowed if we take into account the fact that female workers may sacrifice more wages in exchange for flexitime than male workers. However, the estimation results suggest that it is not the case.

In the third chapter, I investigate the effect of flexitime on workers' labour supply decisions. A simple model is developed and empirically tested to show under what conditions flexitime will encourage workers' labour supply decisions. The static model has two predictions. Prediction 1 is that workers will only increase their market hours if the benefit (increased child care production efficiency) bought by flexitime is relatively large compared to the cost (wage reduction) of working with flexitime. Prediction 2 is that the increased working hours under a flexitime regime are more likely to be observed among high human capital workers. The static model is also extended to two periods, where workers do not have flexitime in the first period, but may have flexitime in the second period if they are in the flexible world. I find that because of the human capital accumulation process, flexitime may increase the marginal utility of working in the first period if workers can derive high benefits (increased child care production efficiency) from flexitime relative to the wage reduction associated with flexitime. This suggests that flexitime may induce workers to increase their working hours in both periods. Intuitively, anticipating that flexitime will induce some to supply more time to the labour market, workers' incentive to work in the first period becomes stronger because current working experience will be translated into increased wages in the next period. For some parameter specifications (if the wage reduction cost of flexitime is high compared to the benefit brought by flexitime), flexitime may decrease the marginal utility of working in the first period, which suggests that workers who work with flexitime will supply fewer market hours than those without flexitime. However, this is less likely to be the case for high human capital workers than for low human capital workers. The two predictions of the static model are also tested empirically. When testing prediction 1, I specify working mothers as the group of workers who can derive high benefits from flexitime relative to the cost. In my second chapter I do not find any evidence showing that flexitime decreases working mothers' wages, which could suggest that they do not sacrifice part of their wages in exchange for flexitime. In addition, they also benefit from working with flexitime because they usually take the main responsibility for child care. Estimation results show that flexitime is positively associated with working mothers' labour market hours. This result is also robust to several econometric specifications. This confirms the model prediction 1. In order to test prediction 2, I include an interaction term of flexitime and high human capital into workers' labour supply equation. However, I do not find strong empirical evidence suggesting that flexitime causes high human capital workers to increase their working hours more than low human capital workers.

Also, the empirical results need to be interpreted with caution for the correlation between flexitime and workers' working hours may be because firms set long contract hours for workers as a form of compensation for flexitime. This may be particularly true among workers whose flexitime requests have been agreed, such as workers with high human capital levels.

The fourth chapter explores the effect of flexitime on workers' job satisfaction and job mobility decisions. Ordered probit analysis shows that flexitime increases workers' job satisfaction levels for both genders. Moreover, working with flexitime also decreases female workers' probability of quitting their job if they have children at home. For male workers, though flexitime increases their job satisfaction levels, it has little effect on their job mobility decisions. The gender differences in their responses to flexitime may suggest that only working mothers treat flexitime as a family friendly practice that helps them with child care responsibilities. Unlike female workers, male workers' responses to flexitime seem to have little to do with child care responsibilities. They appear to work with flexitime because they are senior employees who can bargain themselves for generous compensation packages. Descriptive statistics on the allocation of child care responsibilities and the occupation distribution of workers with flexitime confirms the idea that flexitime means different things to male and female workers.

To conclude, this thesis provide some evidence showing that flexitime is closely related to workers' labour market outcomes. Flexitime may effectively increase working mothers' labour supply. In addition, among female workers, flexitime also decreases the probability of quitting for those who have children to take care of. The fifth chapter gives the conclusion and implications of this thesis.

Chapter 2

Flexitime: Do Workers Pay for It?

A Study of Compensating Wage Differentials for Flexitime

Abstract

In this chapter, I estimate workers' marginal willingness to pay for flexitime using data from the British Household Panel Survey. Estimation results using both cross sectional and panel data are presented. In the cross sectional dimension, I find a negative relationship between workers' wages and flexitime when focusing on high wage workers. However, there is not sufficient evidence suggesting the negative compensating wage differentials for flexitime when all workers are kept in the sample. In the panel dimension, workers' wage equation is estimated by a fixed effects model to control for individual unobserved heterogeneity. Meanwhile, I also try to use an instrumental variable approach to correct for the endogeneity of flexitime. The results in panel dimension suggest that working with flexitime is not significantly correlated with workers' wages. Due to the quality of instruments, the results are only suggestive. I also test whether flexitime explains part of the gender wage gap and I find this is not the case.

Key words: High wage workers, flexible working arrangements, instrumental variables, gender wage gap

2.1 Introduction

The theory of compensating wage differentials suggests that jobs are not necessarily ranked by their monetary payoffs. Non-pecuniary job dimensions also affect workers' labour market decisions. This chapter studies the relationship between workers' wages and flexible working arrangements (from here on "flexible working arrangement" will be referred as "flexitime"). The first objective (objective 1) of this chapter is to study whether workers receive lower wages when they are working with flexitime. The second objective (objective 2) is to test whether flexitime explains part of the gender wage gap, since male workers and female workers may want to pay different prices to work with flexitime.

Initiated in Germany about half a century ago, flexitime is now the second most popular flexible working arrangements in the United Kingdom, whereas part time is the most popular. In this chapter, I will only focus on "flexitime". It is a practice which gives employees the freedom to decide when to start and end their working time. The usual practice is that employers choose a certain period of the day as "core hours", during which workers have to stay at work. For the rest of the time, it is up to the workers to decide when to work. Flexitime plays an important role in balancing workers' work and family responsibilities. So far, little attention has been paid to the study of flexitime in economics. The first objective (objective 1) of this chapter is to study workers' willingness to pay for flexitime using the British Household Panel Survey (hereafter BHPS), which is a national-wide survey containing information about workers' labour market characteristics and their flexible working arrangements.

The theory of compensating wage differentials predicts that workers receive a wage premium, or penalty, for various job characteristics. However, economists often fail to find convincing evidence to prove the existence of wage premiums for most job characteristics, except for the risk of death (Quintana-Domeque, 2011). Borjas (2010) documents that tests for the compensating wage differentials theory for almost all job characteristics get mixed results.

This chapter contributes to the literature in the following respects. First, it is one of the few papers that investigates the relationship between wages and workers' flexible working arrangements. Second, I propose an estimation strategy showing that the compensating wage differentials effect of flexitime is only present among certain types of workers. Previous empirical studies on the relationship between flexitime and wages find that flexitime is either positively or insignificantly correlated with workers wages when all workers are kept in the data set (Gariety and Shaffer, 2001; Bell and Hart, 2003). Instead of pooling all workers

together, I focus on the heterogeneity across groups with different income levels. If we think flexitime is a normal good, then only workers with relatively high incomes would like to pay for it, or in other words, can afford to do so. For workers with low incomes, even if flexitime is a helpful option, they may not want to forfeit part of their wages in order to get it. Therefore, the expected compensating wage differentials for flexitime may be present only among high wage workers. In this chapter, I divide workers into four groups according to their income levels, and estimate the top quartile workers' wage equation. Results using cross sectional data do in fact show that the main compensating wage differential effect of flexitime is present among those high wage workers. When all workers are kept in the sample, I find that the relationship between flexitime and wages are mixed and inconclusive.

I have also tried to estimate the compensating wage differentials for flexitime using panel techniques so that I can control for individual unobserved heterogeneity. A fixed effect model is applied to control for all time invariant factors that may affect workers' wages. The estimation results show that in this case flexitime does not lead to significant changes in workers' wages. Even among high wage workers, flexitime has little effect on workers' wages when individual fixed effects have been controlled for. This makes the results reported in the cross sectional section less convincing. I attempt the instrumental variable approach to correct for the endogeneity of flexitime. However, it is difficult to find proper instruments for flexitime. The instruments chosen to correct for the endogeneity of flexitime are only weakly correlated with the endogenous variable flexitime, so the results are only suggestive. Despite the weaknesses of the instruments, I conduct this analysis to see whether taking into account the endogeneity issue can help obtain a more accurate estimation of the compensating wage differentials associated with flexitime.

Several possible reasons are proposed to explain the insignificant relationship between wage and flexitime. Though flexitime is costly to provide, firms may have incentives to provide flexitime free of charge if the benefits brought by flexitime exceed the costs. For instance, flexitime may increase workers' productivity, so the wage expressed by per efficiency unit of labour is lower under flexitime. Firms do not need to reduce the actual wages. In addition, flexitime could increase workers' net working hours, and in turn increase the returns to firms' specific human capital investment. Further more, by providing flexitime at low prices, firms may achieve lower turnover rates, so that they can protect their human capital investments in workers. Given the potential benefits associated with flexitime, it is possible

that firms are willing to allow workers to work flexitime without experiencing any wage reductions.

Objective 2 of this chapter is to test whether flexitime helps to explain part of the gender wage gap. Flexitime gives workers the freedom to rearrange their working time so that they can take care of their family responsibilities in a more efficient way. Therefore, there might be gender differences in their willingness to pay for flexitime given that female workers generally take the main responsibilities for home production. I include the interaction term of gender and flexitime into the wage equation to see whether or not this is the case. Unfortunately, the results are mixed and inconclusive. However, according to estimation results for high wage workers, it seems that they are the only group that would like to pay for flexitime. Given that most high wage workers are male, it is suggestive that taking into account flexitime will not narrow the current observed gender wage gap.

The rest of this chapter is organized as follows. In section 2.2, I review the related literature. Section 2.3 gives the empirical framework. In section 2.4, I describe the data set and the definitions of variables used. Section 2.5 discusses the empirical results. In section 2.6, I conclude.

2.2 Review of Literature

2.2.1 Literature on Compensating Wage Differentials

The idea of compensating wage differentials can be traced back to Adam Smith, who suggested that all aspects of a job plays a role in the wage determination (Duncan and Holmlund, 1983). Rosen (1986) then formalizes this idea and the theory of compensating wage differentials was established. In the compensating wage differentials theory, under perfect competition and full information, workers receive wage premiums for various job characteristics. In equilibrium, workers are sorted to jobs with different wage-(dis)amenities combinations according to their preferences. The debate around this theory centers primarily on ways to empirically test it: to use cross sectional or panel data, to use information at the individual or industry level, whether or not to control for unobserved heterogeneity, and whether or not to control for the endogeneity of job attributes.

The first method for testing the compensating wage differentials theory is to estimate a hedonic wage equation. The hedonic wage equation expresses the workers' wage as a function of various job amenities and the workers' personal characteristics. One class of studies focuses on the calculation of "Value of life",

which refers to the wage premium workers receive when working in an environment with fatal risks. Most studies in this area find convincing evidence of the trade-off between wage and risk, though the quantitative implications vary across different data sets and specifications[1]. Viscusi (1993) gives a comprehensive review of the literature in this area.

Though the hedonic wage equation is a straightforward way to estimate the relationship between wage and non-wage job attributes, there are many things that need to be taken into account in order to obtain the accurate coefficient estimates.

First, the estimation results highly depend on the data sets and specification used. Due to restricted data availability, researchers often have to use industry level data, assuming workers in the same industry have the same preferences. It is also a common practice for researchers to calculate industry/occupation average job attributes and match that to individuals (Hersch, 1998; Hamermesh, 1999). This approach might be problematic because it does not take into account that even within industries (or occupations), workers' job attributes may be different.

Second, different measurements of the variable of interest are also a source of the inconclusive results. In the "value of life" case, Hersch (1998) uses the Current Population Survey data to calculate the gender-specific incidence rates. He successfully demonstrates that female workers working in the dangerous environment receive wage premiums. He also shows that using different ways to measure the "risk" variable does make a difference in the final estimation results. In the case of flexitime, Lazear (2007) discusses flexitime in terms of percentage of working time that is at workers' disposal. However, the data on the exact levels of flexibility workers have are generally unavailable. To my knowledge, all empirical studies on flexitime treat it as a discrete choice.

Third, failing to control for individual unobserved heterogeneity (such workers' innate ability, motivation, and productivity) also generates potential problems for the estimation. Brown (1980) and Duncan and Holmlund (1983) have tried to control for those unobserved factors by using fixed effects models. They were able to find significant compensating wage differentials for some of the job amenities (working conditions), though the results are still mixed and inconclusive. Quintana-Domeque (2011) also focuses on the problem of unobserved individual preferences and explains that mismatch of workers' preferences and jobs will lead to low productivity (low ability/productivity workers are also more likely to be

[1]Studies on the compensating wage differentials for on the job risk find conclusive evidence that workers receive wage premiums for working under risky environment. For other job attributes, the findings are mixed and inconclusive (Borjas, 2010; Quintana-Domeque, 2011).

mismatched too), which spares little profit room for the compensating wage differentials.

Another approach to test the compensating wage differentials theory takes the dynamics of the labour market into consideration. Hwang et al. (1998) demonstrate that the hedonic wage equation estimates may lead to a downward bias even if individual heterogeneity has been included into the regression. He argues that the hedonic wage equation approach assumes a static process of workers' labour supply decision, and ignores the fact that workers can adjust job attributes to their preferences by moving between jobs. Gronberg and Reed (1994) incorporate an underlying job search model to estimate workers' marginal willingness to pay (MWP) for certain job attributes. Gronberg and Reed (1994) estimate those parameters in a hazard function that expresses workers' willingness to stay at one job in terms of various job attributes (including wage) and personal characteristics. They express workers' MWP as "the ratio of the marginal utility of one job attribute over the marginal utility of the wage". The idea is that due to firms' cost heterogeneity, some firms are able to offer both favorable working conditions and high wages, which will result in a longer stay of workers within those firms. They construct a hazard function where workers' length of stay in the firm is represented by wage-attributes combinations and personal characteristics, and find significant compensating differentials associated with many undesirable job amenities. This starts a new generation of estimating compensating wage differentials. Bonhomme and Jolivet (2009) summarize that estimation results using this approach suggest larger compensating wage differential effects than hedonic wage equation estimates.

So far, it is still not agreed what should be the most appropriate method for estimating the compensating wage differentials. Simply estimating a cross sectional hedonic wage equation fails to incorporate the labour market dynamics and individual heterogeneity. Models using fixed effects take into account individual unobserved heterogeneity, but ignore the wage differentials across individuals. The approach proposed by Hwang et al. (1998) assume preference homogeneity, which is a strong assumption too.

2.2.2 Literature on Flexitime and Other Flexible Working Schedules.

There are few studies in economics that investigate the effect of flexible working schedules on workers' wages. Golden and Altman (2007a) develop a theoretical model to analyze the persisting excess demand of flexitime at work places. He

argues that the technology constraint is the primary reason that leads to the under-supply of flexitime. Gariety and Shaffer (2001) use cross sectional data from the Current Population Survey to estimate the compensating differentials for flexitime. They find that flexitime is associated with higher wages, which is contradictory to the compensating wage differentials theory. They attribute such a positive relationship to the high productivity associated with workers that have flexitime. Glass (2004) finds that family friendly policies may have negative effects on female workers' wage growth. However, she does not control for workers' educational information. This may lead to inaccurate estimation results since workers' chances of working with family friendly policies are closely related to their education levels. Bell and Hart (2003) study the relationship between annualized hours and workers' labour market outcomes using data from the Labour Force Survey. They find that after excluding managers and professional workers, workers on annualized hours contracts earn higher wages than workers who do not work with annualized hours contracts. They also include workers' flexitime status as a control variable in workers' wage equation, and find insignificant (or positive) relationship between flexitime and workers' wages.

There are also some studies on the effect of flexible working arrangements on other aspects of workers' behaviours in other disciplines such as sociology and management (Hicks and Klimoski, 1981; Kostiuk, 1990; Dalton and Mesch, 1990; Golden, 2001; McCrate, 2005). Table A.1 in the appendix A.1 gives a brief summary of such literature on flexitime.

Apart from flexitime, part time jobs are also popular flexible working schedules. They can also be regarded as a type of flexible working arrangement. Manning and Petrongolo (2005) investigate wage differentials between part time workers and full time workers. They find that unconditionally, part time workers earn lower wages than full time workers. However, most of these wage differentials are driven by the occupation differences between full time and part time workers, since part time jobs tend to concentrate in unskilled occupations.

2.3 Empirical Framework

The marginal willingness to pay for flexitime is obtained by estimating a hedonic wage equation. The model can be written as:

$$ln(wage)_i = \alpha + \beta Flexitime_i + \sum_{m=1}^{M} \gamma_m X_{im} + \sum_{n=1}^{N} \delta_n P_{in} + \varepsilon_i \qquad (2.1)$$

where $ln(wage)_i$ is the natural logarithm of employee i 's wage, α is the constant, $Flexitime_i$ is the respondent's flexitime status. It takes a value of one if the respondent works with flexitime and zero otherwise. X_{im} is the vector of individual employee's personal characteristics,m is the personal characteristics index, denoting the mth personal characteristic controlled, P_{in} is the vector that denotes workers' job characteristics, and n is the job characteristics index, denoting the nth job characteristic controlled. ε_i is the error term.

Most previous studies on compensating wage differentials estimate equation (2.1) using cross sectional data. In this chapter, equation (2.1) is estimated using each wave of BHPS data in turn. Several interaction terms of workers' type and flexitime are also added into the regression in order to control for workers' preference heterogeneity. In addition, I also estimate equation (2.1) for workers with different income levels.

One of the main arguments against estimating wage equations using cross sectional data is that it fails to control for individual unobserved heterogeneity. Duncan and Holmlund (1983) argue that fixed effects models help correct coefficients to the "right" sign as they control for individual unobserved heterogeneity, but this only works for a few job attributes. The advantage of the fixed effects model is that it controls for individual unobserved heterogeneity, and produces statistically consistent results.

In this chapter, the wage equation estimated using panel data can be written as:

$$ln(wage)_{it} = c + a_i + \eta Flexitime_{it} + \sum_{m=1}^{M} \gamma_m X_{imt} + \sum_{n=1}^{N} \delta_n P_{int} + \zeta_{it} \qquad (2.2)$$

where t is the time index, c is the constant term, a_i is individual unobserved heterogeneity, and ζ_{it} is the error term. $ln(wage)_{it}$ is the natural logarithm of workers' wage at time t. $Flexitime_{it}$ is respondent i's flexitime status at time t, X_{imt} is the vector that denotes individual workers' personal characteristics at time t, and P_{int} is the vector that denotes workers' job characteristics at time t.

The endogeneity of flexitime is also considered in the panel dimension. High human capital workers may have a lot of bargaining power when negotiating contracts with employers, and they may enjoy both high wages and flexitime as a result. Employers may also be willing to offer flexitime to high human capital workers to induce them to stay with the firm. Workers' wages and flexitime status may be jointly determined. To this end, flexitime should be treated as an endogenous variable in the wage equation. In this chapter, following Garen's

(1988) technique, flexitime is instrumented by number of children aged between 0-2, 3-4 and the workers' non-labour income. The choice of those instruments will be discussed later. Equation (2.2) is estimated by Two Stage Least Squares. The reduced form of workers' flexitime equation can be written as:

$$\begin{aligned} Flexitime_{it} &= b + d_i + \theta Nonlabor_{it} + \lambda Child02_{it} + \vartheta Child34_{it} \\ &+ \sum_{m=1}^{M} \phi_m X_{imt} + \sum_{n=1}^{N} \mu_n P_{int} + \psi_{it} \end{aligned} \tag{2.3}$$

where b is the constant term, d_i is the individual unobserved heterogeneity, t is the time index, $Nonlabor_{it}$ is workers' non-labour income at time t, $Child02_{it}$ is the number of children aged between 0-2 in the household at time t, $Child34_{it}$ is the number of children in the household aged between 3-4 at time t, and ψ_{it} is the error term.

In most households, wives take the main responsibility for looking after children. Therefore, it is possible that flexitime is more helpful to female workers than to male workers. If female workers are willing to pay a higher price for flexitime than male workers, then the gender wage gap might be narrowed if we take into account flexitime. In order to test this hypothesis, I include the interaction term of gender and flexitime to check whether there are any gender differences in their willingness to pay for flexitime.

2.4 Data and Variable Definitions

2.4.1 Data

Data from the British Household Panel Survey (BHPS), wave 11 to wave 17 (year 2001 to year 2007), are used in the analysis. BHPS is a British national-wide survey containing comprehensive information about respondents' demographic characteristics and labour market activities. In each wave, there are more than 10,000 individuals interviewed, and each respondent is re-interviewed in the following successive years if possible. Since wave 11 (year 2001), samples from all over the UK are included, and respondents' labour market activities are recorded using the same coding system. Waves before 2001 use an alternative method to measure workers' job characteristics, which makes it impossible to make cross-wave comparisons. Since 2001, the BHPS also separates workers' labour income from their total income, which makes it more convenient to examine the effect of flexitime on workers' wages in the compensating wage differentials context.

The BHPS asks questions about respondents' flexitime status only to wage earners. In this chapter, the sample is restricted to contain only employed people. Both unemployed and self-employed respondents are excluded. In addition, I only include people who completed the interview themselves rather than those who let someone else to answer the questionnaires. This is because data about people who do not answer questions themselves often contain excessive missing values and inaccurate answers. Part time workers are also excluded from the sample. The effect of flexitime on part time workers' wages is unclear, since part time jobs can be thought as a flexible working practice. After clearing all the invalid observations, there are around 6000 observations left in each wave.

2.4.2 Variable Definitions

Flexitime

The variable *Flexitime* is measured by a dummy variable which takes a value of one if the respondent reports that they work with flexitime, and zero otherwise.

Ln (wage)

The variable $ln(wage)$ is defined as the natural logarithm of workers' real hourly wage. BHPS separates workers' labour income from their total income. For each respondent, I divide their monthly labour income by the total number of working hours (including over time hours) in that month to get the hourly wage. Because BHPS only records each respondent's weekly total working hours, I scale it up to get the monthly working hours. After calculating workers' hourly wages, I adjust them for inflation to get the real hourly wage.

The BHPS only records workers' monthly labour income, which includes overtime payments. Therefore, when constructing the hourly wage variables, I include the workers' overtime hours in their weekly working hours. This method may be subject to the criticism that workers' weekly working hours may vary due to the fluctuations in workers' overtime working. However, the BHPS does not contain enough information on workers' overtime premium[2], which makes it difficult to calculate the exact standard hourly wage rates.

I also construct the real hourly wage by dividing workers' weekly income by their normal weekly hours (excluding overtime). Using this alternative measure of

[2]In the BHPS, some workers report that they work paid overtime while some other workers report they work unpaid overtime, but there is no information about how much workers are paid for each overtime hour. This makes it even more complicated to work out the standard hourly wage rates.

real hourly wage in regressions does not qualitatively change the estimation results . Tables A.5 and A.6 in Appendix A report the estimation results of workers' wage equations (2.1) and (2.2) respectively using the alternative measure of real hourly wage[3]. It can be seen that the estimation results are almost identical to those reported in tables 2.3 and 2.9. In addition, when estimating workers' wage equations in the panel dimension, year dummies are included as regressors to take into account of aggregate time shocks that may lead to fluctuations in workers' overtime hours.

Personal and Job Characteristics

There are 6 demographic variables included in the wage equation: $Male$, $Union$, $Children$, $Married$, Age, $Age\ squared$. $Male$ is a dummy variable which takes a value of 1 if the respondent is a male and 0 otherwise. $Union$ is a dummy variable that takes a value of 1 if the worker has union membership and 0 otherwise. $Children$ is a dummy variable which takes a value of 1 if the worker has children under 16 and 0 if the worker does not have children under 16. $Married$ denotes workers' marital status. It takes a value of 1 if the worker is married and 0 otherwise. Age records workers' age at the interview. $Age\ squared$ is the square of worker's age.

Individual's educational information is also included. Education information is measured by the highest qualification obtained by the respondent. BHPS divides workers' educational degrees into 7 levels; higher degree (postgraduate degrees), first degree, hnd, hnc, teaching degree, A level qualification, O level qualification, Cse qualification, and No qualification. Industries and occupations are controlled at one digit levels.

2.5 Empirical Results

2.5.1 Sample Statistics

Table 2.1 gives the sample statistics of the key control variables in workers' wage equations. For each variable, both the mean and the standard deviation (in parentheses) are reported. For dummy variables, the mean of each variable can be interpreted as the proportion of respondents which belong to the category that is coded 1. According to table 2.1, the percentage of workers with flexitime

[3]It is derived by diving workers' weekly labour income by their weekly working hours excluding overtime.

Table 2.1: Sample Statistics of Variables in Workers' Wage Equation.

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
Flexitime	.22	.15	.18	.15	.16	.16	.17
	(.42)	(.35)	(.37)	(.36)	(.36)	(.36)	(.36)
Male	.57	.57	.57	.57	.57	.57	.56
	(.49)	(.49)	(.49)	(.49)	(.49)	(.49)	(.49)
Wage	10.82	11.39	11.50	11.89	12.00	12.33	12.45
	(5.85)	(6.66)	(6.41)	(9.34)	(6.62)	(7.01)	(7.28)
Married	.54	.54	.54	.54	.53	.54	.54
	(.49)	(.49)	(.49)	(.49)	(.50)	(.50)	(.50)
Children	.34	.34	.33	.33	.33	.33	.33
	(.47)	(.47)	(.47)	(.47)	(.47)	(.47)	(.47)
Union	.34	.34	.34	.34	.33	.33	.33
	(.47)	(.47)	(.47	(.47)	(.47)	(.47)	(.47)
Age	37.63	37.93	38.30	38.58	38.58	39.00	39.14
	(11.48)	(11.59)	(11.63)	(11.78)	(11.82)	(11.83)	(11.91)
No. of obs	6839	6095	5921	5716	5685	5406	5286

Source: British Household Panel Survey, years 2001-2007.
For each variable, both mean and standard deviation (in parentheses) are reported.

fluctuated slightly across all the seven years. In 2003, the British government put forward legislation specifying that workers with children under 6 years old can request flexible working schedules from their employers. This legislation was first put in the Employment Act 2002, and became formal legislation in April, 2003. Manning and Petrongolo (2005) report, however, that the proportion of people that have flexible working arrangements did not rise significantly after the legislation. According to BHPS data, it seems that the legislation in 2003 had little effect on flexitime specifically. In 2003, a slightly higher percentage of people had flexitime, but the percentages fell back to the pre-2003/2002 level in 2004. Figures 1.1 to 1.4 also suggest that the 2003 legislation did not change the distribution of flexitime across different gender, fertility and education groups.

Other demographic information, such as the proportion of people that are married, have children under 16, or have union membership stays relatively stable. The mean and standard deviation of those variables almost do not change over 7 years. Average real hourly wage is increasing over the years, which is reasonable because the survey follows the same individual.

In chapter 1, I have presented graphs that describe the incidence of flexitime by different workers' characteristics (figures 1.1 to 1.4). These graphs show that workers' flexitime status is closely connected to their gender (female workers are more likely to have flexitime than male workers), parental status (working parents are more likely to work with flexitime than childless workers), and educational qualifications (there is a positive relationship between flexitime and academic

qualifications). The popularity of flexitime among female workers and working mothers could imply that flexitime is a useful family friendly policy which helps employees with their child care responsibilities. The positive relationship between flexitime and workers' academic qualifications may suggest that high human capital workers are more likely to work with flexitime than low human capital workers. This might be because well educated workers earn high wages, and they are more likely to "purchase" favourable working conditions than low educated workers due to the income effects (Garen, 1988 and Viscusi, 1993). What is more, firms are also willing to grant flexitime requests from workers with high human capital levels in order to protect their sunk firm-specific human capital investment.

Other factors that may have an effect on workers' flexitime status are their occupations and the industries of their employers. Across all seven years, "administrative and secretarial occupations" are the most "flexible" jobs. What is more, the distribution of flexitime over occupations also suggests a positive relationship between wages and flexitime. Workers in high wage jobs, such as managerial occupations and professional occupations, are more likely to have flexitime than workers in low-wage jobs, such as elementary occupations and machine operatives. Workers in different industries also have different probabilities of working with flexitime. Among all the industries, people that work in public administration and defence are most likely to have flexitime, followed by people working in financial intermediation industries.

In summary, the descriptive statistics suggest that both workers' demographic information and their job characteristics are related to their access to flexitime. These factors are also widely acknowledged to have significant effects on workers' wages. Therefore, they should be included into workers' wage equations when estimating the compensating wage differentials associated with flexitime.

2.5.2 Empirical Results

Cross Sectional Evidence

First, the relationship between flexitime and workers' wages is examined using cross sectional data. An important assumption here is that the flexitime is exogenous and uncorrelated with the error term. Admittedly, this is a very strong assumption, and there are a few reasons why this assumption might not be true. I will also discuss how the results may change after relaxing this assumption later. If flexitime is in fact exogenous, the OLS estimator will be unbiased and

consistent.

Table 2.2 displays the regression results using BHPS wave 15 (year 2005) data only. This year is chosen randomly out of all 7 years. The objective is to show how the flexitime coefficient evolves in the workers' wage equation when I increase regression controls.

Table 2.2: Estimation Results of Workers' Wage Equation (2.1)

	(1)	(2)	(3)	(4)
Flexitime	.09***	.07***	.01	-.02*
	(.01)	(.01)	(.01)	(.01)
Male		.15***	.15***	.11***
		(.01)	(.009)	(.01)
Children		.008	.03**	.03**
		(.01)	(.01)	(.01)
Married		.05***	.05***	.03***
		(.01)	(.01)	(.01)
Union		.16***	.11***	.12***
		(.01)	(.01)	(.01)
Age		.07***	.05***	.04***
		(.003)	(.003)	(.003)
Age squared		-.0008***	-.0006***	-.0004***
		(.00004)	(.00004)	(.00004)
Education dummies			yes	yes
Ind & Occ dummies				yes
Constant	2.35***	.74***	1.34***	1.33***
	(.006)	(.05)	(.06)	(.11)
R squared	0.0054	0.19	0.36	0.48
No. of obs	5599	5599	5599	5599

Source: British Household Panel Survey, year 2005.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by Ordinary Least Squares.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Beginning with the most simple specification in column 2 of table 2.2, where the only explanatory variable is the flexitime dummy itself, there is a positive relationship between flexitime and wage. When more individual demographic and labour market information is added into the regression, the positive relationship still persists, though the flexitime coefficient becomes smaller. After controlling for the educational information, as showed in column 4, the flexitime coefficient drops sharply and is no longer significantly different than zero. This could imply that within the same education group, having flexitime does not affect workers' wages. In the final column, where I add industry and occupation information

into the regression, the flexitime coefficient became negatively significant at the 10% level.

The regression results in table 2.2 show that when little information is controlled for, the positive productivity effect of flexitime on workers' wages dominates. Workers with high human capital levels may have high productivity and thus earn high wages. At the same time, they are also more likely to work with flexitime than low productivity workers. Therefore, it would be observed that workers who work with flexitime also earn high wages. When more information on workers' human capital levels is taken into account, this positive relationship between flexitime status and wages disappears. Estimation results in the final column of table 2.2 suggest that workers who work with flexitime earn lower wages than those who do not have flexitime, controlling for personal and job characteristics. Intuitively, based on this single year data, there is a negative relationship between flexitime and workers' wage. This confirms the predictions of the compensating wage differentials theory.

The results showed in table 2.2 give some evidence for the compensating wage differentials effect of flexitime. However, when I estimate the complete version of the wage equation specification (the specification displayed in the final column in table 2.2) using other six year's data, the results are mixed and inconclusive. The estimated flexitime coefficients in the wage equations vary across different years. They are either negative or insignificant.

Table 2.3 displays the the estimation results of equation (2.1) using all seven waves of the BHPS data (year 2001 to year 2007). Combining results from tables 2.2 and 2.3, the compensating wage differentials for flexitime are negative in years 2001, 2005, 2006 and 2007. Across the other three years, there is little evidence suggesting that workers receive negative compensating wage differentials for working with flexitime. All the other coefficient estimates of the control variables are in line with the previous literature. Male workers earn higher wages than female workers. Married workers earn higher wages than single workers. Workers with children under the age of 16 earn higher wages than workers without children under the age of 16. Workers' wages also increase with their ages.

Previous studies on the relationship between flexitime and wages report either positive or insignificant coefficient estimates of flexitime in the workers' wage equation (Gariety and Shaffer, 2001)[4]. As indicated by tables 2.2 and 2.3, in-

[4]They use data from the Current Population Survey, which is an American data set. Here, I investigate the same research question using data from a British national survey. This may explain why there are small differences between their estimates and mine. For example, I do not find any positive relationship between wages and flexitime when all workers are kept in the

Table 2.3: Estimation Results of Workers' Wage Equation (2.1)

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
Flexitime	-.02*	.01	-.009	.001	-.02*	-.03**	-.02*
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Male	.14***	.14***	.15***	.12***	.11***	.12***	.12***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Children	.03***	.05***	.03***	.02**	.03**	-.0005	.01
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Married	.03***	.02**	.03***	.03***	.03***	.06***	.05***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Union	.10***	.09***	.09***	.08***	.12***	.08***	.09***
	(.009)	(.01)	(.01)	(.009)	(.01)	(.01)	(.01)
Age	.04***	.04***	.05***	.04***	.04***	.04***	.04***
	(.002)	(.003)	(.003)	(.002)	(.003)	(.002)	(.002)
Age squared	-.0004***	-.0005***	-.0005***	-.0005***	-.0004***	-.0005***	-.0004***
	(.0003)	(.0004)	(.0003)	(.0003)	(.00004)	(.00003)	(.00003)
Education dummies	yes	yes	yes	yes	yes	yes	yes
Ind & Occ dummies	yes	yes	yes	yes	yes	yes	yes
Constant	1.57***	1.95 ***	1.50***	.97***	1.33***	1.29***	1.15***
	(.07)	(.10)	(.12)	(.12)	(.11)	(.15)	(.16)
R squared	.49	.50	.48	.50	0.48	.53	.52
No. of obs	6839	6095	5921	5716	5599	5406	5286

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by Ordinary Least Squares.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

vestigating the compensating wage differentials for flexitime using cross sectional data may lead to mixed results.

Estimation results in both tables 2.2 and 2.3 do not provide convincing evidence for compensating wage differentials associated with flexitime. The coefficient estimates of flexitime vary across years. In many years, flexitime does not have a significant effect on workers' wages. There are several possible reasons (from both the demand side and the supply side) to explain why working with flexitime might not reduce workers' wages, as predicted by the compensating wage differentials theory.

First, firms might be willing to provide flexitime "free of charge" because flexitime may increase workers' productivity and bring firms additional benefits. With the help of flexitime, workers' production efficiency may rise as they suffer fewer conflicts between work and family responsibilities. For instance, flexitime can be used as a means of offsetting boredom and fatigue so that workers can be more devoted to their jobs (Golden and Altman, 2007b; Gariety and Shaffer, 2001). Quintana-Domeque (2011) also argues that workers' productivity is lower if they are mismatched with jobs which do not have the amenities they desired. Under

sample, though in 3 out of 7 years, flexitime is insignificantly correlated with wages.

the flexitime regime, for each unit of labour input devoted to the production process, the output may thus have increased. To this end, firms do not necessarily need to reduce actual wages in order to provide flexitime, for even if they keep workers' wages at the original level, the wages expressed by per efficiency unit of labour could be lower than before. Firms can have a share of the additional output produced by workers with the help of flexitime. Though flexitime is costly to provide, the increased production efficiency associated with it may mitigate or even overcome the costs so that some firms would like to provide flexitime to workers without reducing the actual wages. As a result, we may observe that wages are insignificantly associated with workers' flexitime status.

Second, the provision of flexitime may induce longer net working hours (see chapter 3).In my third chapter, I find that flexitime consistently increases working mothers' weekly working hours. This could improve firms' returns to specific human capital investments. Firms invest in workers with training that helps them accumulate specific human capital. When flexitime induces workers to work longer hours, firms also benefit more from their human capital investments. In this scenario, the wage reduction associated with flexitime is also unlikely to happen, for firms are already "compensated" by workers' long working hours. Similarly, flexitime may help firms reduce the turnover rates, so that firms can protect their sunk investment in workers' specific human capital. If firms invest heavily in workers, they will suffer substantial losses if those workers with high firm-invested specific human capital quit their jobs for family reasons. The replacement costs of those workers might be very high to firms. In order to reduce the quit threats, firms may be willing to provide flexitime at low prices, resulting in a insignificant flexitime-wage relationship.

Another possible reason could be that these mixed results are driven by the heterogeneity among different types of workers. It might be the case that some types of workers do not value flexitime much and therefore they are not willing to trade part of their monetary payoffs for flexitime. Meanwhile, other types of workers may place a high value on flexitime. They are willing to pay a high price for it and firms are willing to accommodate their requests for flexitime. In this case, when all workers are pooled together, the compensating wage differential effects associated with flexitime are mixed and inconclusive. This concern is also closely related to the second objective of this chapter; to investigate whether male and female workers' different preferences towards flexitime could explain part of the gender wage gap.

The first type of heterogeneity considered is the difference across income

groups. Assuming that flexitime is a normal good, the willingness to consume flexitime increases with income. Consider a worker who earns minimum wage and can barely feed her family, it would be unlikely that she would sacrifice part of her wages in exchange for flexitime, even though she may have young children to care for. On the other hand, workers who have decent incomes may choose to work more flexibly at the price of lower wages. Such an income effect is verified by the descriptive statistics which show that the proportion of workers working with flexitime is increasing in educational levels. In addition, most workers with flexitime concentrate in well-paid occupations. Very few workers in the elementary occupations work with flexitime. For workers with relatively low incomes, the marginal rate of substitution between wages and flexitime is very low. Therefore, the compensating wage differentials for flexitime should be more prominent among workers with high wages.

In order to control for income heterogeneity, I divide workers into several groups and estimate their wage equations separately. For each year, I divide the sample into four equal sized groups according to their wage levels, and I run a regression for the highest-income group. This should be the group of workers that are most likely to be able to afford flexitime.

Table 2.4 reports the regression results for the high wage workers. From table 2.4, it can be seen that in all years except 2002, flexitime is negatively correlated with workers' wages. This suggests that among high wage workers, those who work with flexitime receive negative wage premiums. Wage equations for workers with relatively lower wages (the lower 75 percentile) are also estimated. The estimation results are reported in table A.2 in the appendix A.2. From table A.2, it can be seen that flexitime is either positively or insignificantly associated with workers' wages among low wage workers, and no negative relationship is observed across seven years.

Given the flexitime coefficients displayed in table 2.4, we can calculate the exact percentage of wage loss that workers suffer when they work with flexitime. Keeping other controls constant, the percentage change in workers' real hourly wages resulting from flexitime status change can be written as:

$$\%\Delta(\hat{wage}) = 100[exp(\hat{\beta}\Delta flexitime) - 1] \tag{2.4}$$

Since $\Delta flexitime$ is 1, plugging flexitime coefficient estimates into expression (2.4)shows that flexitime decreases workers' wages by 3.1%-7.2%[5] for the different

[5]For small $\hat{\beta}$, the coefficient estimates of flexitime approximately reflect the percentage changes in wages resulted from having flexitime.

years. Suppose a worker's hourly wage is 14 pounds (which is approximately the lower bound wage among top quartile workers) without flexitime, she will earn 0.42-0.98 pounds less per hour if she works with flexitime. Assuming she works 40 hours a week and four weeks a month, the annual cost of working with flexitime is approximately between 806.4 and 1881.6 pounds. We can expect more extreme results given that these numbers only represent the lower bound of compensating wage differentials associated with flexitime among high wage workers.

Results in table 2.4 may be subject to the criticism that the possible income effect is only partially present under a somewhat *ad hoc* test, since the way I divide workers into subgroups seems to be arbitrary. In fact,I find that the estimation results do not depend heavily on the way in which sub-income groups are defined. I also tried dividing workers into two groups and three groups, and the general pattern remains the same. There is always a negative compensating wage differential effect associated with flexitime among high wage workers. Tables A.3 and A.4 in Appendix A report the estimation results using workers at or above the 67th and 50th percentiles, respectively. These two tables also show a negative relationship between flexitime and workers' wages among high wage workers. To some extent, they confirm the idea that the compensating wage differential effect associated with flexitime is more likely to be observed among high wage workers.

The results reported in table 2.4 show a negative wage-flexitime relationship among high wage workers. On worker's side, those with high labour incomes behave differently than workers with low labour incomes. The marginal rate of substitution between wages and flexitime are different between high income and low income groups. If all workers are pooled together, the negative relationship between wages and flexitime found among high wage workers might be mitigated by the insignificant/positive relationship between wages and flexitime found among low wage workers. Among low wage and mid-wage workers, flexitime is often associated with good jobs. As a result, the overall effect of flexitime on workers' wages is mixed and inconclusive when all workers are kept in the sample.In addition, on the demand side, firms are more willing to offer high wage workers the opportunity to work with flexitime. High wage earners generally are involved in jobs that require high levels of human capital investment in firm specific knowledge or skills. Firms invest heavily in those high-ability workers (who are also high wage earners) to train them to do complex and multi-tasking jobs. If those high-ability workers are denied access to flexitime, they are likely quit their jobs, because they may have good outside opportunities. Consequently, firms

Table 2.4: Estimation Results of High Wage (top quartile) Workers' Wage Equation

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
	(1)	(2)	(3)	(4)	(5)	(6)	(6)
Flexitime	-.03***	-.01	-.04***	-.034**	-.07***	-.06**	-.03*
	(.01)	(.01)	(.01)	(.018)	(.01)	(.01)	(.02)
Male	.05***	.06***	.04**	.03*	.02*	.04**	.05***
	(.01)	(.01)	(.01)	(.02)	(.01)	(.02)	(.01)
Children	.005	.03**	.02	.05***	.02	.003	.01
	(.01)	(.01)	(.02)	(.01)	(.02)	(.01)	(.01)
Married	.02*	.002	.001	.01	.01	.02*	-.005
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Union	-.04***	-.02	-.04***	-.05***	-.04***	-.03**	-.03**
	(.01)	(.02)	(.01)	(.02)	(.01)	(.01)	(.01)
Age	.02**	.02***	.03***	.02***	.02***	.02***	.03**
	(.006)	(.006)	(.005)	(.006)	(.005)	(.006)	(.006)
Age squared	-.0001*	-.0002**	-.0003***	-.0002***	-.0003***	-.0002***	-.0003***
	(.00006)	(.00007)	(.00006)	(.00007)	(.00006)	(.00007)	(.0006)
Education dummies	yes	yes	yes	yes	yes	yes	yes
Ind & Occ dummies	yes	yes	yes	yes	yes	yes	yes
Constant	2.50***	2.65***	2.37***	2.69***	2.25***	3.14***	2.72***
	(.13)	(.21)	(.18)	(.13)	(.15)	(.38)	(.21)
R squared	.20	.18	.21	.18	.19	.21	.21
No. of obs	1713	1527	1510	1438	1409	1359	1335

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by Ordinary Least Squares.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

will suffer the loss of their specific human capital investment. In order to protect the sunk investment and reduce quitting threats, firms are willing to accommodate the requests for flexitime from high wage workers. As for those low-ability workers (who probably are also low wage earners), they can be easily replaced and firms do not invest heavily in them. They are less likely to be granted the chance of working under flexitime compared with high wage earners. Table 1.4 shows that some firms do not allow workers who are on temporary contracts or workers who are with the firms for short period of time to work with flexitime, which suggests that firms restrict low human capital workers' access to flexitime. To this end, we observe that high wage earners are mo an capital, and high wage earners are more likely to pay for flexitime because of income effects.

Apart from the income distribution, the other heterogeneity I examine is the difference between employees with and without children at home. Since flexitime helps workers rearrange their time so that they can cater to family responsibilities, workers with children may be more willing to sacrifice their wages in exchange for flexitime. In order to test this hypothesis, the interaction term of flexitime and parental status, $Flexitime * Children$, is included in the wage equation (2.1).

Table 2.5: Estimation Results of Workers' Wage Equation with Interaction Term of Flexitime and Children.

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Flexitime	-.004	.003	.0003	-.006	-.01	-.02	-.004
	(.01)	(.02)	(.01)	(.01)	(.01)	(.01)	(.01)
Male	.14***	.14***	.15***	.12***	.11***	.12***	.12***
	(.009)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Flexitime*Children	-.03*	-.06**	-.003	-.01	-.03 [a]	-.02	-.05**
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Children	.04***	.05***	.03***	.02**	.03***	.003	.02**
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Married	.03***	.02**	.03**	.03***	.02***	.06***	.05***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Union	.10***	.09***	.09***	.09***	.11***	.08***	.08***
	(.009)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Age	.04***	.04***	.05***	.04***	.04***	.04***	.04***
	(.002)	(.003)	(.002)	(.003)	(.002)	(.002)	(.002)
Age squared	-.0004***	-.0004***	-.0005***	-.0005***	-.0005***	-.0005***	-.0004***
	(.00003)	(.00003)	(.00003)	(.00003)	(.00003)	(.00003)	(.00003)
Education dummies	yes	yes	yes	yes	yes	yes	yes
Ind & Occ dummies	yes	yes	yes	yes	yes	yes	yes
Constant	1.57***	1.94***	1.50***	.97***	1.33***	1.29***	1.15***
	(.07)	(.10)	(.12)	(.12)	(.12)	(.15)	(.16)
R squared	.48	.50	.50	.50	.50	.53	.52
No. of obs	6839	6095	5921	5716	5599	5406	5286

[a] In column 6, $Flexitime * Chilren$ and $Flexitime$ are jointly significant at the 10% level.
Source: British Household Panel Survey, years 2001-2007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by Ordinary Least Squares.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

The coefficient of this interaction term tells whether workers with children under 16 would like to pay a higher price for flexitime than workers without children under 16. The estimation results are reported in table 2.5.

The coefficient estimates of the interaction term $Flexitime * Children$ vary across years. In some years they are negative, and in some years they are insignificant. The results could imply that even among the group of workers with children, the compensating wage differentials effect of flexitime is not very significant. One may argue that female and male workers may behave differently when having children at home. Fathers may be responsible for financially supporting the family. Mothers may take the main responsibilities of child care. In order to take this behavioral difference into account, I also estimate female and male workers' wage equations separately with the interaction term $Flexitime * Children$ added, and the results are still mixed and inconclusive. For female workers, the interaction term $Flexitime * Children$ is never significantly negative.

Why might it be the case that female workers with children still do not trade

their wages for flexitime? First, as I have shown in table 2.4, the main compensating wage differentials associated with flexitime is driven by workers with high labour income. It could be the case that female workers who desire flexitime are unable to purchase it because of their low comes. It might also be the case that many female workers with children choose to stop participating in the labour market or to shift to part time jobs. On average each year around 14% of the women who have babies between 0 and 2 years of age shift from full time jobs to part time jobs. These women are not included in my sample since I only focus on the full time workers. Among working mothers, more than half of them (56%) are part time workers and many decide to stay out of the labour market altogether. Workers who have a strong preference towards flexible working schedules may prefer part time jobs to flexitime jobs. Given that more than half of the female workers with young children are part time workers, it would be reasonable to assume that full time workers in the sample should be those have relatively less child care responsibilities. Therefore, it may explain the fact that we do not observe a significant compensating wage differentials effect associated with flexitime among full time working parents. What is more, flexitime reduces the conflicts between family and work obligations. Once provided with flexitime, workers (especially working mothers) may feel less stressed and can be more devoted to their work by working harder or working longer hours. In this case, flexitime increases firms' returns to human capital investments, and firms may be willing to provide flexitime without reducing wages.

As mentioned above, workers' flexitime status is demand constrained. Whether they can work with flexitime also depends on firms' characteristics. The costs of providing flexitime may vary across firms due to the nature of their business. For example, firms with continuous production (such as steel plants) may be unable to provide flexitime for technical reasons. It is also difficult and expensive for firms to provide flexitime to workers whose jobs involving many interactive or team-based activities. Therefore, information about firms' characteristics should also be included in workers' wage equations when estimating the compensating wage differentials for flexitime. Unfortunately the BHPS is an individual household panel survey which contains little information about the firm/job characteristics. In the regressions discussed above, I used controls for one digit industrial classifications and also occupations dummies. In order to check robustness, I will include in the wage equations (2.1) and (2.2) a dummy variable big_firm which records the size of the firm that the respondent works with. It takes value 1 if the respondent works with a firm with over 50 employees, and 0 if the re-

Table 2.6: Flexitime Coefficient Estimates in Workers' Wage Equation (2.1) with Firm Size

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
All Workers:							
Flexitime	-.02***	.004	-.004	-.002	-.03**	-.03***	-.03**
	(.009)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
R squared	.50	.51	.50	.52	.51	.54	.53
No. of obs	6839	6095	5921	5716	5599	5406	5286
Top Quartile Workers:							
Flexitime	-.04***	-.02	-.04**	-.04**	-.07***	-.06***	-.033**
	(.01)	(.02)	(.01)	(.02)	(.01)	(.02)	(.017)
R squared	.21	.18	.21	.18	.20	.21	21
No. of obs	1713	1527	1510	1438	1409	1359	1335
Panel Dimension Estimation Results, All Workers: Fixed Effects							
Flexitime				.005			
				(.004)			
R squared				.15			
No. of obs				38110			
Panel Dimension Estimation Results, Top Quartile Workers: Fixed Effects							
Flexitime				-.003			
				(.004)			
R squared				.13			
No. of obs				9605			

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by Ordinary Least Squares. The last two panels display the panel dimension estimation results, and the wage equation is estimated with a fixed effects model.
The other control variables include: *big_firm*, *male*, *children*, *married*, *union*, *age*, *age squared*, education dummies, occupation dummies, industry dummies, year dummies (in the panel dimension estimation only).
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

spondent works with a firm that has 50 or fewer employees. Big firms are more likely to provide flexitime than small firms (Golden, 2001). The objective is to see whether the inclusion of firm size in workers' wage equation may change the flexitime coefficient estimates. Table 2.6 reports the flexitime coefficient estimates when estimating workers' wage equations including firm size as an additional control variable. Table 2.6 suggests that the inclusion of firm size does not qualitatively change the estimation results of workers' wage equation in either cross sectional or panel dimension estimates.

Given the analysis above, what can we conclude about the role of flexitime in explaining the existing gender wage gap? Admittedly, female workers on average do enjoy more flexitime than male workers as shown in the descriptive statistics. However, according to the estimation results in table 2.3, overall flexitime

Table 2.7: Gender Distribution of Workers with Flexitime and High Wage Workers.

	Male workers	Female workers
Total No. of obs	23,400	17,563
Proportion of workers With Flexitime	15.2%	19.2%
Proportion of flexi-timers who earn wage higher than 14 pounds	41.4%	20.8%

Source: British Household Panel Survey, years 2001-2007.
The first row reports the total number of observations in each gender. The second row displays the proportion of workers working with flexitime in each gender respectively. The third row reports the proportion of flexi-timers who earn wage higher than 14 pounds (top quartile).

has little effect on workers' wages. This could suggest that flexitime has little explanatory power in the gender wage gap.

However, the results displayed in table 2.4 are telling a different story. Workers with relatively high wages seem to be more likely to pay for flexitime than low wage workers. By looking at the gender and flexitime distribution of the high wage workers, we have a rough idea about whether female workers and male workers would like to pay different prices to work with flexitime.

Table 2.7 reports the gender distribution of flexi-timers (workers who work with flexitime) and high-wage flexi-timers (worker who earn high wages and work with flexitime). There are more male workers than female workers in the sample. Proportionally more female workers have flexitime than male workers, as shown in the third row. However, we can see that the wage distributions of flexi-timers are extraordinarily different between genders. As many as 41.4% of male flexi-timers have hourly wages higher than 14 pounds (top quartile). Only 20.8% of female flexi-timers earn high wages. If workers with relatively high wages are willing to pay for flexitime, then it seems that male workers are more likely to pay for flexitime than female workers.

Table 2.7 gives a basic description of how flexitime might affect the gender

Table 2.8: Estimation Results of Workers' Wage Equation with Interaction Term of Flexitime and Male.

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Flexitime	-.001	.02	.02	-.001	-.01	-.007	-.02
	(.01)	(.02)	(.02)	(.01)	(.02)	(.01)	(.02)
Male	.14***	.14***	.16***	.12***	.12***	.13***	.12***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Flexitime*Male	-.02[a]	-.01	-.05*	.003	-.02 [b]	-.04*	-.003
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Children	.03***	.04***	.03***	.03***	.03***	-.0006	.01
	(.009)	(.01)	(.01)	(.009)	(.005)	(.01)	(.01)
Married	.03**	.02***	.03***	.03***	.03***	.06***	.05***
	(.009)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Union	.10***	.09***	.09***	.08***	.12***	.08***	.09***
	(.009)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Age	.04***	.04***	.04***	.04***	.05***	.04***	.04***
	(.002)	(.002)	(.002)	(.002)	(.003)	(.002)	(.002)
Age squared	-.0005***	-.0005***	-.0005***	-.0004***	-.0005***	-.0005***	-.0004***
	(.00003)	(.00003)	(.00003)	(.00003)	(.0003)	(.0003)	(.00003)
Education dummies	yes	yes	yes	yes	yes	yes	yes
Ind & Occ dummies	yes	yes	yes	yes	yes	yes	yes
Constant	1.57***	1.94***	1.49***	.97***	1.33***	1.28***	1.15***
	(.08)	(.10)	(.12)	(.12)	(.12)	(.15)	(.16)
R squared	.49	.50	.50	.51	.51	.53	.53
No. of obs	6839	6095	5921	5716	5599	5406	5286

[a] In column 2, $Flexitime * Male$ and $Flexitime$ are jointly significant at the 10% level.
[b] In column 6, $Flexitime * Male$ and $Flexitime$ are jointly significant at the 10% level.
Source: British Household Panel Survey, years 2001-2007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by Ordinary Least Squares.
Ind & Occ is short for "Industries and Occupations"
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

wage gap. However, it is not clear if this difference is statistically significant. A formal way to test the gender difference in their willingness to pay for flexitime may be to estimate the wage equation (2.1) with the gender and flexitime interaction terms included. The coefficient associated with the interaction term $Flexitime*Male$ tells whether male workers pay different prices for flexitime than female workers. The estimation results with the gender and flexitime interaction terms are reported in table 2.8.

According to table 2.8, it seems that male workers are more willing to sacrifice part of their wages in exchange for flexitime only in some waves. The coefficient of the interaction term $Flexitime * Male$ has a negative sign in all seven years. In year 2001, 2003, 2005, and 2006, the coefficient of the interaction term is statically significant or jointly significant with $Flexitime$. Though the results are not very conclusive, they do *not* suggest that female workers would like to pay more for flexitime than male workers. This finding is also in line with the descriptive statistics displayed in table 2.7 and the regression results displayed

in table 2.4. Since only high wage workers can afford flexitime, and most high wage workers are male, we expect to find that male workers pay a higher price for flexitime than female workers in some years.

However, this finding is not very convincing since it only appears in some years. Nevertheless, it can be seen that there is no evidence suggesting that female workers would like to pay a higher price for flexitime than male workers.

Though this conclusion is quite the opposite of what is expected, it still makes sense and coincides with some literature in compensation inequality. For example, Pierce (2001) argues that the compensation inequality is much larger than pure wage inequality because high workers workers are also more likely to enjoy favorable non-wage benefits than low wage workers. Pierce's (2001) discussion is mainly from the perspective of total compensation, which includes both wages and non-wage benefits. The price of those non-wage benefits are calculated as the cost the employer pays to provide them rather than the compensating wage differentials. The overall conclusion is still that non-wage benefits increase the inequality instead of narrowing it.

To conclude, cross sectional evidence shows that when all workers are kept in the sample, flexitime is only negatively correlated with workers' wages in some years. The most important finding is that the compensating wage differentials associated with flexitime is mainly driven by high wage workers. Simple calculation suggests that high wage workers pay around 806.4 to 1881.6 pounds per year in order to have flexitime. Given that most male flexi-timers are also high wage earners and most female flexi-timers are not high wage earners, a tentative conclusion is that flexitime does not explain the gender wage gap.

Panel Dimension Estimation

One of the major disadvantages of cross sectional estimation is that it fails to control for unobserved individual heterogeneity. Estimation using panel data can overcome this shortcoming by including an individual unobserved heterogeneity term into workers' wage equation.

In the panel dimension, the wage equation to be estimated is specified as equation (2.2). Statistically, whether equation (2.2) should be estimated using fixed effects or random effects depends on the assumptions we make with regard to the correlation between individual unobserved heterogeneity (a_i) and the explanatory variables. Random effects models are subject to strong assumptions that individual unobserved heterogeneity is not correlated with the explanatory variables. Fixed effects models treat individual heterogeneity (a_i) as a parameter to estim-

ate, and allow for it to be correlated with the explanatory variables (Wooldridge, 2010, chap. 10).

The Hausman test is conducted to see which estimation method is more appropriate. Though fixed effects estimation is always consistent, random effects estimation will have efficiency gain if the control variables are not correlated with individual unobserved heterogeneity. Random effects take both variations within and across individuals into account. The test statistic is reported in appendix A.3, table A.7. The Hausman test shows that fixed effects estimation is preferable.

Table 2.9 reports the estimation results of equation (2.2) using fixed effects models. First, I estimate the wage equation for all workers in my sample. Then following the approach in the cross sectional estimation section, I focus on high wage workers (top quartile) only. I found significant negative compensating wage differentials for flexitime among high wage workers in the cross sectional estimation section. The objective now is to examine whether this still holds in the panel dimension, where the individual unobserved heterogeneity has been controlled for.

According to table 2.9, when all workers are kept together in the sample, flexitime has an insignificant effect on workers' wages. This result is similar to what was found in the cross sectional section. When only high wage workers are kept in the sample, the fixed effects model estimation results still suggest that flexitime is not correlated with wages. This suggest that even among high wage workers, flexitime has little effect on wages after individual unobserved heterogeneity has been controlled for.

One advantage of estimating the workers' wage equation using the fixed effect model is that all time-invariant factors that may affect workers' wages have been controlled for. The omitted variable bias should be reduced as a result. However, it is worth noticing that when controlling for individual unobserved heterogeneity using fixed effects, we eliminate a substantial proportion of variation among wages. The data set is a seven-year panel with 40862 observations. In other words, this data set is large in the cross sectional dimension while relatively short in the time dimension. Since the fixed effects model only picks up the variation within individuals and most variation in workers' wage comes from the cross sectional dimension, there is not much wage dispersion left. This may be particularly true when only high wage workers are kept in the sample, given that the wage dispersion among high wage workers is low[6].

[6]For the sake of completeness, I also estimate the model using random effects. I find that flexitime is negatively correlated with workers' wages if only high wage workers are kept in the sample. This might be suggestive that the insignificant coefficient estimates in the fixed effects section may be driven by the fact that there is little wage variation among high wage workers.

Table 2.9: Estimation Results of Workers' Wage Equation with Fixed Effects.

	All workers	High wage workers
Flexitime	.005	-.0003
	(.004)	(.005)
Children	.003	-.007
	(.005)	(.008)
Married	.001	.01
	(.007)	(.008)
Union	.05***	.005
	(.006)	(.01)
Age	.05***	.03***
	(.004)	(.01)
Age squared	-.0007***	-.0004***
	(.0003)	(.00007)
Education dummies	yes	yes
Ind & Occ dummies	yes	yes
Constant	1.62***	2.44***
	(.18)	(.26)
R squared	.18	.13
No. of obs	38110	9605

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by a fixed effects model.
Ind & Occ is short for "Industries and Occupations".
Time dummies are also included in the regression to get rid of the aggregate shock of each year.
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Some other control variables are also worthy of consideration. For example, in both cross sectional and panel specifications, union status has a positive effect on workers' wages when all workers are kept in the sample. This suggests that workers with union membership earn higher wages than workers without union membership. Quantitatively, the effect of union status on workers' wages seems to be larger in the cross sectional specification (around 9-12% according to table 2.3), and lower in the panel dimension specification (5% according to table 2.9). The positive union-wage relationship is also well documented in previous studies (Blanchflower and Bryson, 2004; Duncan and Stafford, 1980; Swaffield, 2001). The union coefficient estimates reported in tables 2.3 and 2.9 are very close to those reported in Swaffield (2001), which compares the cross sectional estimates with panel dimension estimates of union effects using the BHPS. Intuitively, employees rely on unions to bargain for higher wages when negotiating contracts. Meanwhile, union membership also helps protect them from downward adjustment of wages when the economy is in recession (Blanchflower and Bryson, 2004). As a result, there is a persistent positive relationship between workers' wages and union membership. The union wage premium differs across income/skill groups. Low educated/skilled workers tend to have a high union wage premium, for they are the group of workers who can benefit most from unionisation (Card, 2001). Card (2001) reports that the union wage premium is generally large and positive among low skilled workers, while for high skilled workers, the union wage premium is usually small or even negative. That is exactly what I find in tables 2.3, 2.4 and 2.9. When workers' wage equation is estimated using cross sectional data, the union wage premium is negative among workers with very high wages, and positive when all workers are kept in the sample. When individual fixed effects are controlled for, the union effect is positive when all workers are kept in the sample, and insignificant when only high wage workers are kept in the sample. Card (2001) argues that this is because union members with high observed skills tend to have lower unobserved skills than their non-union counterparts, and union members with low observed skills are likely to have higher unobserved skills than their non-union counterparts. This also explains why the negative union wage premium for high wage workers found in cross sectional estimates (table 2.4) becomes insignificant in the panel fixed effects specification (table 2.9), because the unobserved heterogeneity has been controlled for. Apart from union, the coefficient estimates of variables *age* and *age squared* are also stable in both cross sectional specification and panel specification. Both tables 2.3 and 2.9 suggest that workers' wages increase with ages, but the speed of increase is decreasing

over time. Workers' age is closely correlated with their labour market experience. For workers with the same level of education, older workers tend to have greater labour market experience. The coefficient associated with workers' age partly captures the return to labour market experience. As suggested by Dustmann and Meghir (2005), the return to experience is higher during the first several years after workers enter into the labour market, and becomes lower afterwards. Therefore, the coefficient of variable *age squared* is negative in workers' wage equation.

We must also consider the fact that flexitime status is endogenous. Wages and flexitime status might be jointly determined. First, people with high wages are more likely to be able to afford flexitime. But at the same time, it is conceivable that flexitime also affect wages.

Failing to control for the endogeneity of job attributes when estimating compensating wage differentials may bias the coefficient estimates, resulting in the wrong sign (Hwang et al., 1998). Garen (1988) argues that OLS estimators are severely downward biased in the case of estimating compensating wage differentials for on the job risk. Garen (1988) adapts an instrumental variables approach to correct for the endogeneity of job risk in workers' wage equation. His set of instruments includes marital status, number of children, house value, and non-labour income.

Following Garen's (1988) technique, the instruments chosen for flexitime are: (1) workers' fertility information, including number of children aged between 0-2 and 3-4 in the household, and (2) workers' non-labour income, which includes various kinds of transfers from other family members or friends, rents, states and local benefits. People with young kids may particularly demand flexitime for child care reasons. As shown in figure 1.2, workers with children under 16 are more likely to work with flexitime than workers without children under 16. Meanwhile, the number of young children in the household should be independent of the error term in the wage equation. Non-labour incomes, such as rents, are also important financial resources. As I have shown in the cross sectional estimation section, high income people are more likely to "buy" flexitime. It is also reasonable to think that non-labour income does not have any relationship with the error term in the wage equations.

Table 2.10 reports the estimation results of the workers' wage equation (2.2) using Two Stage Least Squares with the flexitime variable instrumented by the number of children at different ages and/or workers' non-labour income. Table 2.11 displays the first stage regression results. I tried two different instrument sets.

Table 2.10: Correcting for the endogeneity of Flextime. (2SLS Estimates of Workers' Wage Equation (2.2))

	Instruments set A	Instruments set B
Flexitime	-.35	-.41
	(.22)	(.70)
Married	.00007	-.0001
	(.007)	(.008)
Union	.06***	.06***
	(.008)	(.01)
Children	.002	.002
	(.006)	(.007)
Age	.03***	.03
	(.01)	(.02)
Age squared	-.0007***	-.0007***
	(.00003)	(.00003)
Education dummies	yes	yes
Ind & Occ	yes	yes
No. of obs	38110	38110

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$).
Workers' wage equation (2.2) is estimated by Two Stage Least Squares. The dependent variable is $ln(wage)$.
Instruments Set A: number of children aged between 0-2 ($child02$), number of children aged between 3-4 ($child34$) in the household, non-labour income ($nonlabor$). Instrument Set B: Non-labour income ($nonlabor$)
Ind & Occ is short "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Instrument set A includes non-labour income, number of children aged between 0-2, and number of children aged between 3-4. Instrument set B contains only non-labour income.

According to table 2.10, both specifications suggest that flexitime is insignificantly correlated with workers' wages. Both the coefficient estimates and the standard errors are unrealistically high. Garen (1988) also finds that the instrumental variable approach leads to substantially large coefficient estimates compared to the models that do not correct for the endogeneity. He argues that this is because OLS severely underestimates the compensating wage differentials for job attributes. However, the results displayed in table 2.10 raise some concerns about the quality of the instruments. Good instruments need to satisfy two requirements. First, they should be highly correlated with the endogenous

explanatory variable. Second, they should not be correlated with the error term. In order to check the instruments relevance, the first stage estimation results are reported in table 2.11.

According to the second column of table 2.11, non-labour income is positively correlated with the workers' chances of working with flexitime, as expected. It means that non-labour increases the workers' chances of working with flexitime. The number of children aged between 0-2 is uncorrelated with the workers' flexitime status. The number of children aged between 3-4 is negatively correlated with the chances of working with flexitime. This negative correlation implies that the more children aged between 3-4 in the household, the less likely that workers will work with flexitime. A possible reason to explain this counterintuitive finding is that workers with children within that age range feel high financial pressure to work hard to support the family. The budget constraint is tight for them to "buy" flexitime. Monetary payoffs rather than flexitime might be their first concern, and they are not more likely to work with flexitime than other workers[7]. The F statistics to test the joint significance of all excluded instruments is 4.60 when flexitime is instrumented by the instrument set A. This may suggest that the instruments are only weakly correlated with the endogenous variable. Weak correlation between instruments and the endogenous variable leads to large standard errors and may bias the coefficient estimates towards the OLS estimation direction (Wooldridge, 2010, chap. 5). Several formal tests are conducted to test the quality of these instruments. The test statistics are reported in appendix A.4, table A.8. The instruments in instrument set A pass the over-identification test. The test statistics also suggest that these instruments are weak. Similarly, if flexitime is instrumented with non-labour income only (instrument set B), there is little correlation between flexitime and non-labour income.

I have also tried to use some other instruments to correct for the endogeneity of flexitime, including spousal income and spousal working hours. The idea is that a worker is more likely to work with flexitime if their spouse's income is high or their spouse's working hours are long. However, it turns out that neither of these variables are correlated with the endogenous variable ($Flexitime$) and cannot serve as proper instruments for flexitime.

Strictly speaking, evidence from tables 2.3, 2.9 and 2.10 do not provide enough evidence for the existence of compensating wage differentials for flexitime. As

[7]Compared to parents with children in other age groups, parents with children aged between 3-4 are more likely to have a lot of children in the household. Around 70% of parents with children aged between 3-4 have at least 2 children in the household, compared to only 50% of parents with children aged between 0-2.

Table 2.11: Workers' Flexitime Equation (First Stage Estimation Results)

	Instruments set A	Instruments set B
Non-labor income	.0000012*	.0000012
	(.0000007)	(.00000076)
No. of children aged between 0-2	.002	-
	(.008)	-
No. of children aged between 3-4	-.02***	-
	(.008)	-
Married	.002	-.002
	(.008)	(.01)
Union	.01***	.01*
	(.008)	(.008)
Children	-.002	-.004
	(.009)	(.008)
Age	-.04***	-.04***
	(.007)	(.007)
Age squared	.000004	.00003
	(.00004)	(.00004)
Education dummies	yes	yes
Ind & Occ dummies	yes	yes
No. of obs	38111	38111
First stage F statistics	4.60	2.57
Pass over-identification test	yes	-

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is *Flexitme*. The model is estimated by a fixed effects model.
Instruments Set A: number of children aged between 0-2 (*child*02), number of children aged between 3-4 (*child*34) in the household, non-labour income (*nonlabor*). Instrument Set B: Non-labour income (*nonlabor*)
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

explained in the cross sectional section, flexitime may bring other benefits to firms (such as increasing the production efficiency so the wage per efficiency unit of labour is actually lower; increasing the returns of specific human capital investment; reducing turnover rates; inducing longer net working hours among workers.) so that the costs of providing flexitime are mitigated or even eliminated. In this case, firms dot not necessarily need to ask for an actual wage reduction when providing flexitime.

At this stage, we can see that estimation results using cross sectional data and panel data are at odds with the compensating differentials estimates. Arguably estimation results using panel data with fixed effects should produce more consistent results, since all time invariant individual fixed effects have been controlled for. However, cross sectional estimation also adds value. It has the advantage of capturing variations across individuals, which might be the main source of variations in wages and flexitime status. As argued above, estimation using fixed effects only captures the variations within individuals. But the variation of wages within each individual might be low, and this may be particularly true if only top quartile workers are kept in the sample. Also, the variation of flexitime status within each individual may also be low. The BHPS data set is an unbalanced panel. During the period I choose (years 2001-2007), on average workers stay in the panel for 4 years. Among workers who stay in the panel for 4 years, 73.16% of them never change their flexitime status, and 17.56% of them only change their flexitime once. This means that over 90% of the respondents in the sample change their flexitime less than or equal to once during the period they stay in the panel. Among workers who stay in the panel for 7 years (2001-2007), 64.06% of them never change their flexitime status, 17.08% of them change their flexitime status only once, and another 10.93% of them change their flexitime status twice. Meanwhile, we can compare the cross section estimation results with the panel estimation results to show how different estimation strategies may affect the estimation results of compensating wage differentials. Most (if not all) previous literature on the compensating wage differentials for flexitime using cross sectional data. The cross sectional estimates also provide comparisons with previous literature to show how the results may change when only focusing on high wage workers.

To conclude, when I estimate the workers' wage equation in the panel dimension controlling for individual unobserved heterogeneity using the fixed effects model, I find that flexitime does not have a significant impact on wages. Meanwhile, flexitime also seems to have little effect on high wage workers' wages.

However, these insignificant estimation results might be due to the little variation picked up by the fixed effects estimators, especially when only high wage workers are kept in the sample. More importantly, firms may also have incentives to provide flexitime for free if the benefits brought by flexitime outweigh the costs of flexitime. Attempts are also made to correct for the endogeneity of flexitime using the instrumental variable approach. However, it is difficult to find proper instruments for flexitime. The instruments chosen are only weakly correlated with flexitime, and the conclusion should be treated as provisional.

2.6 Conclusion

This chapter studies the compensating wage differentials associated with flexitime in the UK labour market using data from the British Household Panel Survey. Evidence from both cross sectional data and panel data are presented. Cross sectional estimates reveal that when all workers are kept in the sample, flexitime has either negative or insignificant effects on workers' wages. However, workers with high wages do receive negative wage premiums when they are working with flexitime.

In the panel dimension, I control for unobserved individual heterogeneity by using a fixed effects model. The results suggest that flexitime is not correlated with workers' wages. I also try to adopt the instrumental variable approach to explore the relationship between flexitime and wages. Still, there is little evidence suggesting a negative relationship between wages and flexitime. Since the instruments are only weakly related to workers' flexitime status, this conclusion is only provisional.

Previous studies on flexitime report that flexitime is associated with higher (or insignificant) wages (Gariety and Shaffer, 2001). However, the theory of compensating wage differentials predicts that workers would like to sacrifice part of their wages in exchange for favourable working conditions (Rosen, 1986). This chapter tries to reconcile the compensating wage differentials theory with the data by accounting for income heterogeneity. I find that the compensating wage differential effect of flexitime may be present among high wage workers when using cross sectional data. However, after controlling individual unobserved heterogeneity and the endogeneity of flexitime, I find that flexitime does not lead to lower wages. Factors on the demand side may be helpful in explaining the insignificant wage-flexitime relationship. Flexitime may successfully increase workers' production efficiency, reduce quit threats, increase workers' working hours and firms'

return to specific human capital investment. In this case, firms may have incentives to provide flexitime without asking for actual wage reductions because they are already "compensated" by benefits brought by flexitime in other respects. As for the gender wage gap, I find flexitime plays little role. It does not narrow the existing gender wage gap.

Appendix A

A.1 Literature on Flexitime

Table A.1 gives a summary of literature on flexitime in sociology and management.

Table A.1: Literature on Flexitime

Authors	Estimation Approach	Data Used	Empirical Results
Hicks and Klimoski (1981)	OLS regression. They run an experiment within companies to see whether the introduction of flexitime changes workers' attitudes toward their job.	Experimental data from two companies.	Flexitime affects workers' attitudes towards their jobs.
Kostiuk (1990)	OLS. Regress workers' wages on shift work.	Current Population Survey supplements	Positive relations between shift work and workers' wages.
Dalton and Mesch (1990)	OLS. They run an experiment within companies to see whether flexitime reduces workers' absenteeism.	Data from one company which adopts a one-year flexitime programme within one of its sub-units.	Flexitime reduces the absenteeism significantly, but does not affect worker turnover.
Golden (2001)	Logit regression. Investigates what type of workers work with flexitime.	Current Population Survey 1997.	The chances of working with flexitime are highly correlated with workers personal and job characteristics.
McCrate (2005)	Logit regression. Investigates what type of workers work with flexitime.	Telephone survey data. Small number of observations.	Female workers are not more likely to work with flexitime than male workers.

A.2 Estimation Results of Lower-wage Workers' Wage Equation (2.1)

Table A.2: Estimation Results of Lower-Wage (lower 75 percentile) Workers' Wage Equation.

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
	(1)	(2)	(3)	(4)	(5)	(6)	(6)
Flexitime	-.01	.02*	.02**	.01	.006	-.006	-.009
	(.008)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Male	.08***	.09***	.09***	.07**	.07**	.08***	.08***
	(.008)	(.008)	(.008)	(.008)	(.009)	(.009)	(.009)
Children	.01	.02**	.009	.-.003	.005	-.02*	-.01
	(.008)	(.009)	(.009)	(.009)	(.009)	(.01)	(.009)
Married	.01	-.007	.015*	.02***	.02***	.04***	.03***
	(.008)	(.008)	(.008)	(.008)	(.009)	(.008)	(.008)
Union	.10***	.09***	.09***	.10***	.11**	-.03*	-.09**
	(.008)	(.008)	(.008)	(.008)	(.009)	(.01)	(.009)
Age	.03***	.03***	.03***	.03***	.03***	.03***	.03**
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Age squared	-.0003***	-.0003***	-.0003***	-.0004***	-.0003***	-.0004***	-.0003***
	(.00002)	(.00003)	(.00003)	(.00003)	(.00003)	(.00002)	(.0003)
Education dummies	yes	yes	yes	yes	yes	yes	yes
Ind & Occ dummies	yes	yes	yes	yes	yes	yes	yes
Constant	1.47***	1.64***	1.61***	1.12***	1.40***	1.43***	1.27***
	(.06)	(.10)	(.08)	(.15)	(.05)	(.13)	(.15)
R squared	.35	.36	.36	.39	.37	.40	.39
No. of obs	5126	4568	4428	4278	4190	4047	3951

Source: British Household Panel Survey, years 2001-1007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by Ordinary Least Squares.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

A.3 Robustness Check of Income Effects

In this section, workers are divided into either two or three groups according to their wage levels. I estimate "top third" and"top half" workers' wage equations respectively. The results are displayed in tables A.3 and A.4.

Table A.3: Estimation Results of Top 33.3 Percentile Workers' Wage Equation.

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
	(1)	(2)	(3)	(4)	(5)	(6)	(6)
Flexitime	-.02*	.02	-.04***	-.03**	-.06***	-06***	-.04**
	(.01)	(.02)	(.01)	(.01)	(.01)	(.01)	(.02)
Male	.06***	.06***	.05***	.04***	.04***	.03**	.05***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Children	.01	.02*	.03**	.04***	.03**	-.01	.02*
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Married	.02*	.01	.01	.01	.005	.02*	.005
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Union	-.03***	-.02	.01	-.04***	-.02**	-.03**	-.02*
	(.01)	(.015)	(.01)	(.01)	(.01)	(.01)	(.01)
Age	.02***	.02***	.03***	.02***	.02***	.02***	.03***
	(.005)	(.005)	(.004)	(.005)	(.005)	(.005)	(.005)
Age squared	-.0002***	-.0003***	-.0003***	-.0002***	-.0002***	-.0002***	-.0003***
	(.00006)	(.00006)	(.00005)	(.00006)	(.00005)	(.00006)	(.0006)
Education dummies	yes	yes	yes	yes	yes	yes	yes
Ind & Occ dummies	yes	yes	yes	yes	yes	yes	yes
Constant	2.38***	2.45***	2.33***	2.41***	2.51***	2.45***	2.06***
	(.13)	(.17)	(.17)	(.16)	(.15)	(.24)	(.13)
R squared	.21	.22	.23	.21	.22	.22	.24
No. of obs	2077	2033	1978	1918	1878	1810	1773

Source: British Household Panel Survey, years 2001-1007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by Ordinary Least Squares.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Table A.4: Estimation Results of Top 50 Percentile Workers' Wage Equation.

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
	(1)	(2)	(3)	(4)	(5)	(6)	(6)
Flexitime	-.02*	.01	-.04***	-.02**	-.05***	-05***	-.02*
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Male	.08***	.08***	.07***	.07***	.05***	.05***	.06***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Children	.02**	.04***	.02*	.02**	.03**	.02*	.02*
	(.01)	(.01)	(.01)	(.01)	(.01)	(.02)	(.01)
Married	.02*	.01	.01	.01	.009	.02*	.03**
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Union	.007	.005	-.001	-.02*	.005	-.007	-.003
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Age	.02***	.03***	.03***	.03***	.03***	.03***	.03***
	(.003)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)
Age squared	-.0002***	-.0003***	-.0003***	-.0003***	-.0003***	-.0003***	-.0003***
	(.00004)	(.00005)	(.00005)	(.00005)	(.00005)	(.00005)	(.0005)
Education dummies	yes	yes	yes	yes	yes	yes	yes
Ind & Occ dummies	yes	yes	yes	yes	yes	yes	yes
Constant	2.08***	2.14***	2.03***	1.97***	2.09***	1.91***	1.93***
	(.10)	(.12)	(.12)	(.17)	(.11)	(.11)	(.13)
R squared	.29	.28	.28	0.28	.26	.28	.30
No. of obs	3516	3065	2984	2878	2817	2720	2658

Source: British Household Panel Survey, years 2001-1007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). The wage equation is estimated by Ordinary Least Squares.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

A.4 Alternative Measure of Wage

Table A.5 reports the cross sectional estimation results of workers' wage equation (2.1) using an alternative measure of $ln(wage)$. Table A.6 reports the estimation results with panel data using the alternative measure of $ln(wage)$.

Table A.5: Estimation Results of Workers' Wage Equation (2.1) Using Alternative Measure of Wage

	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007
Flexitime	-.02*	.01	-.0001	.001	-.02**	-.03**	-.03**
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Male	.14***	.15***	.15***	.12***	.11***	.12***	.12***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Children	.03***	.05***	.03***	.03***	.03**	-.001	.01
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Married	.03***	.02**	.03***	.03***	.03***	.06***	.05***
	(.009)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Union	.11***	.10***	.09***	.09***	.12***	.08***	.09***
	(.009)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Age	.04***	.05***	.05***	.05***	.05***	.05***	.04***
	(.002)	(.002)	(.002)	(.003)	(.002)	(.002)	(.002)
Age squared	-.0005***	-.0005***	-.0005***	-.0005***	-.0005***	-.0005***	-.0004***
	(.0003)	(.0004)	(.0003)	(.0003)	(.00003)	(.00003)	(.00003)
Education dummies	yes	yes	yes	yes	yes	yes	yes
Ind & Occ dummies	yes	yes	yes	yes	yes	yes	yes
Constant	1.60***	1.96 ***	1.52***	.98***	1.32***	1.27***	1.16***
	(.08)	(.10)	(.12)	(.12)	(.12)	(.15)	(.16)
R squared	.49	.50	.49	.50	0.48	.54	.52
No. of obs	6839	6095	5921	5716	5599	5406	5286

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). It is measured by dividing workers' weekly gross income by their standard weekly hours. The wage equation is estimated by Ordinary Least Squares.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Table A.6: Results of Workers' Wage Equation (2.2) Using Alternative Measure of Wage, Fixed Effects

	All workers	High wage workers
Flexitime	.007	.00005
	(.004)	(.006)
Children	.002	-.01
	(.006)	(.008)
Married	.002	.002
	(.007)	(.01)
Union	.06***	.004
	(.006)	(.01)
Age	.05***	.03***
	(.004)	(.008)
Age squared	-.0007***	-.0004***
	(.0003)	(.00007)
Education dummies	yes	yes
Ind & Occ dummies	yes	yes
Constant	1.65***	2.49***
	(.18)	(.26)
R squared	.17	.13
No. of obs	38110	9605

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is the natural logarithm of workers' hourly wage ($ln(wage)$). It is measured by dividing workers' weekly gross income by their standard weekly hours. The wage equation is estimated by a fixed effects model.
Ind & Occ is short for "Industries and Occupations".
Time dummies are also included in the regression to get rid of the aggregate shock of each year.
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

A.5 Hausman test Statistics (Random effects v.s. Fixed effects)

Hausman test is conducted to check which specification (random effects or fixed effects) is more appropriate when estimating equation (2.2). The test statistics are reported in table A.7.

Table A.7: Hausman Test Statistics of Model Choice (Fixed Effects v.s. Random Effects)

Null hypothesis: difference in coefficients not systematic	
	$chi2(42) = 2956.82$
	$Prob > chi2 = 0.0000$

This table displays the Hausman test statistics of model choices. It tests whether fixed effects or random effects model should be applied when estimating workers' wage equation.
Source: British Household Panel Survey, years 2001-2007.
The null hypothesis is that there is not any systematic difference in the coefficient estimates between fixed effects and random effects. In that case, random effects models are more appropriate. Under the null, the Hausman test statistic follows a χ^2 distribution. The second row displays the Hausman test statistic and the third row displays the p-value. The test statistics reject the null hypothesis, suggesting that fixed effects estimators are more approporiate.

A.6 Test of Instruments Validity

Table A.8 gives the test statistics for the validity of instruments chosen (Instruments set A).

Table A.8: Instruments Validity Tests (Instruments sets A)

Under identification test [a]**:**	
Kleibergen-Paap rk LM statistic	13.070
Chi-sq(3) P-val = 0.0045	
Weak identification test [b]	
Kleibergen-Paap rk Wald F statistic :	4.603
Stock-Yogo weak ID test critical values:	
5% maximal IV relative bias	13.91
10% maximal IV relative bias	9.08
Over identification test of all instruments [c]	
Hansen J statistic	0.237
Chi-sq(3) P-val = 0.888	

This table displays the test statistics for the validity of instruments for the fixed effects models in table 2.10.

Data source: British Household Panel Survey, years 2001-2007.

[a] The null hypothesis of the under-identification test is that the endogenous variable cannot be identified by the instruments. Rejecting the null hypothesis suggests that the model is identified.

[b] Weak instruments means that the endogenous variable is identified by the instruments but they are only weakly correlated. The null hypothesis is that the instruments are only weakly correlated with the endogenous variable. The test statistics in this case falls below the critical values at the 10% level, suggesting that the set of instruments are only weakly correlated with the variable *flexitime*. In this case, other estimators such as LIML (Limited Information Maximum Likelihood) might be more efficient (Wooldridge, 2010, chap. 5). In this chapter I also try to estimate the same wage equation using LIML with the same set of instruments, and the estimation results do not change much.

[c] The null hypothesis of the over identification test is that all instruments included are not correlated with the error term of the wage equation. The test statistics and p value suggest that the instruments pass the over-identification test and they are not correlated with the error term.

Chapter 3

Flexitime and Female Labour Supply

Abstract

This chapter studies the effect of flexitime on workers' labour market working hours. A simple model is presented to compare workers' labour supply decisions with and without flexitime. In the static case, prediction 1 is that flexitime will increase workers' labour supply if the benefits (increased child care production efficiency) brought by flexitime are high relative to the costs (wage reduction). Prediction 2 is that the increase in working hours under flexitime regime is more likely to be observed among high human capital workers than low human capital workers.

I also extend the model to two periods, where workers do not have flexitime in the first period, but may have flexitime in the second period if they are in the flexible world. The dynamic model predicts that flexitime increases the marginal utility of working in the first period if workers can derive high benefits from flexitime relative to the wage reduction. This suggests a that flexitime may induce workers to increase their working hours in both periods. The two predictions of the static model are also tested empirically using data from the British Household Panel Survey. When testing prediction 1, I specify working mothers as the group of workers who can derive high benefits from flexitime relative to the cost. Estimation results show that flexitime is positively associated with working mothers' labour market hours. In order to test prediction 2, I include an interaction term of flexitime and high human capital into workers' labour supply equation. However, the empirical evidence suggests that this is not the case.

Key words: Working hours, child care, work and home production balances, human capital accumulation

3.1 Introduction

During the past fifty years, most developed countries have experienced significant increases in female workers' labour supply (Attanasio et al., 2008). Many explanations are put forward to explain the reason behind such an increase. This chapter analyses a potential factor that may induce female workers to supply more market hours under certain conditions: the opportunity to work with flexible working arrangements (from here "flexitime"). By giving workers the authority to vary the starting and ending time of their work, flexitime eases the tension between workers' home production and work responsibilities. With flexitime, workers can rearrange their working time so that they may produce child care in a more efficient way. As a result, workers may devote more time to labour market work when working with flexitime. In this chapter, a simple labour supply model with flexitime is developed and empirically tested to show the effect of flexitime on workers' labour supply choices. The model predicts that working with flexitime increases workers' labour supply if the benefit (increased child care production efficiency) is high relative to the cost (compensating wage differentials for flexitime). I also show in the static setting that the increase in working hours under a flexitime regime is more likely to be observed among high human capital workers than among low human capital workers.

These two predictions are tested empirically using data from the British Household Panel Survey. I estimate workers' labour supply equations with flexitime as a control variable to see whether it is associated with high working hours among workers who can derive high benefits from flexitime. I also test whether high human capital workers are more likely to increase their working hours when working with flexitime than low human capital worker by including an interaction term of workers' human capital level and flexitime into workers' labour supply equation.

In this chapter, the particular type of flexible working arrangement analysed is flexitime. It is a practice that gives employees' freedom to decide the when to start and end their work. The usual practice is that employers choose a certain period of a day as "core hours" during which workers have to stay at work. For the rest of the time, workers can decide when to work. Though flexitime was initiated in Germany in the 1970s, few economics studies have investigated the economic consequences of flexitime, possibly because it is difficult to get comprehensive data recording workers' flexitime status.

This chapter contributes to the existing literature in the following ways. First, a model is developed to explain the conditions under which flexitime may increase

workers' labour supply. The model captures two important features of flexitime: (i) Flexitime is often accompanied by certain costs. In this chapter, the cost is modeled as a compensating wage differentials effect of flexitime; Workers need to sacrifice part of their wages in exchange for flexitime. (ii) Combined with a human capital accumulation process, flexitime may affect workers' labour supply decisions dynamically. Workers accumulate human capital by participating in the labour market. Accumulated human capital in the current period will be translated into future wages. Anticipating that flexitime will affect their future labour supply decisions, workers may change current period labour supply accordingly to accumulate more or less human capital. Second, this chapter is also one of the first studies that empirically explores the relationship between flexible working and workers' labour supply. I divide workers into several groups based on their possible costs and benefits associated with working with flexitime and estimate their labour supply equations separately.

The main findings of this chapter can be summarized as follows. The static model has two predictions. Prediction 1 is that flexitime only increases workers' labour supply if they can derive high benefits (increased child care production efficiency) from flexitime relative to costs (compensating wage differentials for flexitime). Prediction 2 is that, given the same benefit-cost ratio, the increase in working hours under a flexitime regime is more likely to be observed among high human capital workers than among low human capital workers. According to the model, we can think of flexitime as if it expanded workers' time endowments. Workers with high human capital levels are more likely to devote the "expanded" time endowment to market work because they earn higher wages than low human capital workers. Meanwhile, on the demand side, firms are also likely to ask high human capital workers to increase their labour supply in order to cover the costs of providing flexitime. In the two period dynamic setting, flexitime may increase workers' labour supply in both periods if it can substantially increase workers' child care production efficiency and can be obtained at a low price. This is similar to prediction 1 in the static setting, except that in the dynamic setting, flexitime affect workers' labour supply decisions throughout their life time. Prediction 1 and prediction 2 are also tested empirically using 7 years of data from the British Household Panel Survey. When testing prediction 1, I specify working mothers as the group of workers that may derive high benefits from working with flexitime relative to costs (wage reduction costs). Evidence from the empirical results reveals that flexitime is particularly effective in inducing working mothers to increase their labour market working hours. In addition, it is associated with

higher chances of working full time among female workers and working mothers. The positive relationship between flexitime and working mothers' labour supply is also robust to various specifications. When testing prediction 2, I divide workers into three groups according to their working hours (above 40 hours, less than 30 hours, between 30 and 40 hours). An interaction term of high human capital and flexitime is included in workers' labour supply equation to see whether high human capital workers are more likely to increase their working hours than low human capital workers when provided with flexitime. I tried two proxies for workers' human capital levels: labour market experience and educational qualifications. When using the former as proxy for human capital, I do not find any empirical evidence supporting model prediction 2. When using the latter as proxy for human capital, I only find this positive relationship among workers working between 30 and 40 hours a week. However, these results can only treated as provisional, since both measures for human capital are imperfect.

This rest of this chapter is organized as follows. Section 3.2 reviews the related literature on workers' labour supply choices and recent studies on flexible working. Section 3.3 gives a simple model that explains how flexible working will affect workers' labour supply decisions. Section 3.4 gives the empirical results. Section 3.5 concludes.

3.2 Previous Literature

How do female workers allocate their time across market work and other activities has raised interests both theoretically and empirically. Heckman and Killingsworth (1986) as well as Blundell and Macurdy (1999) give very comprehensive reviews on the important issues in this area. Fertility and child care responsibilities play very important roles when female workers are making their labour supply decisions. Montgomery et al. (1986) provide a comprehensive review of the models on marital status and child bearing.

Early models on female labour supply describe a static setting where female workers derive utility from leisure, consumption and children (Montgomery et al., 1986). Child care is produced by a combination of parental time and monetary expenditure. Female workers maximize utility by allocating time across different activities at any given desired child care level. Such static models can produce several testable implications. In the static settings, female workers' time allocation and fertility decisions are considered to be completed, and wages are exogenously determined and are the only price for women's time when they decide how to

allocate time between market work and child care.

However, these static models fail to explain the variations in fertility and labour supply decisions over time in response to changes in female workers education level, human capital accumulation (Hotz and Miller, 1988). Later on, there are some studies investigating the life-cycle choices of female workers (Heckman and Macurdy, 1980; Ma Curdy, 1981; Eckstein and Wolpin, 1989; Francesconi, 2002). In a dynamic setting, female workers maximize their expected life time utility by making a set of plans for each period's fertility and labour supply decisions. In such scenario, children and child care now have more profound influences on female workers' labour supply choices due to the effect of human capital accumulation process. In the static settings, children can be considered as durable goods which are costly to produce but yield utility to the parents. In the dynamic situation where experience/human capital accumulation plays a central role in determining wages, the career interruption due to fertility reasons may be detrimental to female's future wages and career development (Erosa et al., 2002; Attanasio et al., 2008; Olivetti, 2006). The human capital loss due to fertility might be one of the most important reasons to explain women's disadvantaged positions in the labour market (Erosa et al., 2002).

Recent increase in female labour supply experienced by most major developed countries has also attracted attention in labour economics. Attanasio et al. (2008) design a life-cycle model to explain the increase in female labour participation rate for three cohorts (1930s, 1940s, 1950s) of women in United States. They propose that the reduction in child care combined with a narrowed gender wage gap encourages women to participate in the labour market. Olivetti (2006) uses a calibrated six period life-cycle model with human capital accumulation and home production to show that the relative increase in the returns to the experience are one of the most important factors that account for increases in female labour supply. High returns to experience increase women's opportunity cost of interrupting their career and encourage them to participate more actively in the labour market. Meanwhile, female workers also accumulate human capital while participating in the labour market. Accumulated human capital not only determines workers' current period wages but also increases their future wages. With higher wages, women tend to substitute money for time in producing child care. So long as the wealth effects dominate, children will be better off, and female workers supply more hours to the labour market. Greenwood et al. (2005) use a model with home production to address the importance of technological progress in freeing women from time-consuming housework so that they can have

enough time to participate in the labour market. Erosa et al. (2002) attribute female workers' less advantaged labour market status to the loss of human capital resulting from fertility related career interruptions. Rocha and Fuster (2006) develop a theory pointing out that labour market frictions can interact with female labour supply so that there might be positive relations between fertility and the employment ratio. Conventional fertility-labour supply theory predicts that the increase in female workers' earning power will increase the opportunity cost of time spent with children, resulting working women having fewer kids compared than unemployed women. Therefore a positive relationship between fertility and unemployment will be observed. Studying the case of Peru, Field (2007) proposes that property laws allow people to spend less time on home protection, freeing up time which can be spent in the labour market.

So far there has been little written within economics about the economic consequences of flexitime. Early studies in the 1980s were mainly experimental work in sociology and human resource management (See chapter 2 for a review).

Golden and Altman (2007b) adopt a behavioural approach, arguing that the cost of firms providing flexitime makes the supply of flexitime perfectly inelastic regardless of the demand in the market. Technological constraints prevent firms from providing flexitime that caters to workers' interests. Flabbi and Moro (2010) develop a model with job search and bargaining in both wage and job flexibility dimensions. They find that the wage distribution under a flexible working scheme and a non-flexible working scheme can overlap, and each distribution supports a different match-specific productivity. However, they calibrate the model by using workers' part time status as proxies for flexitime due to data limitations.

This chapter is different form the existing literature from the following respects. First, it analyzes a job dimension that has been overlooked by previous literature. Second, human capital accumulation is allowed to interact with flexitime, so flexitime may have a dynamic influence on workers' labour supply decisions. The idea of human capital accumulation throughout workers' life cycle comes from recent papers by Erosa et al. (2002) and Olivetti (2006)[1], in which workers' employment history and past working hours may be translated into current human capital levels.

[1]Erosa et al. (2002) assume that workers' human capital is accumulated via participation in the labour market, while Olivetti (2006) assumes that workers human capital level is a function of past working hours.

3.3 Model

In this section, a simple model is described which illustrates how flexible working practices such as flexitime may affect workers' labour supply decisions. This model extends standard labour supply models by incorporating flexitime into workers' utility maximization process. Here, flexitime is a practice that makes the child care production process more efficient, but also brings a proportional reduction in wages.

3.3.1 Model setup

In each period, a worker derives utility from consumption C_t and child quality Q_t, which is produced by time spent with children. For simplicity, the utility function is given by:

$$\begin{aligned} U &= \sum_{t=1}^{k} \beta^{t-1} U_t(C_t, Q_t) \\ &= \sum_{t=1}^{k} \beta^{t-1} C_t Q_t \end{aligned} \tag{3.1}$$

where β is the time discount factor, C_t is the consumption level at each period, Q_t is the child quality level at each period. The specific utility function form described in equation (3.1) assumes that consumption and child quality are non separable, and workers attach the same importance to child quality and to consumption. This chapter mainly focuses on female workers' labour supply decisions, and one of the main responsibilities faced by female workers is child care. The utility function captures the importance of child care production in female workers' time allocation decisions. Besides, it also guarantees an analytical solution in the dynamic case so that we can have a rough idea about how flexitime may affect workers' labour supply decisions over their life time.

Consumption in each period comes from two parts,

$$C_t = n_t h_t + R_t \tag{3.2}$$

where R_t is workers' non-labour income, n_t is the number of working hours in each period and h_t is the human capital level at period t. It is assumed that workers are paid according to their human capital level (h_t). Similar to the model developed by Erosa et al. (2002) and Olivetti (2006), I assume human capital accumulation

follows a learning by doing process specified by

$$h_t = h_{t-1}(1 + \delta n_{t-1}) \tag{3.3}$$

where δ is a parameter that measures the speed at which human capital is accumulated. Equation (3.3) suggests that current period market work experience will be translated to future human capital (and, future wages). Therefore, workers' will have additional incentive to supply more market work hours in the first period given the human capital accumulation process. Following Becker (1975), the literature on human capital often distinguishes between "specific human capital" and "general human capital". The former refers to the knowledge and skills that can be only applied in a single firm, while the latter refers to the knowledge and skills that can be used with all employers. By supplying more working hours to the labour market, workers accumulate both general and specific human capital. Both types may lead to higher future wages. If workers move to other firms or industries, then specific human capital may be lost. Here in this chapter, following Olivetti (2006)'s specification, I do not model workers' job mobility behaviour. The accumulated human capital discussed here can be regarded as general human capital such as market experience, which depends on workers' labour supply history. It will not be lost if workers move across firms. Therefore, so long as workers supply a positive amount of hours to the labour market, they will accumulate human capital that leads to higher future wages. For the rest of this chapter, "human capital" refers to "general human capital" if not specified otherwise.

Workers do not value leisure here. All the time left from the market work is devoted to the child care production, which can be described as the following production function:

$$Q_t = T - n_t \tag{3.4}$$

where T is workers's total time endowment. Q_t is the output of child care production.

Flexitime changes workers' utility maximization problem via two channels. First, workers need to bear certain costs in order to work with flexitime. The costs can take many forms, such as wage reduction, or reduced future promotion probability. Here the costs are modelled as a compensating wage differential effect. Flexitime proportionally reduces workers' wages and in turn workers' consumption changes under the flexitime regime. Specifically,

$$C_t^f = n_t h_t b + R_t \tag{3.5}$$

where C_t^f is workers' consumption level when working with flexitime at period t, b is a parameter that measures the degree of wage reduction, and $b \in [0, 1]$. It follows that high values of b implies a *lower* wage reduction associated with flexitime and small values of b suggest that workers need give up *higher* amounts their wages in exchange for flexitime. $b = 1$ means that workers' do not need to sacrifice any wages in order to work with flexitime. $b = 0.5$ means that workers need to give up half of their wages in order to work with flexitime. $b = 0$ suggests that workers need to give up all their wages in exchange for flexitime.

Flexitime also changes workers' child care production according to the following process:

$$Q_t^f = T - n_t + a \tag{3.6}$$

where Q_t^f is the child quality under the flexitime regime, a is a parameter that measures how working with flexitime can help with child care production, and $a \in (0, \infty)$. High values of a mean that flexitime is very helpful with workers' child care production. $a = 0$ means that flexitime does not help with child care production at all. When it comes to the ability to fulfil family responsibilities such as child care, it is not only the total amount of time available that matters, but also when the parents are available to take care of the children. Flexitime enables parents to spend time with children when the children need them most. Consequently, even though parents spend the same amount of time taking care of their children under the flexitime scheme, the quality of child care production may increase. To some extent, we can think as if flexitime could extend workers' time endowment.

Workers choose the number of working hours (n_t) in each period to maximize life time utility. Given the above set up, workers' utility maximization problem without flexitime can be written as (3.7):

$$\begin{aligned} Max\ U_t &= \sum_{t=1}^{k} \beta^{t-1} C_t Q_t \\ s.t.\ C_t &= n_t h_t + R_t \\ Q_t &= T - n_t \\ h_t &= h_{t-1}(1 + \delta n_{t-1}) \end{aligned} \tag{3.7}$$

The maximization problem under flexitime regime can be summarized as (3.8):

$$\begin{aligned} Max\ U_t &= \sum_{t=1}^{k} \beta^{t-1} C_t^f Q_t^f \\ s.t.\ C_t^f &= n_t h_t b + R_t \\ Q_t^f &= T - n_t + a \\ h_t &= h_{t-1}(1 + \delta n_{t-1}) \end{aligned} \tag{3.8}$$

3.3.2 Static Case

Here, I analyze the case assuming that workers only live for one period. In this case, we can suppress all the time subscripts and the problem reduces to a static case. Solving (3.7) and (3.8) in the static setting by choosing the number of working hours in each period, we will have:

$$n^* = \frac{T}{2} - \frac{R}{2h} \tag{3.9}$$

$$n^{f*} = \frac{T+a}{2} - \frac{R}{2bh} \tag{3.10}$$

where n^* and n^{f*} represent the optimal market work hours under the rigid working scheme and flexitime scheme respectively. From (3.9) and (3.10), it can be seen that high human capital workers will always supply more market hours than low human capital workers, and non labour income acts as a disincentive to work. Heckman and Killingsworth (1986) illustrate a simple version of model on family time allocation assuming a conventional Cobb-Douglas utility function, and end up with similar solutions as described in (3.10)[2].

And equation (3.10) shows that workers will supply more market hours if (i) flexitime can help a lot in child care production (i.e. high values of a), or (ii) flexitime can be obtained with less wage reduction (i.e. high values of b). Note here the time endowment constraint needs to be binding, i.e. $n^{f*} \leq T$.

$$n^{f*} = Max\ (\frac{T+a}{2} - \frac{R}{2bh}, T) \tag{3.11}$$

Expression (3.11) simply states that no matter how helpful flexitime is, workers

[2]In their model, workers' utility depends on consumption and leisure. They find that for each family member, non labour income is in a negative relationship with working hours, and wage is in a positive relationship with working hours.

cannot supply working hours that are higher than their time endowment.

Given the analytical solutions (3.9) and (3.10), it can be verified that whether workers will work more hours when provided flexitime depend on how much they can benefit from flexitime (in terms of increased child care production efficiency), how much they need to pay for working with flexitime (wage reduction cost), and their human capital levels.

Proposition 1 *When the benefit to cost ratio associated with flexitime is above a certain range ($\frac{ab}{1-b} \geq T$), flexitime induces more workers to participate in the labour market, and conditional on participation, workers supply more working hours if they work with flexitime than they do without flexitime. In addition, the increase in working hours under a flexitime regime is greater among high human capital workers.*

Proof. See appendix B.1. ■

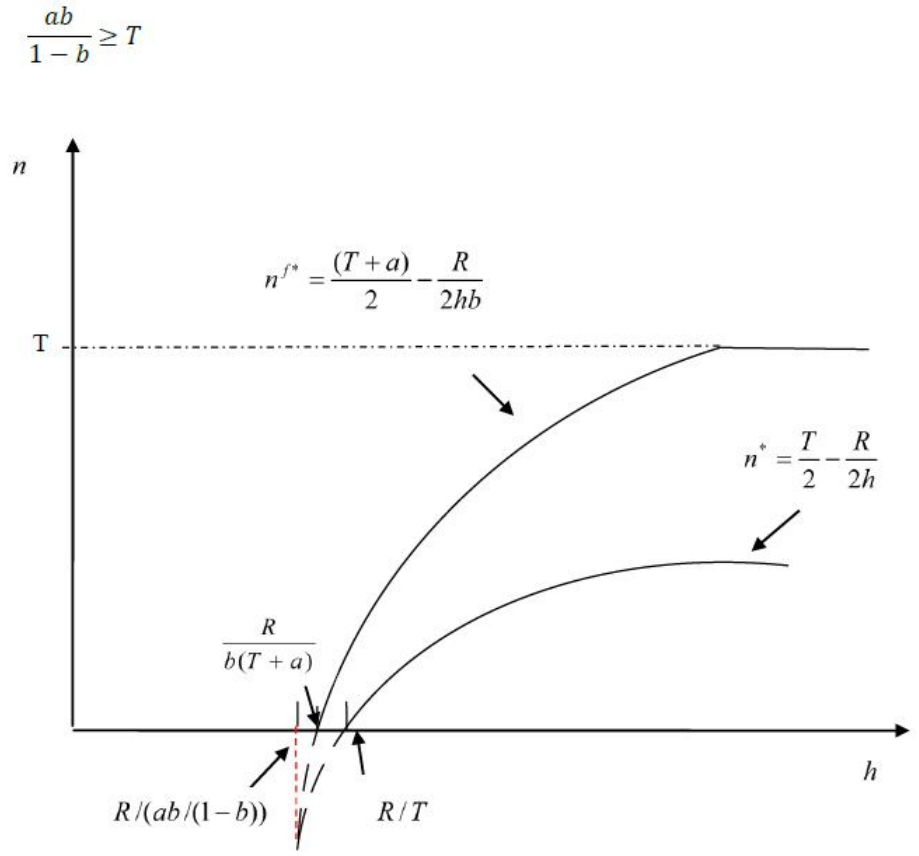
Proposition 2 *When the benefit to cost ratio associated with flexitime is below a certain range ($\frac{ab}{1-b} < T$), workers are more likely to participate in the labour market when they do not work with flexitime. Conditional on participation, flexitime only increases the labour supply of workers with human capital higher than a certain level ($h \geq \frac{R}{\frac{ab}{1-b}}$).*

Proof. See appendix B.2. ■

In order to see the two propositions of this model in a more intuitive way, I plot workers' labour supply decisions under two different schemes against their human capital levels. Figures 3.1 and 3.2 show the optimal working hours under different working hours arrangements when the relative size of the benefit-cost brought by flexitime are different. In these two figures, the horizontal axis represents workers' human capital levels, and the vertical axis represents workers' optimal market working hours.

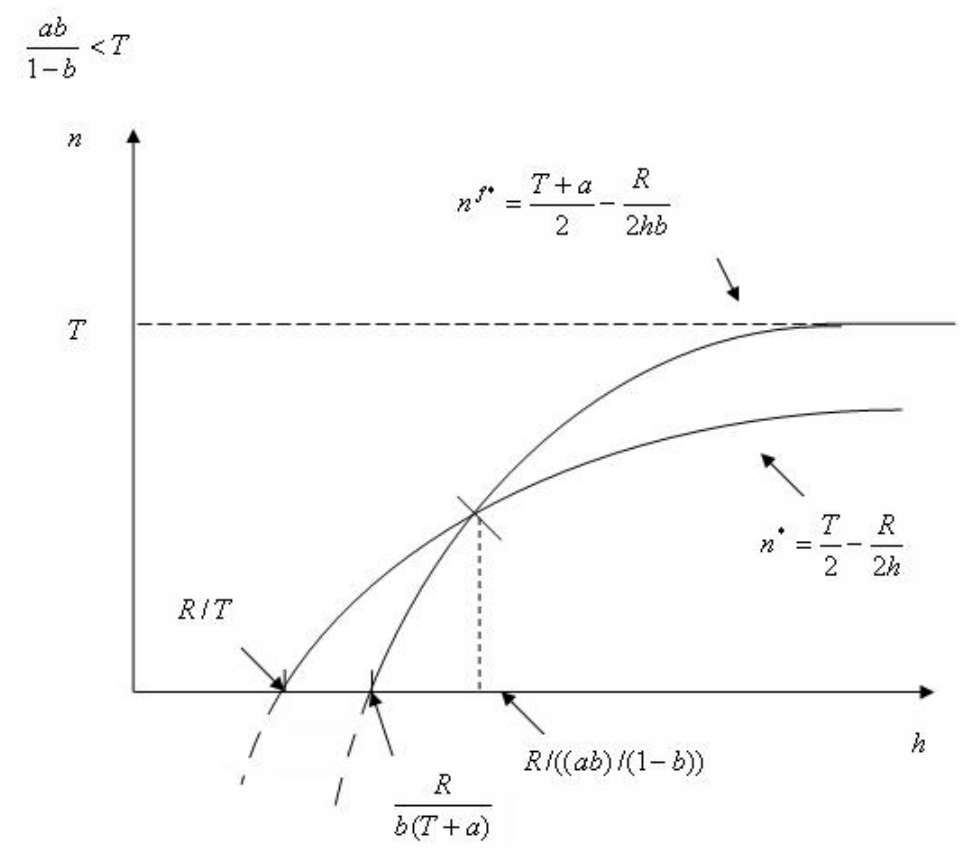
Figure 3.1 shows the situation where flexible working is helpful and cheap. In this case, the benefit to cost ratio associated with flexitime is high ($\frac{ab}{1-b} \geq T$). In this situation, flexitime increases workers' child care production efficiency by a large amount, and workers do not need to pay a high price for flexitime. In figure 3.1, the points where the working hours curves cross the horizontal axis represents the critical human capital level for participation ($\hat{h^f}$). The point where the optimal working hours curve under flexitime scheme crosses the horizontal axis lies to the left of the point where the optimal working hours curve under the non-flexible working scheme. Intuitively, flexitime reduces the cost of working,

Figure 3.1: Optimal Working Hours When Flexitime is Cheap and Helpful



This graph shows optimal working workers under different working hours arrangements when the benefit-cost ratio of flexitime is high ($\frac{ab}{1-b} \geq T$). The horizontal axis denotes workers' human capital levels, and the vertical axis denotes workers' optimal working hours. n^{f*} curve denotes workers optimal working hours under flexitime regime, and n^* curve denotes workers' optimal working hours without flexitime. The points where curves intersect with horizontal axis determines the critical human capital level of participating. In the special case of $\frac{ab}{1-b} = T$, these two labour supply curves will intersect at point where $h = \frac{R}{b(T+a)} = \frac{R}{T} = \frac{R}{ab/(1-b)}$.

Figure 3.2: Optimal Working Hours When Flexitime is Expensive and Not Helpful



This graph shows optimal working workers under different working hours arrangements when the benefit-cost ratio of flexitime is low ($\frac{ab}{1-b} < T$). The horizontal axis denotes workers' human capital levels, and the vertical axis denotes workers' optimal working hours. n^{f*} curve denotes workers optimal working hours under flexitime regime, and n^* curve denotes workers' optimal working hours without flexitime. The points where curves intersect with horizontal axis determines the critical human capital level of participating.

and the critical human capital level of participation becomes lower with the help of flexitime. More importantly, under such circumstances, regardless of workers' human capital levels, they all choose to work more hours when they are provided with flexitime. Being able to work with flexitime makes child care production more efficient. The same amount of time now can produce more child care and therefore workers can use the saved time to do more market work. This is also reflected in figure 3.1, as the optimal working hours with flexitime curve (n^{f*} curve) always sits above the optimal working hours without flexitime curve (n^* curve). Figure 3.1 also suggests that the higher the human capital level, the bigger the difference between optimal working hours under two schemes. Flexitime saves workers time from child care production. For each one hour devoted to the market work, high human capital workers earn higher wages than low human capital workers. Consequently, it is observed that when working with flexitime, high human capital workers increase their labour supply more than low human capital workers.

Figure 3.2 describes workers' labour market decisions when condition (B.3) is not satisfied (i.e. $\frac{ab}{1-b} < T$). In this case, flexitime is not helpful and expensive. In figure 3.2 the two curves intersect at the point where $h = \frac{R}{\frac{ab}{1-b}}$, and after that the optimal market hours with flexitime (n^{f*}) curve lies above the optimal market hours without flexitime (n^*) curve. This suggests that only workers with high human capital levels are going to increase their labour supply when they are working with flexitime. Flexitime increases workers' child care production by a fixed amount a, as if it increased workers' time endowment. This extra time can be used for either market work or child care production. Workers' wages, meanwhile, are determined by their human capital, and high human capital workers are more likely to devote their extra time to market work than low human capital workers are. Thus, even though flexitime is associated with a significant compensating wage differential, workers with high levels of human capital are still likely to increase their working hours once they are provided with flexitime.

Propositions 1 and 2 (discussed above) focus on the labour supply side to explain the possible effects of flexitime on workers' labour supply decisions. We must also consider the fact that the provision of flexitime is subject to other constraints. Flexitime has always been an under supplied family friendly practice (Golden and Altman, 2007a), in the sense that more workers have wanted it than have had access to it. Some technology constraints and other constraints (such as administrative costs and/or coordination costs) may prevent firms from granting flexitime working requests from all workers (Golden, 2001; Golden and Altman,

2007a). Table 1.4 in chapter 1 shows that at least some firms do not allow certain types of employees to work flexitime.

Firms will only provide flexitime for workers if the costs of providing it are less than or equal to the benefits they can derive from it. On one hand, flexitime may reduce the absenteeism and promote on the job attachment so that the productivity of workers may increase (Dalton and Mesch, 1990; Golden and Altman, 2007a). On the other hand, firms may need to adopt new equipment and additional supporting staff to be able to provide flexible working opportunities at the workplace. In order to cover the non-trivial costs associated with flexitime, firms would like to be compensated by asking workers to work longer hours. Therefore, we may observe a positive relationship between working hours and workers' flexitime status. This may be particularly true for high human capital workers. Workers with high human capital are more frequently observed to work with flexitime than workers with low human capital. Possibly it is because their requests for flexitime are more likely to be agreed by firms due to their high bargaining power when negotiating the contract. In addition, the replacement costs of those high human capital workers may also be higher than those low human capital workers, so the quit threats of high human capital workers may give firms additional incentives to provide them with flexitime. For each unit of labour devoted to the production process, workers with high human capital produce more output than low human capital workers. Firms benefit more by inducing or asking high human capital workers to increase their working hours under the flexitime regime than increasing low human capital workers' labour supply. What is more, if firms invest heavily in workers (in this case, workers with high specific human capital), they may also wish to accommodate workers' request for flexitime working and amortize rents by asking them to work longer hours. To this extent, longer working hours may act as a pre-condition for workers to work with flexitime. Once provided with flexitime, it is possible that high human capital workers are required by firms to raise their labour supply more than low human capital workers.

In summary, the static model has two predictions. Prediction 1 is that workers will increase their labour supply when working with flexitime if it can effectively increase the child care production, and can be obtained at a low price. Prediction 2 is that the increase in working hours is more likely to be observed among workers with high human capital.

3.3.3 Two Periods, Two worlds

In this section, the simple static model discussed above is extended to a two period model. There are two distinct worlds: flexible world and non-flexible world. In the non flexible world, workers do not have access to flexitime, and are restricted to the rigid working schedules throughout their life time. In the flexible world each worker has access to flexitime in the second period but not in the first period. By comparing workers' labour supply decisions in these two different worlds we may have a better understanding of the effect of flexitime on workers' market hours. Compared to the static case, human capital accumulation now plays a very important role in workers' labour market decisions . Anticipating that they are going to work with flexitime in the future, workers' incentives to work in the previous period also change. Therefore, the introduction of flexitime has a more profound effect on workers' labour market decisions in the dynamic case than it does in the static case.

In the two-period model, workers' utility maximization problem in the two distinct worlds are given by (3.7) and (3.8) with $t = 2$. Workers choose the optimal working hours in each period to maximize their utility. In the non flexible world, the two first order conditions are:

$$n_1 = \frac{Th_1 - R_1}{2h_1} + \beta(T - n_2)n_2\delta \tag{3.12}$$

$$n_2 = \frac{T}{2} - \frac{R_2}{2h_2} \tag{3.13}$$

Similarly, in the flexible world, the two first order conditions are:

$$n_1^f = \frac{Th_1 - R_1}{2h_1} + \beta(T - n_2 + a)n_2 b\delta \tag{3.14}$$

$$n_2^f = \frac{T + a}{2} - \frac{R_2}{2h_2 b} \tag{3.15}$$

Equations (3.13) and (3.15) are very similar to the optimal working hours chosen by workers in the static case. In the second period, each worker knows that this is the last period. Therefore, workers maximize their utility as if they were in the static case. The introduction of the human capital accumulation process makes workers supply more market work hours in the first period given certain initial human capital levels, for their current experience will increase their future wages.

The analytical solutions to the maximization problem in the non-flexible world

are:

$$n_1^* = \frac{1}{24h_1^3\delta^2}\frac{P}{O} - O^{\frac{1}{3}} \tag{3.16}$$

$$n_2^* = \frac{T}{2} - \frac{R_2}{2h_1}(1 + \frac{1}{24h_1^3\delta}(\frac{P}{O} - O^{\frac{1}{3}})) \tag{3.17}$$

where n_1^* and n_2^* are workers' first period and second period optimal working workers in the non-flexible world, and,

$$\begin{aligned} P &= -16h_1^3\delta + 4h_1^3T\delta^2 + h_1^2T^2\beta\delta^3 \\ &- 4h_1^2\delta^2R_1 - (h_1^4\delta^2(T^2\beta\delta_4^2h_1(2+T\delta) - 4\delta R_1)^2) \end{aligned}$$

$$\begin{aligned} O &= -h_1^6\delta^3((T+a)\beta\delta^2 + 4h_1(2+T\delta))^3 \\ &+ 4h_1^6\delta^4(3(T^2\beta\delta^2 + 4h_1(2+T\delta))^2R_1 \\ &- 12\delta(T\beta\delta^2 + 4h_1(2+T\delta)R_1^2 + 16\delta^2R_1^3 + 216\beta\delta R_2^2) \\ &+ 24\sqrt{3}\sqrt[3]{h_1^{12}\beta\delta^8R_2^2(T^2\beta\delta^24h_1(2+T\delta) - 4\delta R_1)^3 - 432\beta\delta^2R_2^2} \end{aligned}$$

The optimal number of working hours in both periods in the flexible world are:

$$n_1^{f*} = \frac{1}{24bh_1^3\delta^2}\frac{A}{B} - B^{\frac{1}{3}} \tag{3.18}$$

$$n_2^{f*} = \frac{T+a}{2} - \frac{R_2}{2h_1(1 + \frac{1}{24bh_1^3\delta}(\frac{A}{B} - B^{\frac{1}{3}}))} \tag{3.19}$$

where n_1^{f*} and n_2^{f*} are workers' first period and second period optimal working hours in the flexible world, and,

$$\begin{aligned} A &= -16bh_1^3\delta + 4bh_1^3T\delta^2 + a^2b^2h_1^2 + 2ab^2h_1^2T\beta\delta^3 + b^2h_1^2T^2\beta\delta^3 \\ &- 4bh_1^2\delta^2R_1 - (b^2h_1^4\delta^2(b(a+T)^2\beta\delta^2 + 4h_1(2+T\delta) - 4\delta R_1)^2) \end{aligned}$$

$$\begin{aligned} B &= -bh_1^6\delta^3(b(a+T)^2\beta\delta^2 + 4h_1(2+T\delta))^3 \\ &+ 4b^2h_1^6\delta^4(3b(b(a+T)^2\beta\delta^2 + 4h_1(2+T\delta))^2R_1 \\ &- 12b\delta(b(a+T)^2\beta\delta^2 + 4h_1(2+T\delta))R_1^2 + 16b\delta^2R_1^3 + 216\beta\delta R_2^2) \\ &+ 24\sqrt{3}\sqrt[3]{-b^4h_1^{12}\beta\delta^8R_2^2(b(b(a+T)^2\beta\delta^2 + 4h_1(2+T\delta) - 4\delta R_1)^3 - 432\beta\delta^2R_2^2} \end{aligned}$$

Though the analytical solutions to the maximization problem appear to be complicated, still some inferences can be made.

Proposition 3 *When the benefits of flexitime (increased child care production efficiency) are high relative to the wage reduction cost associated with flexitime (i.e. when* $\frac{ab}{1-b} \geq T$*), the marginal utility of one hour of market work in the first period is higher in the flexible world than that of the non-flexible world. This suggests that workers will supply more hours in both the first and second period when working with flexitime, regardless of their initial human capital levels.*

Proof. See appendix B.3. ■

Intuitively, when flexitime greatly improves workers' child care production efficiency and can be obtained at a low price (wage reduction), workers with flexitime will supply more hours of market work in the second period than they do without flexitime. Nevertheless, anticipating that they are going to supply more hours in the second period than they are in the non-flexible world, workers with flexitime have additional incentive to work more hours in the first period than they do without flexitime so that they will accumulate enough human capital to earn high wages in the second period. Therefore, in the dynamic situation, flexitime will increase workers' labour supply decisions in both periods if the benefit to cost ratio associated with flexitime is very high ($\frac{ab}{1-b} \geq T$).

On the other hand, if $\frac{ab}{1-b} \geq T$ (which means flexitime is not very helpful with child care production or workers need to sacrifice a large amount of wages in exchange for it), whether the introduction of flexitime will increase labour supply depends on workers' human capital levels.

Proposition 4 *If the benefits of flexitime (increased child care production efficiency) are low relative to the cost (wage reduction cost) of working with flexitime (i.e. when* $\frac{ab}{1-b} < T$*), the overall effect of flexitime on workers' labour supply is ambiguous. The marginal utility of first period work could be lower for some parameter specifications* ($n_1^{f*} \leq (\frac{R_2}{h_1(\frac{ab}{1-b})-1)})^{\frac{1}{\delta}}$*), which suggests that workers may supply less hours of market work in both periods in the flexible world. However, this is less likely to be the case for high human capital workers than for low human capital workers.*

Proof. See appendix B.4. ■

Intuitively, when flexitime is not helpful with workers' child care production, workers cannot save much time from their child care production to be devoted to market work. In addition, the compensating wage differentials effect associated with flexitime may also discourage them from supplying more hours into the labour market. Therefore, workers may choose to work less under the flexitime scheme in the second period. Anticipating that they are going to work less in the

second period with flexitime, workers in the flexible world have less incentive to accumulate human capital in the first period as well because the marginal utility of the first period working is lower with flexitime than without flexitime. This may be particularly true for workers with low human capital levels since they earn lower wages than workers with high human capital, and have less incentive to work long hours in the labour market. As a result, we may observe that workers with low human capital levels supply fewer hours in the flexible world for both periods than they do in the non-flexible world.

We can also look at this problem from the demand side. Given the costs associated with flexitime provision, firms may wish to be "compensated" by asking workers to work more hours. Meanwhile, firms are more likely to grant high human capital workers' requests for working flexitime as they may want to maximize the return to human capital investment. As a result, we are likely to observe that the labour supply of high human capital workers increases more than that of low human capital workers. If firms only agree to workers' flexitime requests if their human capital levels exceed a certain level ($\overline{h}$), then such flexitime constraints imposed by firms may give workers additional incentives to work more hours in the first period. They need to accumulate up to the threshold level human capital ($\overline{h}$) in order to enjoy flexitime working in the second period.

In summary, in the dynamic setting, human capital accumulation is crucial in workers' labour supply decisions. Not only does it affect workers' current period labour supply under different time arrangement regimes, but also it alters workers' optimal time allocation strategies over time. If flextime is very helpful with workers' child care production and can be obtained with little cost, then all workers will increase their working hours in both periods regardless of their human capital levels. If the cost of working with flexitime is very high compared to the benefit, then for some parameter specifications (as suggested by inequality (B.18)), workers may decrease their working hours in both periods when working with flexitime. The negative effect of flexitime on workers' labour supply is more likely to be found among workers with low human capital levels.

The introduction of flexitime has two effects on workers labour supply decisions. By increasing child care production efficiency, it saves workers' time in child care production so that they can spend more hours at market work. On the other hand, flexitime reduces workers' hourly wages so that it becomes less attractive for them to work long hours. As a result, whether flexitime can increase workers' labour supply depends on the overall effect of these two forces.

The main insight of the two period model is that flexitime now has dynamic

effects on workers' labour supply decisions via a human capital accumulation process. In the static case, flexitime only affects workers' labour supply decisions in the current period. It did not affect workers' incentives to accumulate human capital. Now, the human capital accumulation process links workers' labour supply decisions in the two periods together, so flexitime not only affects current period working hours, but also working hours in the previous period. Anticipating that they will later work with flexitime, workers may alter their optimal first period working hours because their incentives to accumulate human capital are different under the flexitime and non-flexitime regimes. Particularly, if flexitime is associated with high benefits and can be obtained at a low price, then it gives people additional incentives to work in the labour market. When workers choose to increase their working hours in the first period, knowing that they are going to work in the flexible world in the next period, they accumulate more human capital than they would in the non-flexitime world. In turn, the accumulated human capital from the first period induces workers to increase their second period working hours. Thus, the interaction between flexitime and workers' human capital accumulation process enables flexitime to have more nuanced effects on workers' labour supply decisions in the two period model.

3.4 Empirical Implications

This section tests the model predictions empirically. Admittedly, in the dynamic model, flexitime has more nuanced effects on workers' labour supply decisions than it does in the static model. It would be interesting to know whether flexitime does affect workers' life cycle labour supply decisions via its interaction with the human capital accumulation process. However, it is difficult to empirically test the predictions of the dynamic model. Particularly, it would be difficult to test how flexitime affect workers' labour supply in the previous period. I can observe workers' flexitime status in each period, but I cannot observe how workers perceive their future flexible working opportunities. According to the dynamic model described in previous section, workers' incentives to work is affected by their future flexitime status because they know that they are going to work with flexitime in the next period. However, in the data set, such information is unavailable and we cannot distinguish workers who know their next period flexitime status and those who do not. In addition, according to the dynamic model, both wage and past labour market experience are endogenous in workers' hours equation. It is difficult to find instruments for both of them to correct for the

endogeneity issue in the system. Given the limitations discussed above, in this section I focus on testing for the predictions of the static model only.

The model predicts (i) the effect of flexitime depends on the benefit to cost ratio associated with flexitime. If flexitime is helpful with workers' child care production and can be obtained at a low price, then it can effectively increase workers' labour supply (prediction 1). If flexitime is not very helpful and expensive, then it might be the case that workers decrease their market work hours when they work with flexitime. (ii)The increase in working hours under flexitime regime is more likely to be observed among high human capital workers.

3.4.1 Data, Variable Definitions and Sample Statistics

The data used are from the British Household Panel Survey (Hereafter BHPS), years 2001-2007. The BHPS is a national wide survey that includes comprehensive information on workers' labour market activities, demographic characteristics and flexitime status. The survey started in 1991 and was conducted on a yearly basis. I chose wave 11 (year 2001) to wave 17 (year 2007) for the sake of consistency in the coding system.[3] Because BHPS only asks respondents questions regarding their flexitime status if the respondent are employed, only employed people are kept in the sample.

In this chapter, a labour supply equation is estimated:

$$Hours_{it} = c + a_i + \beta Flexitime_{it} + \Sigma_{m=1}^{M} \phi_m X_{imt} + u_{it} \tag{3.20}$$

where $Hours_{it}$ is the normal weekly working hours of individual i at time t, c is constant, a_i captures the individual unobserved heterogeneity, t is the time index, $Flexitime_{it}$ denotes workers' flexitime status at time t, X_{imt} is a vector including factors that may affect workers' labour supply decisions, and u_{it} is the error term. $Flexitime_{it}$ is a dummy variable that takes value 1 if the respondent works with flexitime at time t and 0 otherwise. Variables included in vector X include $ln(wage)$, age, $agesq$, $Male$, $Children$, $Married$, $Non-labour\ income$, $Education$. The variable $ln(wage)$ is the natural logarithm of workers' real hourly wage. Age records workers' age at the interview. $Agesq$ is the square of each worker's age. $Male$ is a dummy variable which takes value 1 if the respondent is a male and 0 otherwise. $Children$ is a dummy variable which takes value 1 if the worker has children under 16 and 0 if the worker does not have children under 16.

[3]Starting fro wave 11 (year 2001), samples from Scotland and Northern Ireland are included, and a new industry and occupation coding system was introduced.

Married denotes workers' marital status. It takes value 1 if the worker is married and 0 otherwise. *Education* is defined as the highest academic degrees held by the respondent. *Education* is measured by the highest qualification obtained by the respondent. BHPS divides workers' educational degrees into 7 levels; higher degree (postgraduate degrees), first degree, hnd, hnc, teaching degree, A level qualification, O level qualification, Cse qualification, and No qualification.

Sample Statistics

Table 3.1 reports the sample statistics of those key variables in workers labour supply equation (3.20). Most of the sample statistics are stable throughout the sample period. The first row in table one displays the average real hourly wages of all workers across seven years. Average real hourly wage has increased from 10.00 pounds in 2001 to 11.56 pounds in 2007. The percentage of workers that work with flexitime fluctuates across years. It is relatively high in year 2001[4]. Average normal weekly working hours are around 37 hours. 47% of respondents are male. On average, workers in my sample are 37 years old. 54% of them are married, and 37% of respondents have children under age 16.

3.4.2 Testing For Prediction 1

In this section, I will focus on testing prediction 1. Prediction 1 suggests that the effect of flexitime on workers' labour supply decisions depends on the benefits they can derive from working with flexitime (increased child care production efficiency) relative to the cost (reduced wages). It is reasonable to assume that female household members take the main responsibilities for child care production in most households. Therefore, working mothers should be the group of workers that can derive high benefits from working with flexitime. In addition, in my second chapter, I find that flexitime decreases high wage workers' wages, and most high wage workers are male. This may be suggestive that female workers and working mothers receive less wage penalty for working with flexitime than male workers. Therefore, I estimate workers' labour supply equation (3.20) keeping all workers in my sample first, then I restrict my sample to female workers, and finally I estimate equation (3.20) for working mothers only.

[4]Some of the respondents in wave 11 (year 2001) are interviewed in year 2002. If we calculate the percentage of workers working with flexitime on calendar year basis rather than on wave basis, then this spike is washed out. Manning and Petrongolo (2005) also find that the percentage of workers with flexitime is slightly higher than other years in 2001 using Labour Force Survey data, but the difference is not so big as suggested here.

Table 3.1: Sample Statistics of Variables in Labour Supply Equation (3.20)

	2001	2002	2003	2004	2005	2006	2007
Wage	10.00	10.52	10.67	11.00	11.09	11.42	11.56
	(6.25)	(6.98)	(7.55)	(9.28)	(7.22)	(7.04)	(7.40)
Flexitime	.22	.14	.18	.15	.15	.15	.16
	(.42)	(.34)	(.37)	(.35)	(.35)	(.35)	(.35)
Age	37.28	37.56	37.84	38.09	38.12	38.92	38.87
	(12.11)	(12.16)	(12.29)	(12.45)	(12.52)	(12.36)	(12.51)
Married	.54	.54	.54	.53	.52	.53	.53
	(.49)	(.49)	(.49)	(.49)	(.50)	(.50)	(.50)
Children	.37	.36	.36	.36	.36	.36	.36
	(.48)	(.48)	(.48)	(.48)	(.48)	(.48)	(.48)
Male	.47	.47	.47	.47	.47	.47	.47
	(.50)	(.50)	(.50)	(.50)	(.50)	(.50)	(.50)
Hours	37.31	37.10	36.91	36.74	36.62	36.75	36.86
	(13.57)	(13.09)	(13.21)	(13.17)	(12.97)	(12.58)	12.79
No.of obs	9148	8127	7953	7750	7567	7195	7049

Source: BHPS, years 2001-2007.
For each variable, both mean and standard deviation (in parentheses) are reported.

The Effect of Flexitime on Workers' Weekly Working Hours

Table 3.2 reports the estimation results of equation (3.20) for different sets of samples (all workers together, female workers, working mothers). According to model prediction 1, flexitime should be effective in inducing working mothers supply more market hours. In table 3.2, from left to right, the benefit to cost ratio associated with flexitime should be in ascending order. Workers' labour supply equation (3.20) is estimated using a random effects model, because within each person, the variation of hours is small over years.

According to table 3.2, the presence of children in the household decreases the workweek by 3.42 hours. Education level increases workers' hours choice. Workers with no academic degrees work around 5.30 hours less per week than workers holding higher education degrees (postgraduate degrees). If we can treat workers' education degree as a proxy for their human capital levels, then it is clear from table 3.2 that human capital is associated with an increased incentive to work, which confirms the model's prediction.

In all three regressions, a negative relationship between wages and working hours is reported, which suggests that an increase in workers' wages induces them to reduce their weekly working hours. This seems to be at odds with conventional literature on labour supply. According to standard labour supply models, work-

Table 3.2: Estimation Results of Workers' Labour Supply Equation (3.20), Random Effects

		All workers	Female workers	Working mothers
		(1)	(2)	(3)
Male		11.023***		
		(.180)		
Flexitime		-.287***	.095	.713***
		(.107)	(.155)	(.231)
ln(wage)		-1.765***	-1.795***	-1.596***
		(.115)	(.286)	(.415)
Age		.874***	.815***	.184
		(.040)	(.068)	(.193)
Age squared		-.012***	-.011***	-.0001
		(.0005)	(.0009)	(.003)
Married		-.564***	-1.882***	-.959***
		(.139)	(.219)	(.365)
Children		-3.421***	-6.309***	
		(.130)	(.279)	
Non-labour income		-.0002***	-.0002***	-.0001**
		(1.00e-05)	(.00005)	(.00004)
Education	First degree	-.494	-1.508**	-2.772*
		(.434)	(.750)	(1.437)
	Hnd teaching	-2.330***	-3.842***	-4.293***
		(.487)	(.860)	(1.492)
	A level	-3.062***	-4.862***	-5.657***
		(.437)	(.778)	(1.460)
	O level	-3.607***	-6.434***	-6.911***
		(.433)	(.792)	(1.503)
	Cse qualification	-4.696***	-9.015***	-9.440***
		(.533)	(.914)	(1.588)
	No qualification	-5.306***	-9.890***	-8.747***
		(.468)	(.851)	(1.570)
Constant		26.69***	32.58***	31.336***
		(.83)	(1.44)	(3.76)
R squared		.24	.18	.04
No. of obs		50669	26430	10189

Source: BHPS, years 2001-2007.

The dependent variable is normal weekly working hours. Equation (3.20) is estimated by a random effects model.

Time dummies are also included in the regression to control for the aggregate shock of each year.

For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

ers' labour supply can respond to wages either positively or negatively, depending on whether the substitution effect or income effect dominates. Usually the negative relations between wages and labour supply are only found among workers with very high wages. In most empirical studies, wage elasticity of labour supply is positive (Heckman and Killingsworth, 1986). However, there is also literature reporting a negative wage elasticity to labour supply in the panel dimension. When estimating workers labour supply equation using panel data, Smith Conway and Kniesner (1994) also find persistent negative relationship between labour supply and wages, and that relationship is robust through many specifications.

A possible reason for this could be that within the individual, the real hourly wage is increasing over time, while the working hours may remain relatively stable due to labour market restrictions or even slightly decrease over time. Therefore, the negative relationship between wages and real hourly wage is not entirely surprising in the panel dimension. Heckman (1993) points out that the measurement error in workers' self reported data may also lead to this problem. Heckman (1993) suggests that measurement errors in hourly wages are positively correlated with workers' characteristics such as education, and measurement errors in hours are negatively correlated with its true values. As a result, a negative relationship between hourly wage and workers' hours is observed. In addition, workers face hours constraints imposed by firms, which means that they cannot choose their working hours freely (Altonji and Paxson, 1992). Models of implicit lifetime contracts suggest that workers' wages and the value of their marginal product may diverge at a given point of time. When wage exceeds the value of marginal product, firms may restrict workers from working longer hours. When the value of marginal product surpasses the wage, then firms may restrict workers form working fewer hours (Kahn and Lang, 1992). In other words, firms prevent workers from working long hours if they are overpaid. Therefore, we may observe a negative relationship between workers' wages and their working hours over years, as suggested by table 3.2.

The key variable of interest is the dummy variable denoting workers' flexitime status. When all workers are put together, the flexitime coefficient is negative and significant. This suggests that workers who work with flexitime supply fewer weekly working hours than workers who do not work with flexitime. As per the model prediction, this could be the result of a low benefit to cost ratio associated with working flexibly. For example, flexitime gives workers the ability to decide when they start and end work. If the worker is engaged in a job requiring long working hours each day, she may not be able to derive much utility from working

with flexitime since there is not much room for her to vary her working time. As a result, we find a negative relationship between flexitime and working hours. This may be particularly true for male workers since they may not enjoy many benefits from flexitime, or because they need to pay high costs when working with flexitime.

After restricting the sample to female workers only, we can find that the flexitime coefficient becomes positive, though insignificant. When the sample is further restrained to contain only working mothers, the positive effect of flexible working on labour supply decisions is significant at the 1% level . The fourth column shows that on average workers with flexitime work 0.71 hours more than those who do not have flexitime. It can be seen that the effect of flexitime is more prominent among working mothers than other workers. This finding confirms model prediction 1. Workers will be induced to increase their working hours if the benefit to cost ratio brought by flexitime is high enough (Flexitime can increase child care production efficiency a lot and can be obtained at low price). Compared to male workers and childless female workers, working mothers may enjoy highest benefits from flexitime. It is also reasonable to assume that it is easier for working mothers to obtain flexitime at a lower costs with many legislations aiming at helping female workers with their family responsibilities. As a result, working mothers respond to flexitime by increasing their working hours.

Estimations using fixed effects are also conducted and tell the same story. Table 3.3 displays the coefficient estimates of *Flexitime* using a fixed effects model. According to estimation results using a fixed effect model, flexitime is still most effective in increasing working mothers' weekly working hours. Though statistically the fixed effects model produces consistent estimates, it only picks up variations within individuals. This is also reflected by the low R squared reported in table.

I also tried adding workers' union membership into the labour supply equation to see whether that alters the estimation results significantly. Workers who are union members may have high bargaining power when negotiating contracts with their employers. Possibly they are more likely to have flexitime than workers without union membership. Table B.1 in appendix B displays the estimation results with union membership as an additional control variable. Across all three specifications, the variable "union" is positively associated with workers' working hours, suggesting that union members work more than non-union members. More importantly, adding union status as an additional control into workers' wage

Table 3.3: Estimation Results of Labour Supply Equation (3.20): Fixed Effects

	All workers	Female workers	Working mothers
Flexitime	-.07	.18	.70***
	(.13)	(.17)	(.24)
R squared	.04	.06	.05

Source: BHPS, years 2001-2007.
The dependent variable is normal weekly working hours. Equation (3.20) is estimated by a fixed effects model. Other control variables included are the same as in table 3.2.
Time dummies are also included in the regression to control for the aggregate shock of each year.
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

equation does not qualitatively alter the coefficient estimates of flexitime. Table B.1 shows that flexitime can effectively increase working mothers' labour supply. When all workers are pooled together, flexitime is associated with fewer weekly working hours. When the sample is restricted to contain female workers only, flexitime has insignificant effect on workers' weekly working hours.

We also must consider the fact that workers' wages are endogenous in the labour supply equation. As discussed above, firms may choose to set wages and hours simultaneously according to the efficiency contract models (Kahn and Lang, 1992). Moffitt (1984) argues that workers' wage rates depend on their hours, and extends the conventional labour supply model by making wages endogenous. Failing to correct for the endogneity of wages in the labour supply equation may lead to biased estimation results. This simultaneity problem may be solved by the instrumental variable approach. The existing literature often use two types of information as the instruments for wages. The first type of information is workers' own characteristics. Mroz (1987) summarizes that workers' characteristics, such as high order terms of age, years of education, and the interaction term of age and education could be used as instruments for their wages. In addition, factors on the demand side may also be useful in specifying workers' wage equation. Moffitt (1984) uses three area variables (size of labour force in the respondent's region, the employment fractions in manufacturing and in government in the census region of residence) to specify the workers' wage equation. The rationale is that such information reflects the aggregate wage level and the general labour market characteristics which may affect workers' wage levels.

Following Moffitt (1984)'s style, in this chapter, I use area variables as instruments for workers' wages[5]. Since BHPS only contains information about the workers' side, I use the regional dummies as the instruments for workers' wages. I created a dummy variable *London* which takes value 1 if the respondent lives in London and 0 otherwise. I also created another variable *Scotland* that takes value 1 if the respondent lives in Scotland. These regional dummies contain information on the characteristics of local labour market, which may also affect the wage levels of workers in that area. In addition, I also include an ethnicity dummy *white* as instrument for wage. It takes value 1 if the respondent is white and 0 otherwise. It is well documented that workers' ethnicity group affects their wages (Blau and Beller 1992). Table 3.4 reports the estimation results of workers' labour supply equation (3.20) using 2SLS, and table 3.5 gives the first stage estimation results.

According to table 3.4, after correcting for the endogeneity of the variable $ln(wage)$, the negative relationship between wage and workers' weekly working hours disappears in all three specifications. When all workers are pooled together, wage has a positive effect on workers' labour supply, suggesting that a high wage induces more weekly working hours. This is similar to what has been reported in most of the previous literature (Heckman and Killingsworth, 1986). When the sample is restricted to contain only female workers, the positive relationship between wage and working hours persists. When only working mothers are kept in the sample, wages seem to have little effect on workers' labour supply decisions. The changes in the signs of the wage coefficient from table 3.2 to table 3.4 suggest that treating the wage as endogenous does matter when specifying workers' labour supply equation. Besides, the instrumental variable approach is also helpful for correcting the potential measurement error that may arise during the construction of the hourly wage variable. Particularly, the hourly wage is calculated by dividing workers' labour income by their working hours. Any measurement error in workers' weekly working hours may lead to a spurious negative correlation between wage and weekly working hours (Mroz, 1987). The changed signs of the wage coefficient may also be the outcome of reduced measurement error.

[5]I also tried using workers' characteristics suggested by Mroz (1987) as instruments, such as age, age squared, experience, experience squared, cubic and quartic terms in ages and experience, interaction terms of education dummies and experience. However, they all failed the over-identification test, which means that they cannot serve as proper instruments for wages. Mroz (1987) also suggests spousal income and spousal experience as possible instruments. However, the spousal information does not fit in this chapter for around 44% of workers in my sample are not married.

Table 3.4: 2SLS Estimation Results of Workers' Labour Supply Equation

		All Workers	Female Workers	Working Mothers
		(1)	(2)	(3)
Male		9.920***		
		(.471)		
Flexitime		-.578***	-.329*	.719*
		(.132)	(.196)	(.400)
ln(wage)		4.089**	4.625***	.295
		(2.040)	(1.587)	(4.026)
Age		.462***	.566***	.288
		(.145)	(.101)	(.180)
Age squared		-.007***	-.009***	-.002
		(.002)	(.001)	(.002)
Union		.595*	1.904***	3.064***
		(.326)	(.382)	(.860)
Married		-.759***	-2.762***	-2.179***
		(.150)	(.167)	(.276)
Children		-3.658***	-7.390***	
		(.135)	(.192)	
Non-labour income		-.0002***	-.0003***	-.0002***
		(1.00e-05)	(.00002)	(.00002)
Education	First degree	.146	-.988**	-1.932*
		(.464)	(.486)	(1.069)
	Hnd teaching	-.715	-2.295***	-3.357*
		(.736)	(.722)	(1.919)
	A level	-.540	-2.192***	-4.060*
		(.938)	(.830)	(2.241)
	O level	-.317	-2.533***	-4.766*
		(1.127)	(.982)	(2.568)
	Cse qualification	-.819	-4.005***	-6.789**
		(1.367)	(1.173)	(2.926)
	No qualification	-.938	-4.646***	-6.141*
		(1.528)	(1.286)	(3.364)
Constant		20.657***	22.640***	24.763***
		(2.221)	(2.313)	(8.062)
No. of obs		50606	26354	10169
Over-identification test		fail (p=0.03)	pass (p=0.90)	pass (p=0.46)

Source: BHPS, years 2001-2007.

The dependent variable is normal weekly working hours. Equation (3.20) is estimated by 2SLS with random effects. The endogenous variable is $ln(wage)$. The instruments used are *London*, *Scotland*, *white*.

Time dummies are also included in the regression to control for the aggregate shock of each year.

For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Table 3.5: First Stage Estimation Results

	All workers	Female workers	Working mothers
London	.145***	.217***	.182***
	(.016)	(.018)	(.040)
Scotland	-.019**	-.007	.005
	(.010)	(.010)	(.019)
White	.052**	.046*	.016
	(.027)	(.028)	(.054)

Source: BHPS, years 2001-2007.
This table reports the first stage regression of the 2SLS estimation of workers' labour supply equation (3.20). The dependent variable is $ln(wage)$.
Other control variables include: *Age*, *Age squared*, *Union*, *Flexitime*, *Married*, *Children*, *Male*, *Non labour income*, Education dummies, year dummies.
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

As shown in table 3.4, people react to flexitime differently. The pattern is the same as that displayed in table 3.2. Generally flexitime is associated with fewer working hours among workers. But when I focus on working mothers only, I find that flexitime is positively correlated with working hours. In other words, after correcting for the endogeneity of wages, I still find that flexitime can effectively increase working mothers' labour supply.

Table 3.5 gives the coefficient estimates of those instruments in the first stage estimation, where $ln(wage)$ is regressed on the instruments and all the other exogenous control variables in workers' labour supply equation. It shows that workers who live in London earn more than workers living in other areas of the United Kingdom. Meanwhile, workers in Scotland seem to earn slightly lower wages, but this area effect is insignificant among female workers and working mothers. Furthermore, as shown by the second and third column of table 3.5, white workers receive higher wages than workers with other ethnicities. However, the variable *white* is not significant in working mothers wage equation, suggesting that ethnicity may have little effect on working mothers' wages. The first stage estimation results show that at least some of the instruments are correlated with the endogenous variable $ln(wage)$.

In addition, over-identification tests are also conducted to test whether all instruments included are not correlated with the error term of the labour supply

equation. As shown in the last row of table 3.4, the instruments pass the over-identification test in female workers' labour supply equation and working mothers' labour supply equation. However, they do not pass the over-identification tests when all workers are kept in the sample. The suggests that at least one of the three instruments are correlated with the error term in workers' labour supply equation when all workers are kept in the sample. Given this, the instruments chosen here are not entirely satisfactory. I have also tried other possible area dummies such as $Wales$, $North\ Ireland$, but they fail the over-identification test in all three specifications. Despite the imperfections of the instruments, I adopt the 2SLS approach to see whether correcting for the endogeneity of $ln(wage)$ helps to get more accurate estimates of workers' labour supply equation.

In conclusion, in this section, I find that flexitime can effectively increase working mothers' labour supply. This empirical finding is in line with model prediction 1, since working mothers may be the group of workers that can derive much benefit from working with flexitime, and possibly they can work with flexitime at a low price.

Robustness Check 1: Correcting for Sample Selection Biases

Regressions using random effects imply positive relations between working mothers' labour supply and the flexitime working arrangements. However, this estimation strategy is subject to some shortcomings. We only observe workers' labour market characteristics such as wages and flexitime status when they are employed. Obviously those people who stay in the employment pool are not a random sample of the whole population. Failing to correct for the self-selection process may lead to biased estimation.

In this chapter, panel techniques rather than cross sectional techniques are used to explore the relationship between flexitime and workers' labour supply decisions. I follow the method discussed in (Wooldridge, 2010, chap. 19) to correct the sample selection problem in the panel dimension. The structural equation of interest is given by (3.20). Let s_{it} denote the selection status of respondents. $s_{it} = 1$ means the person is selected into the sample (i.e. the person is employed in that period) while $s_{it} = 0$ indicates that the person supplies zero market hours in that period. The selection process is assumed to be

$$s_{it} = 1[b + \Sigma_{m=1}^{M} \varphi_m X_{im} + \varpi House\_status_i + \theta health_i + v_{it} > 0] \qquad (3.21)$$

Equation (3.21) underlines the sample selection process. The vector X_i includes all the variables in the structural model (3.20) that can be observed among all workers. Note here X_i not only includes the explanatory variables in the current period but also contains all their lags, because the selection process is not only determined by current period situations, but also past information. In order to preserve more degrees of freedom, when estimating the sample selection equation I follow Mundlak's (1978) procedure. Instead of having all the explanatory variables of each period, I use the variables in the current period as well as their time averages.

Two additional variables are added to identify the selection process. The first is the $House\_status_i$, which records the housing status of the respondent: whether she owns the house she lives in, or has a mortgage, or rents it. Housing status is a good signal of people's financial status, which may significantly affect workers' participation decisions. Another variable is the health indicator–$health_i$, which records whether the respondents think their own health status prevents them from participating in the labour market.

Following Wooldridge (2010), I first estimate a probit regression of (3.21) for each time period and then collect all the inverse mill ratios, λ_{it}. Then I run a pooled regression of equation (3.20), including all the inverse mill ratios from the probit regression and the time averages of all explanatory variables in the structural equation. Table 3.6 reports the estimation results after correcting the sample selection bias. Now there are two coefficients reported for each explanatory variable (except for $Flexitime$ and $Male$). One is for the control variable in the current period, and the other is the coefficient associated with the time average of that particular explanatory variable. The time average of $Flexitime$ is not included because it is highly correlated with $Flexitime$ itself. Including both would lead to multicollinearity which makes both coefficients insignificant. Since I am interested in both quantitative and qualitative effects of flexitime on workers' labour supply, only workers' flexitime status in the current period is kept the equation.

Most estimation results do not differ very much from table 3.2. Children and non-labour income act as disincentives to market work. One significant change is that the coefficients associated with wages are positive after correcting for sample selection bias; suggesting it is important to correct for the fact that workers are non-randomly selected in to employment.

The qualitative relationship between workers' working hours and flexitime remains unchanged in table 3.6. Working mothers are most likely to respond

Table 3.6: Correcting for Sample Selection

		All workers		Female workers		Working mothers	
		(1)		(2)		(3)	
Flexitime		-1.446***		-.386**		.550**	
		(.120)		(.155)		(.264)	
Male		9.491***		n/a		n/a	
		(.103)					
ln(wage)		1.032***	3.133***	.754***	4.182***	1.752***	3.354***
		(.258)	(.235)	(.343)	(.372)	(.530)	(.592)
Age		.495**	-.125	.593***	-.058	-.945**	1.498***
		(.119)	(.121)	(.160)	(.165)	(.392)	(.396)
Age squared		-.006***	.0001	-.005***	-.002	.018***	-.025***
		(.001)	(.001)	(.001)	(.002)	(.004)	(.004)
Married		-.440***	-.662***	-1.121***	-2.305***	-.517	-3.822***
		(.281)	(.309)	(.369)	(.406)	(.612)	(.675)
Children		-2.826***	-1.353**	-4.995***	-2.880***	n/a	
		(.249)	(.281)	(.363)	(.415)		
Non-labour		-.0001***	.-0002***	-.0002***	-.0002***	-.00006	-.0004***
income		(.00003)	(.00004)	(.00005)	(.00006)	(.00004)	(.00007)
Education	First Degree	.057	-.507	.261	-1.440	-4.025	3.442
		(1.41)	(1.465)	(1.629)	(1.716)	(4.096)	(4.185)
	Hnd,teaching	1.006	-2.463	1.020	-3.600*	-1.481	.234
		(1.791)	(1.832)	(2.068)	(2.140)	(3.878)	(3.968)
	A level	-1.412	.478	-.368	-2.215	-7.575*	6.032
		(1.578)	(1.619)	(1.827)	(1.901)	(4.461)	(4.533)
	O level	-1.598	.875	-2.825	.015	-7.372	5.534
		(1.701)	(1.741)	(2.057)	(2.125)	(4.779)	(4.845)
	Cse	-3.101	2.117	-5.724*	1.434	-8.578	4.741
		(2.348)	(2.377)	(3.176)	(3.223)	(5.720)	(5.779)
	No qualification	-.359	-1.029	-1.313	-3.460	-7.202	5.002
		(2.039)	(2.066)	(2.848)	(2.898)	(6.099)	(6.152)
Poor health		-.819***	-.332	-.750**	-.603	-1.168*	2.024
		(.277)	(.418)	(.355)	(.547)	(.648)	(.974)
House in		.194	1.570***	.239	2.085***	-.328	1.440
Mortgage		(.267)	(.320)	(.363)	(.437)	(.820)	(.975)
Renting House		-.127	2.372***	.124	2.345***	-2.054**	2.802**
		(.357)	(.412)	(.492)	(.566)	(1.026)	(1.188)
Constant		22.347***		23.211***		17.292***	
		(1.035)		(1.408)		(3.263)	
R squared		0.27		0.24		0.11	
No.of obs		50602		26400		10184	

Source: BHPS, years 2001-2007.
The dependent variable is normal weekly working hours.
Time dummies are also included in the regression to control for the aggregate shock of each year.
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.
Column 3, 5 and 7 report the coefficients estimates of the control variable specified in column 1 at current period while column 4, 6 and 8 report the coefficient estimates of the time averages of those control variables. The mean of 'male' is not included in the regression because workers' genders do not change over time.

to flexitime by increasing their working hours. Working mothers with flexitime work 0.550 more hours each week than those who do not have flexitime. Still, when all workers are pooled together, flexitime is associated fewer hours, and this relationship also persists when only female workers are kept in the regression. Due to the nature of the regression, no causal relationship can be inferred from the estimation, but at least this provides some information about how flexitime affects different types of workers' labour supply decisions.

Robustness Check 2: Distinguishing Full time and Part time workers

As has been mentioned above, the variation of weekly working hours may be quite small. It is not easy for workers to choose their optimal working hours due to certain labour market frictions. Given such considerations, I focus on workers' labour supply by looking at their full time work status. Instead of exploring the effect of flexitime on weekly working hours, I investigated whether flexitime increases the chances of full time work. BHPS uses objective measurements to record whether the respondent is working full time or part time. Workers whose weekly working hours are below 30 hours are considered part time workers. Compared to full time workers, part time workers may have greater freedom in adjusting their working hours.

In this section, I conduct two types of analysis. First, I investigate whether flexitime increases workers' chances of working fulltime. Second, I estimate the labour supply equation (3.20) for full time workers and part time workers separately to see whether flexitime has different effects on them.

The model describing workers' full time status can be written as

$$Fulltime_{it} = d + a_{2i} + \pi \ln wage_{it} + \mu Flexitime_{it} + \Sigma_{m=1}^{M} \phi_m X_{imt} + \xi_{it} \quad (3.22)$$

where $Fulltime_{it}$ is the dependent variable, which denotes whether the worker is a full time worker or not at time t. It takes value 1 if the worker works full time and 0 otherwise. a_{2i} is the individual unobserved effect (not to be confused with the unobserved effect in equation (3.20)), X_{it} includes all workers' characteristics that may affect their labour supply choices at time t. ξ_{it} is the error term.

Equation (3.22) is estimated by a probit model with random effects. Table 3.7 reports the estimation results of equation (3.22).

According to table 3.7, flexitime is associated with higher chances of working full time. Overall, workers with flexitime are 9% more likely to work full time

Table 3.7: Estimation Results of Workers' Full Time Status Equation (3.22)

		All workers	Female workers	Working mothers
		(1)	(2)	(3)
Male		3.172***		
		(.076)		
Flexitime		.091**	.141***	.196***
		(.042)	(.047)	(.069)
ln(wage)		.096**	.060	.006
		(.040)	(.048)	(.076)
Age		.293***	.205***	.057
		(.015)	(.017)	(.049)
Age squared		-.004***	-.003***	-.00008
		(.0002)	(.0002)	(.0007)
Married		-.402***	-.633***	-.368***
		(.054)	(.060)	(.089)
Children		-1.523***	-1.812***	
		(.055)	(.061)	
Non-labour income		-.00006***	-.00005***	-.00003***
		(4.13e-06)	(5.40e-06)	(6.85e-06)
Education	First degree	-.044	-.147	-.361
		(.162)	(.192)	(.357)
	Hnd teaching	-.452**	-.626***	-.723*
		(.177)	(.210)	(.376)
	A level	-.577***	-.757***	-.969***
		(.160)	(.191)	(.354)
	O level	-.749***	-1.011***	-1.115***
		(.159)	(.189)	(.347)
	Cse	-1.277***	-1.744***	-1.751***
		(.188)	(.227)	(.392)
	No qualification	-1.345***	-1.744***	-1.421***
		(.169)	(.203)	(.377)
Constant		-2.381***	-.122	-.914
		(.305)	(.363)	(.966)
Log Likelihood		-12855	-9880	-4646
No. of obs		50669	26430	10189

Source: BHPS, years 2001-2007.
The dependent variable is *Fulltime*. Equation (3.22) is estimated by a probit model with random effects.
Time dummies are also included in the regression to control for the aggregate shock of each year.
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

than workers without flexitime. This effect is even bigger among female workers and working mothers than that of all workers pooled together. This shows that flexitime might affect workers' labour supply decisions on the extensive margin. Given that 90% of part time workers are female, and only 4% of the male workers work part time, a tentative conclusion is that the positive effect of flexitime on workers' full time working status is mainly driven by female workers.

Labour market frictions may prevent workers from choosing the exact amount of hours they prefer, but workers can still choose to work full time or part time. Compared to other European labour markets, British labour market features high female participation rates. Most female workers, especially those with children, work part time. In the BHPS data, more than half (56%) of the female workers work part time. If the introduction of flexitime can encourage more workers to work full time, then it could result in a substantial increase in the total labour supply of all workers. Part time work opportunities can be thought as flexible working schedules too. However, female workers who choose part time work usually end up with jobs that are below their education level and accumulated labour market experiences (Connolly and Gregory, 2008). Based on the results discussed above, flexitime helps workers stay in or move to a full time job, which reduces the inefficiencies involved in balancing work and home production.

In order to investigate the possible different effects of flexitime on full time workers' and part time workers' labour supply decisions, I estimate the full time and part time workers' labour supply equations separately. Table 3.8 reports the estimation results of equation (3.20) for part time workers only. Compared to full time workers, the variation in part time workers' hours should be bigger. More importantly, part time workers work far less than their time endowment. This means that there is room for them to increase their labour supply. Therefore, I expect that the positive effect of flexitime on workers' market hours will be bigger among part time workers than among full time workers. Table 3.8 reveals a similar pattern as shown in table 3.2. When all workers are pooled together, flexitime has little effect on part time workers' weekly working hours. However, when only working mothers are kept in the sample, the estimated coefficient is positive, which suggests that flexitime may increase part time working mothers' labour supply. However, we may see that though the flexitime coefficient in working mothers' equation is positive and significant, the size is small: flexitime increases working mothers weekly hours by 0.356. This might be because part time workers supply relative low number of working hours into the market; they have plenty of time devoted to child care. Working with flexitime may not increase their child

care production by enough to induce them increase their market hours by a large amount.

Table 3.9 reports the regression results for full time workers only. Unlike part time workers, full time workers' working hours exhibit a negative relationship with flexitime. Such negative relationship is not significant in working mothers' hours equation, which suggests that flexitime has little effect in increasing full time working mothers' labour supply.

A possible explanation for this negative relationship may be that some full time jobs require workers to stay at work for extraordinarily long hours. In this case, it might involve an enormous cost for the firm to provide flexitime to workers. Meanwhile, workers can not benefit much from flexitime since long working hours imply that there is not much room for them to vary their working hours. Therefore, these workaholic workers do not work with flexitime, and this could render the signs of the flexitime coefficients for full time workers to negative. Besides, no matter how helpful flexitime is in helping workers with their child care production, workers cannot supply more market hours than their time endowments. Full time workers already supply substantial working hours into the labour market, and there is little room for them to further increase their labour supply.

From tables 3.7 to 3.9, it can be seen that among full time workers, people who work with flexitime work less than those without flexitime. Flexitime can effectively increase part time working mothers' working hours. More importantly, flexitime increases the possibility of working full time. Possibly flexitime induces part time workers to increase their working hours, until they become full time workers. At this stage, with the help of flexitime, they already supply more market hours compared to other part time workers without flexitime, but compared to other full time workers, they still belong to the "low market hour" category. Consequently, we may observe flexitime is associated with lower working hours among full time workers.

In summary, this section shows how workers' labour supply responds differently to flexitime when they have different benefit to cost ratio associated with flexitime. Working mothers benefit from flexitime most, therefore they respond to flexitime by increase their working hours. Meanwhile, flexitime is also associated with higher chances of working full time for female workers.

Table 3.8: Part Time Workers' Weekly Hours Equation (3.20), Random Effects

		All workers	Female workers	Working mothers
		(1)	(2)	(3)
Male		.463		
		(.288)		
Flexitime		.227	.183	.356*
		(.148)	(.155)	(.187)
ln(wage)		-1.420***	-1.322***	-.840***
		(.192)	(.211)	(.282)
Age		.470***	.499***	-.043
		(.052)	(.059)	(.141)
Age squared		-.006***	-.006***	.001
		(.0007)	(.0007)	(.002)
Married		-.078	-.217	-.260
		(.219)	(.231)	(.279)
Children		-1.097***	-1.269***	
		(.218)	(.234)	
Non-labour income		-.00004	-.00004	-.00003
		(.00003)	(.00003)	(.00003)
Education	First degree	.260	-.285	-.004
		(.665)	(.718)	(.944)
	Hnd, teaching	.017	-.671	-.661
		(.717)	(.779)	(1.053)
	A level	.126	-.364	-.444
		(.649)	(.704)	(.948)
	O level	-.521	-1.235*	-1.236
		(.641)	(.696)	(.945)
	Cse	-1.265*	-2.134***	-2.264**
		(.713)	(.771)	(1.019)
	No qualification	-1.752***	-2.520***	-2.481**
		(.661)	(.721)	(1.010)
Cosntant		13.941***	14.250***	21.237***
		(1.174)	(1.302)	(2.642)
R squared		.02	.04	.005
Number of obs		9826	8922	5236

Source: BHPS, years 2001-2007.
The dependent variable is workers normal weekly working hours. Only part time workers are kept in the sample. Equation (3.20) is estimated by a Random effects model.
Time dummies are also included in the regression to control for the aggregate shock of each year.
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Table 3.9: Full Time Workers Weekly Working Hours Equation (3.20), Random Effects

		All workers	Female workers	Working mothers
		(1)	(2)	(3)
Male		5.257***		
		(.144)		
Flexitime		-.658***	-.522***	-.102
		(.104)	(.124)	(.213)
ln(wage)		-1.436***	-1.203***	-.892**
		(.224)	(.255)	(.447)
Age		.378***	.274***	-.036
		(.040)	(.050)	(.156)
Age squared		-.005***	-.004***	.0007
		(.0005)	(.0006)	(.002)
Married		.032	-.664***	-.563*
		(.134)	(.162)	(.317)
Children		-.780***	-1.883***	
		(.137)	(.198)	
Non-labour		-.00002	-.00004**	-.00006***
-income		(.00002)	(.00002)	(.00002)
	First degree	-.630	-1.330**	-1.917*
		(.411)	(.551)	(1.019)
	Hnd, teaching	-1.856***	-3.024***	-3.389***
		(.455)	(.624)	(1.117)
	A level	-2.219***	-3.877***	-4.057***
		(.416)	(.565)	(1.057)
	O level	-2.137***	-4.488***	-4.645***
		(.423)	(.568)	(1.044)
	Cse	-1.795***	-4.708***	-5.085***
		(.493)	(.646)	(1.172)
	No qualification	-2.300***	-5.752***	-5.003***
		(.474)	(.629)	(1.166)
Constant		38.563***	42.341***	44.757***
		(.785)	(1.032)	(2.979)
R squared		.07	.06	.03
No.of obs		40732	17414	4903

Source: BHPS, years 2001-2007.
The dependent variable is workers normal weekly working hours. Only full time workers are kept in the sample. Equation (3.20) is estimated by a Random effects model.
Time dummies are also included in the regression to control for the aggregate shock of each year.
For each variable, coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

3.4.3 Testing For Prediction 2

The model in described in section 3.3 predicts that if flexitime is very helpful in increasing child care production, then workers will increase their working hours, and workers with high human capital level will increase their hours more. If flexitime is not very helpful or involves large cost, only workers with high levels of human capital may increase their working hours, or high human capital workers are less likely to decrease their working hours with the help of flexitime. On the firms' side, they also have incentives to ask high human capital workers to work more hours in exchange for working flexitime. In summary, the working hours responses to flexitime are more likely to be positive (or less negative) for high human capital workers. In this section, this prediction 2 will be tested empirically.

In order to test prediction 2, two types information are used as proxies for workers' human capital level. The first one is workers' labour market experience[6], which reflects how long workers have participated in the labour market. The second is workers' education. Since the BHPS does not record exactly how many years the respondent has been working in the labour market, I follow the standard approach in labour economics to calculate the labour market experience, i.e. subtracting school leaving age from their age. Next I add an interaction term of workers' experience and flexitime $Exp * flexitime$ into workers' working hours equation (3.20) to see whether flexitime increases the labour supply of more experienced workers more than workers with little market experience. In this case, the labour supply equation to be estimated is:

$$\begin{aligned} H_{it} &= e + a_{3i} + \beta_2 Flexitime_{it} \\ &+ \upsilon_1 Experience_{it} + \upsilon_2 Exp * flexitime_{it} + \Sigma_{m=1}^{M} \vartheta_m X_{imt} + \epsilon_{it} \quad (3.23) \end{aligned}$$

where $Experience_{it}$ is workers' labour market experience, $Exp * flexitime_{it}$ is the interaction term, e is the constant, and ϵ_{it} is the error term. Since the effect of flexitime varies according to the length of working hours, workers are divided into three degree based on their weekly working hours: higher than 40 hours per week, less than 30 hours per week, and those between 30 to 40 hours per week. The idea is that the effect of flexitime on workers' labour supply could be hump shaped. For workers who already supply long hours, flexitime is of little use since they do not have much freedom to vary their working hours. For workers who supply few hours into the labour market, flexitime is not helpful either since they already

[6]The BHPS does not contain a proper measure of tenure. It only records how many days workers are working with current position rather than with current firm.

have enough time to take care of children. Flexitime should be most effective in increasing middle-level-market-hour workers' labour supply. For one thing they still have some space to increase their market hours, for another flexitime also gives them greater freedom than conventional 9-5 working schedules so that they can take better care of their children. Firms, on the other hand side, may also be interested in increasing middle-working-hours workers' labour supply since workers who work over 40 hours per week already supply labour close to their time endowment.

Table 3.10 reports the estimation results of equation (3.23). The first panel of table 3.10 displays the estimation results of equation (3.23) when I keep workers with all kinds of working hours together. Similar to what was reported in table 3.2, flexitime is associated with greater working hours among working mothers. In general, the interaction term of experience and flexitime is not statistically significant in workers' labour supply equation (3.23), suggesting that workers with long labour market experience do not increase their working hours more under a flexitime regime than workers with relatively short labour market experience. The second panel reports the estimation results for workers with very long hours (higher than 40 hours per week). Among those workers, flexitime is negatively correlated with working hours (or flexitime is jointly significant with the interaction term $Exp*flexitime$). The results show that flexitime decreases the working hours of those who already supply long hours into the labour market, and workers with longer labour market experience are observed to have their working hours decreased more than those with short labour market experience. This contradicts the model's prediction. However, workers in this category already supply many hours into the labour market, flexitime may be off little use to them since they do not have much room to vary their work schedule. In addition, firms may also be reluctant to provide flexitime to employees in very senior positions. As suggested by the descriptive evidence in table 1.4, some firms do not allow employees with managerial positions to work flexitime. Meanwhile, those workers with very senior positions in the company also tend to have greater labour market experience. Therefore, when we focus on the group of workers whose weekly working hours are long, flexitime is negatively correlated with workers' working hours, and some times long market experience reinforces such negative effects. As for workers who supply a middle level of working hours (between 30 and 40 hours per week), I find that working with flexitime increases female workers' and working mothers' labour supply, but the interaction term has little effect on workers' labour supply. As discussed above, this group of workers is expected to react to flexitime more

Table 3.10: Estimation Results of Weekly Working Hours Equation (3.23)

	All Workers	Female Workers	Working Mothers
All workers together:			
Flexitime	-.075	.072	1.443***
	(.226)	(.303)	(.536)
Experience	.401***	.338***	-.001
	(.023)	(.031)	(.07)
Exp*flexitime	-.009	.005	-.050
	(.011)	(.015)	(.033)
R squared	.23	.13	.02
No. of obs	48008	25228	10461
Workers with weekly hours higher than 40			
Flexitime	-.335[a]	-1.082***	-.683[b]
	(.260)	(.31)	(.601)
Experience	.156***	.159***	.253***
	(.021)	(.03)	(.079)
Exp*flexitime	-.011	.001	-.011
	(.013)	(.02)	(.048)
R squared	.02	.03	.04
No. of obs	21781	6534	1793
Workers with weekly hours between 30 and 40			
Flexitime	.082	.155*	.523**
	(.060)	(.08)	(.250)
Experience	.008	.003	.005
	(.005)	(.007)	(.027)
Exp*flexitime	-.004	-.003	-.024
	(.003)	(.004)	(.015)
R squared	.05	.02	.01
No. of obs	14362	8115	3256
Workers with weekly hours lower than 30			
Flexitime	.390	.221	.263
	(.282)	(.309)	(.487)
Experience	.300***	.304***	.103**
	(.022)	(.024)	(.052)
Exp*flexitime	-.013	-.010	.002
	(.012)	(.010)	(.030)
R squared	.02	.02	.007
No. of obs	10453	9378	5412

[a] $Flexitime$ and $Exp * Flexitime$ are joint significant at 1% level.
[b] $Flexitime$ and $Exp * Flexitime$ are joint significant at 10% level.
Source: BHPS, years 2001-2007.
The dependent variable is workers normal weekly working hours. Equation (3.23) is estimated by a random effects model. Other controls included are: $ln(wage)$, $Male$, $Married$, $Children$, $Experience\ squared$, $Non\ labour\ income$, Education dummies. Time dummies are also included in the regression to control for the aggregate shock of each year.
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

sensitively (and positively) than the other two groups of workers because they can benefit more from working flexitime and there is room for them to increase their labour supply. However, as shown by the empirical results in table 3.10, in this category, workers with long labour market experience (which can be thought of as a proxy for high human capital) do not increase their labour supply more when working with flexitime than workers with shorter labour market experience. The last panel of table 3.10 gives the estimation results for workers who work under 30 hours per week. This group of workers already has plenty of time to spend on child care production, and flexitime might be of little help to them. As a result, they are not likely to respond to flexitime by increasing their working hours, even for those with high human capital (long labour market experience). As shown in the last panel of table 3.10, through all three specifications, flexitime, as well as the interaction term of flexitime and labour market experience, has insignificant effect on workers weekly working hours.

To summarize, the estimation results displayed in table 3.10 do not support model prediction 2–I find no evidence suggesting that workers with high human capital increase their working hours more with the help of flexitime than workers with low human capital. One possible explanation might be that workers with long market experience already work long hours in the labour market compared with their counterparts in each working group. Therefore, the effect of flexitime on working hours may not be very large.

The way I construct the experience variable is to subtract workers' final school leaving age from their age. One shortcoming of this approach is that workers' labour market experience may not be accurately measured. For example, people may leave school and go to work for some years and come back to university again. In that case, the calculated experience variable may underestimate the true experience. More importantly, the experience variable calculated using the conventional approach is likely to overestimate the actual experience of female workers and working mothers. Many female workers and working mothers are likely to suffer years of career interruptions due to fertility-related reasons, and that is not considered when constructing the experience variable. Given the above concerns, the constructed labour market experience variable may not be the ideal measure of workers' human capital.

I also tried using workers' education as a proxy for workers' human capital. BHPS records the highest academic qualification held by the respondent, which is a relatively accurate measure of respondents' education level. Education level could be regarded as a measure of workers' general knowledge and ability. Human

capital theory developed by Becker (1975) points out that the knowledge and skills that workers learned at school are closely related to workers' productivity later on when they work in the labour market. Therefore, education can also be treated as a measure of workers' human capital level. It reflects workers' ability to deal with work related issues. In the following, education level is used as a proxy for workers' human capital. The empirical model is similar to equation (3.23), except that an interaction term of flexitime and educational information is included.

$$\begin{aligned} H_{it} &= f + a_{4i} + \beta_3 Flexitime_{it} \\ &+ \phi high\_degree_{it} + \eta high\_flex_{it} + \Sigma_{m=1}^{M} \gamma_m X_{imt} + u_{it} \end{aligned} \tag{3.24}$$

where $high\_degree_{it}$ is a dummy variable that takes value one if the worker has a higher than high-school degree at time t and zero otherwise. $high\_flex_{it}$ is the interaction term of flexitime and high degree. a_{4i} is individual unobserved heterogeneity, f is the constant, and u_{it} is the error term.

The null hypothesis is that high human capital (high degree) workers are more likely to respond to flexitime by increasing their working hours. It is expected that the coefficient of the interaction term η will be positive. Table 3.11 displays the estimation results of equation (3.24) for workers with weekly working hours higher than 40 hours.

According to table 3.11, throughout all three specifications, workers with high human capital level (high academic degrees) work more hours in the labour market than workers with low human capital. Flexitime decreases the number of weekly working hours. When all workers are pooled together, the presence of flexitime even significantly decreases the working hours of high human capital workers. This clearly contradicts the model prediction. However, for workers who are working more than 40 hours per week, their labour supply is already high and there is little room for them to increase their working hours. Particularly, substantial proportion of workers in this group supply more than 60 hours market work a week. Therefore, it makes little sense for them to use flexitime for they do not have much space to vary their working time. The higher the human capital level, the more likely that they will be workaholic and use flexitime less. If workers who work extraordinary long hours do not use flexitime, then it is not surprising that the coefficient on flexitime and the interaction terms on flexitime and human capital are negative when only workers with long working hours are kept in the sample.

Table 3.11: Estimation Results of Workers Weekly Working Hours' Equation (3.20), High Than 40 Hours

	All Workers	Female Workers	Working Mothers
Flexitime	-.287	-.861***	-.852
	(.194)	(.257)	(.535)
High_flex	-.700***	-.594	-.374
	(.333)	(.461)	(.725)
High_degree	1.078***	.796	.796
	(.217)	(.589)	(.589)
R squared	.02	.03	.03
No.of obs	23367	7079	1640

Source: BHPS, years 2001-2007.
The dependent variable is workers normal weekly working hours. Only workers with weekly working hours higher than are kept 40 in the sample. Equation (3.20) is estimated by a random effects model. Other controls included are: $ln(wage)$, $Male$, $Married$, $Children$, Age, $Age\ squared$, $Non-labourincome$.
Time dummies are also included in the regression to control for the aggregate shock of each year.
For each variable,a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Table 3.12: Estimation Results of Workers Weekly Working Hours' Equation (3.20), Less Than 30 hours

	All Workers	Female Workers	Working Mothers
Flexitime	289	.183	.237
	(.164)	(.180)	(.254)
High_flex	.059	.050	.045
	(.384)	(.415)	(.476)
High_degree	.749***	.978***	.883***
	(.258)	(.282)	(.376)
R squared	.11	.03	.007
No.of obs	11451	9706	4959

Source: BHPS, years 2001-2007.

The dependent variable is workers normal weekly working hours. Only workers with weekly working hours less than 30 are kept in the sample. Equation (3.20) is estimated by a random effects model. Other controls included are: $ln(wage)$, $Male$, $Married$, $Children$, Age, $Agesquared$, $Non-labourincome$.

Time dummies are also included in the regression to control for the aggregate shock of each year.

For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Things are different if we look at workers with very little labour supply. Table 3.12 displays the estimation results for workers with less than 30 working hours. It follows the same layout as table 3.11. There are very few observations in this group, and around 90% of workers in this group are female workers. This time, all three interaction terms ($high\_flex$) are insignificant, showing that the effect of flexitime does not vary across different human capital levels. Particularly, it can be seen that within this group, most workers do not respond to flexitime significantly either. When workers only supply very few hours into the labour market, the relative benefits they can drive from flexitime are correspondingly small (i.e. a is very small) for they have plenty time devoted to child care. Therefore, it is also difficult for flexitime to induce workers to supply more market hours even though their market hours are far less than their time endowment.

Table 3.13 reports the results of workers whose weekly working hours are between 30 and 40 hours. For this group of workers, unlike those over-40 hours workers, labour supply is not high so there still plenty room to increase their market hours. Also, when compared with the below-30 hours workers, this group benefits more from flexitime. Therefore, when provided with flexitime, this group of workers is more likely to increase their working hours. Particularly, from table 3.13 it can be seen that the coefficients of variable $high\_flex$ are always positive and statistically significant, suggesting that flexitime is mainly acting on workers with high human capital levels to induce them supply more hours into market work. For this group of workers, it is observed that high human capital workers do respond more than low human capital workers.

The shortcoming of using education level as a proxy for human capital might be that it contains less information on the accumulated human capital from actual work. It does not properly discriminate between employees with different skills since most of these will have been accumulated during their work in the labour market. Therefore, the results shown above are only suggestive.

In the model, I only focus on the supply side decisions. However, in the labour market, firms may set the number of working hours and workers are unable to work the exact amount of hours they desire (Altonji and Paxson, 1988). In other words, firms, instead of workers, may choose to set a different amount of working hours according to workers' flexitime status. Particularly, flexitime may reduce workers' utilization[7]. By asking those flexitimers to work more hours firms can mitigate some of the costs of flexitime. This would apply more forcibly to high

[7]For instance, under a flexitime regime, workers' may devote their most productive time period to family duties rather than jobs, or firms may need to hire additional staff to cover the absence of flexitimers when they are not available because of family duties.

Table 3.13: Estimation Results of Workers Weekly Working Hours' Equation (3.20), Between 30 and 40 Hours

	All workers	Female workers	Working mothers
	(1)	(2)	(3)
Male	.763***		
	(.043)		
Flexitime	-.032	.059	.061
	(.043)	(.059)	(.085)
High_flex	.166**	.183*	.327*
	(.072)	(.110)	(.196)
Highdegree	-.113**	.019	.030
	(.050)	(.073)	(.143)
ln(wage)	-.002	.056	-.111
	(.049)	(.068)	(.116)
Age	.073***	.064***	-.045
	(.013)	(.018)	(.062)
Age squared	-.001***	-.001***	.0006
	(.0002)	(.0002)	(.0008)
Married	-.028	-.178**	-.031
	(.048)	(.070)	(.130)
Children	-.221***	-.418***	
	(.046)	(.072)	
Non-labour income	-.00003***	-.00003***	-.00003**
	(5.76e-06)	(9.12e-06)	(1.00e-05)
Constant	35.293***	35.483***	37.013***
	(.217)	(.310)	(1.129)
R squared	.07	.04	.02
No.of obs	15122	8366	2433

Source: BHPS, years 2001-2007.

The dependent variable is workers normal weekly working hours. Only workers with weekly working hours between 30 hours and 40 hours are kept in the sample. Equation (3.20) is estimated with by a random effect model.

Time dummies are also included in the regression to control for the aggregate shock of each year.

For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

human capital workers, whose request for flexitime are more likely to be granted by firms. Due to the data limitations, I have little information on firms' choices of flexitime. Therefore the positive relationship between flexitime and working hours among workers who work between 30 and 40 hours per week when using education information as proxy for human capital may be because firms insist on a higher number of working hours rather than workers deciding to increase their working hours. In other words, we need to take account of firms' flexitime provision choices and working hours offers when interpreting the estimation results.

To conclude, when using workers' labour market experience as a proxy for their human capital level, I do not find evidence supporting model prediction 2. The estimation results suggest that workers with high human capital do not increase their labour supply more when working with flexitime than low human capital workers. When using workers' educational information as a proxy for their human capital levels, I find that among workers whose weekly working hours are between 30-40 hours, the main positive effect of flexitime on workers' labour supply is driven by the high human capital workers (those with high academic degrees). Since both measures of the human capital (experience and education) may have some potential shortcomings, the empirical evidence on model prediction 2 is only suggestive and needs to be interpreted with caution.

3.4.4 Market Work v.s. Child Care

The above analyses show that when provided with flexitime practice, working mothers tend to reallocate their time endowments and spend more time in the labour market work than before. This may lead to concerns about what will happen to workers' child care and to children's well-beings. Intuitively, spending less time on child care does not necessarily decrease children's welfare in the flexitime scenario.

Flexitime improves the child care production efficiency. This mitigates the effects of less time devoted to child care. For example, without flexitime, workers go to work according to the rigid schedules (e.g.9 to 5). This time window is also the period during which children need parents' attention. There is little time the parents can spend with the children after they get off work. However, when workers are working with flexitime, workers can choose to take care of the children in the daytime and work in the evening or the early morning. They can also reschedule their working time so that they work during the time when children are at school.

To some extent, flexitime acts as if it expanded workers' time endowment span

and more time were available to workers now (as shown in the model). Recent papers on women's time allocation find that during recent decades, female workers, especially highly educated female workers spend more time in both work and child care. Ramey and Ramey (2009) find that mothers in the United States increased their child care time along with labour market work time during past two decades. Aguiar and Hurst (2007) report similar findings. Since the probability of working with flexitime is positively related with workers' human capital levels (which can be signalled by their educational achievements), this finding can be explained by the fact that flexible working practices became more popular in the developed world during recent years. With the help of flexitime, high-educated workers can expand both working time and child care time more easily than their counterparts who do not have flexitime.

Moreover, the model developed in this chapter abstracted form the fact that time and monetary expenditure could be close substitutes in the child care production process. If flexitime encourages more labour supply, it also increases workers' labour income for both current period and future periods because of the human capital accumulation process. The income effects suggest that workers are able to spend more money on their children, perhaps by providing them better education. Olivetti (2006) argues that with higher wages, women tend to substitute monetary expenditure for time in producing child care, and so long as the wealth effects dominate, children will be better off.

3.4.5 Other Issues

So far the empirical results shown above only provide a descriptive analysis of the relationship between flexitime and workers' labour supply. It is difficult to use instrumental variables in the estimation because it is difficult to find exogenous variables which are not correlated with the error term. I try to use firm size and occupation as instruments, but the results hardly changed. Another issue is that in this chapter, only employees' working hours are considered. In fact, flexitime not only affect workers' working hours choices but also workers' participation choices. Therefore, the effect of flexitime on workers' labour supply decisions discussed in this chapter can be regarded as a lower bound of the true effect.

3.5 Conclusion

This chapter explores the relationship between flexitime and workers' labour supply decisions. A basic model is developed to show that flexitime can only induce

high levels of market work if the benefit-cost ratio (increased child care production efficiency relative to the compensating wage differentials effect) brought by flexitime falls into a certain range. In other words, flexitime needs to generate sufficient gains in child care production compared to the wage reduction to induce higher levels of labour supply. Meanwhile, workers with high human capital levels are more likely to respond to flexitime by increasing their market hours than low human capital workers. The model also suggests that flexitime provides workers with additional incentives to engage in market work. Anticipating high future labour supply under the flexitime regime, workers may increase current period labour supply.

Empirical evidence confirms some predictions of the model. When working with flexitime, working mothers are more likely to supply more hours than those who do not have flexitime. Working mothers can benefit more from flexitime (they have a higher a). Meanwhile, they are also likely to be engaged in jobs that have low cost in providing flexitime (they have a lower b). Therefore, female workers with children should frequently fall into the area where $\frac{ab}{1-b} \geq T$, and then they may increase their working hours when provided with flexitime. There is also evidence suggesting that flexitime is associated with higher chances of full-time work. It could be that flexitime frees more time for workers so that they are able to shift from part time work to full time work.

Flexitime can be used as an effective tool to reduce working mothers' costs of participating in the labour market and boost labour supply. The findings of this chapter suggest that it is not only the availability of family friendly policies that matters, but also the costs of working with such practices. Though the United Kingdom, government has put forward many policies encouraging workers with children to request flexible working opportunities from their employers, there are still many firms do not provide flexible working to their employees. The British Equal Opportunities Commission Study reports that the proportion of firms that provide flexible working schedules to workers is much less in Britain than that of mainland Europe (British Equal Opprtunities Commision, 2007). Golden and Altman (2007b) point out that the supply of flexitime is always behind the demand due to technological constraints. It is possible that currently in the United Kingdom the cost of employees requesting flexitime is still too high to induce workers to supply more hours. Sometimes the cost involved may be so high that workers may not even ask for it. The same case also applies to other types of flexible working patterns, like part time work. Connolly and Gregory (2008) find that many people need to experience downward occupation mobility

in order to get part time opportunities. Based on the findings of this chapter, in order to have flexitime really help female workers balance their home production and work responsibilities, measures should be taken to encourage firms to provide flexible working at low prices. Current legislation gives employees the right to request flexitime from the employers, but more effort should be made to make sure that those requests are granted without bringing too much cost to the employees.

Appendix B

B.1 Proof of Proposition 1

Proof. Setting (3.9) and (3.10) equal to zero, the critical human capital levels that enable workers to participate in the labour market (supply positive numbers of working hours) in both flexitime and non-flexitime case are:

$$\hat{h} = \frac{R}{T} \tag{B.1}$$

$$\hat{h^f} = \frac{R}{b(T+a)} \tag{B.2}$$

where $\hat{h^f}$ is the critical human capital level that enables workers to participate in the labour market when workers work with flexitime, and $\hat{h}$ is the critical human capital level that enables workers to participate in the labour market when workers do not have flexitime.

If the critical human capital level that enables workers to participate in the labour market is lower under the flexitime scheme ($(B.2) \leq (B.1)$), it means that flexitime encourages more workers to participate in the labour market. In this case, the benefit to cost ratio associated with flexitime is very high:

$$\begin{aligned} \hat{h} &\geq \hat{h^f} \\ \frac{R}{T} &\geq \frac{R}{b(T+a)} \\ &\Rightarrow \frac{ab}{1-b} \geq T \end{aligned} \tag{B.3}$$

When inequality (B.3) is satisfied, there are three cases.

Case 1: when workers' human capital are below certain level ($h \leq \frac{R}{b(T+a)}$), they will not participate in the labour market, regardless of their flexitime status. In this case, under both flexitime and non-flexitime schemes, the number of working

hours will be zero ($n^{f*} = n^* = 0$).

Case 2: when workers' human capital are between between certain levels ($\frac{R}{b(T+a)} < h \leq \frac{R}{T}$), they will participate if they have flexitime but not if they do not have flexitime ($n^{f*} > n^* = 0$). In this case, workers work strictly more with flexitime than they do without flexitime.

Case 3: when workers' human capital are above a certain levels ($h > \frac{R}{T}$), they will participate in the labour market in both flexitime scheme and non-flexitime scheme. They will work more market hours under the flexitime scheme than they do under the non-flexitime scheme. The difference in workers' working hours under two schemes can be written as:

$$\begin{aligned} n^{f*} - n^* &= (\frac{T+a}{2} - \frac{R}{2bh}) - (\frac{T}{2} - \frac{R}{2h}) \\ &= \frac{a}{2} - \frac{R(1-b)}{2bh} \end{aligned} \tag{B.4}$$

Given $\frac{ab}{1-b} \geq T$ and $h > \frac{R}{T}$,

$$n^{f*} - n^* > 0 \tag{B.5}$$

From the analysis discussed in case 1 and case 2, it can be seen that flexitime encourages more workers to participate in the labour market. Conditional on participation, according to expression (B.4), the higher the human capital levels, the larger the difference between the optimal working hours under flextime and non flexitime schemes. In other words, high human capital workers increase more market work hours than low human capital workers when provided with flexitime.

■

B.2 Proof of Proposition 2

Proof. First, given the participation constraints specified in equation (B.1) and (B.2), it can be seen that when the benefit to cost ratio associated with flexitime is low ($\frac{ab}{1-b} < T$), the entry level human capital is higher under flexitime scheme ($\hat{h} < \hat{h^f}$). This suggests that fewer workers are participating in the labour market under flexitime scheme than under the non-flexitime scheme. Flexitime will not always increase workers' labour supply.

If $\frac{ab}{1-b} < T$, there are in total three cases.

Case 1: when workers' human capital is below a certain level ($h \leq \frac{R}{T}$), they will not participate in the labour market under both schemes. In this case, under both flexitime and non-flexitime schemes, number of working hours will be zero

$(n^{f*} = n^* = 0)$.

Case 2: when workers' human capital is between certain levels ($\frac{R}{T} < h \leq \frac{R}{b(T+a)}$), they will supply positive number of working hours if they do not work with flexitime, and choose to not to participate in the labour market in the flexitime scheme. In this case, $n^* > n^{f*} = 0$.

Case 3: conditional on participation, only workers with human capital higher than a certain level will work more hours under flexitime scheme than they do under non-flexitime scheme. In order for workers to work more under the flexitime scheme, it must be the case that:

$$\begin{aligned} n^{f*} - n^* &> 0 \\ \frac{T+a}{2} - \frac{R}{2bh} &\geq \frac{T}{2} - \frac{R}{2h} \\ \Rightarrow h &\geq \frac{R}{\frac{ab}{1-b}} \end{aligned} \tag{B.6}$$

Combined with the results discussed in all three cases, we can conclude that when flexitime is not very helpful with workers' child care production and is expensive, only high human capital workers will increase their working hours under the flexitime scheme.

One thing worths noticing is that when flexitime leads to substantial wage reduction, workers are not always better off under the flexitime scheme. In order for workers to take up flexitime, the benefits and costs associated with flexitime must satisfy condition (B.7).

$$\begin{aligned} V^f &\geq V^{nf} \\ (bn^{f*}h + R)(T - n^{f*} + a) &\geq (n^*h + R)(T - n^*) \end{aligned} \tag{B.7}$$

where V^f and V^{nf} are the maximum utility that can be obtained when workers work with and without flexitime respectively. Plugging (3.9) and (3.10) into (B.7), we will have

$$\frac{a\sqrt{b}}{1-\sqrt{b}} + \frac{1}{\sqrt{b}}\frac{R}{h} \geq T \tag{B.8}$$

Inequality (B.8) gives the condition under which workers will take up flexible working. Inequality (B.3) is a sufficient condition for condition (B.8) to hold. In other words, when the benefit-cost ratio associated with flexitime is high ($\frac{ab}{1-b} \geq T$, which means flexitime is very helpful with child care production and workers do not need to sacrifice substantial wages in order to work with it), workers are

always better off when they are working with flexitime. ■

B.3 Proof of Proposition 3

Proof. When $\frac{ab}{1-b} \geq T$, it follows that

$$\frac{a\sqrt{b}}{1-\sqrt{b}} + \frac{1}{\sqrt{b}}\frac{R}{h_2^f} \geq T \tag{B.9}$$

for all positive values of h_2^f, where h_2^f is second period human capital with flexitime. Inequality (B.9) guarantees that workers will be able to achieve higher utility in the flexible world than in the non-flexible world. The marginal utility of one hour of first period market work in the flexible world is given by:

$$\begin{aligned} \frac{\partial U^f}{\partial n_1} &= h_1 T - 2n_1 h_1 - R_1 \\ &+ \beta b \delta h_1 (\frac{T+a}{2} + \frac{R_2}{2bh_1(1+\delta n_1)})(\frac{T+a}{2} - \frac{R_2}{2bh_1(1+\delta n_1)}) \end{aligned} \tag{B.10}$$

where U^f represents the utility of working in the flexible world. The marginal utility of one hour of market work in the non-flexible world is:

$$\begin{aligned} \frac{\partial U^{nf}}{\partial n_1} &= h_1 T - 2n_1 h_1 - R_1 \\ &+ \beta h_1 \delta (\frac{T}{2} + \frac{R_2}{2h_1(1+\delta n_1)})(\frac{T}{2} - \frac{R_2}{2h_1(1+\delta n_1)}) \end{aligned} \tag{B.11}$$

where U^{nf} represents the utility in the non-flexible world. The second line of (B.10) can be rewritten as:

$$\beta \delta h_1 (\frac{T+a}{2} + \frac{R_2}{2bh_1(1+\delta n_1)})(\frac{b(T+a)}{2} - \frac{R_2}{2h_1(1+\delta n_1)}) \tag{B.12}$$

Given $\frac{ab}{1-b} \geq T$ and $b \leq 1$, it follows that

$$(\frac{T+a}{2} + \frac{R_2}{2bh_1(1+\delta n_1)}) \geq (\frac{T}{2} + \frac{R_2}{2h_1(1+\delta n_1)})$$

and

$$(\frac{b(T+a)}{2} - \frac{R_2}{2h_1(1+\delta n_1)}) \geq (\frac{T}{2} - \frac{R_2}{2h_1(1+\delta n_1)})$$

Therefore,

$$\frac{\partial U^f}{\partial n_1} \geq \frac{\partial U^{nf}}{\partial n_1} \tag{B.13}$$

Inequality (B.13) suggests that when flexitime is helpful and cheap ($\frac{ab}{1-b} \geq T$), the marginal utility of first period market work is higher in the flexible world than that in the non-flexible world. This inequality suggests that workers will supply more first period market work in the flexible world than in the non-flexible world:

$$n_1^{f*} \geq n_1^* \tag{B.14}$$

As a result, the labour supply of workers with flexitime in the first period will be higher than that of the workers without flexitime. As they move to the second period, given the initial human capital level h_1 and the human capital accumulation process, workers in the flexible world now have accumulated more human capital than workers in the non-flexible world ($h_2^f \geq h_2$). In the second period, workers are facing a static maximization problem. It has been shown in the static case that when $\frac{ab}{1-b} \geq T$, workers will supply more hours of market work with flexitime than without flexitime regardless of their initial human capital levels, and that human capital always acts as an incentive for market work in the static case. Because

$$h_2^f \geq h_2$$

we can have:

$$n_2^{f*} \geq n_2^* \tag{B.15}$$

■

B.4 Proof of Proposition 4

Proof. First, workers can only enjoy the benefit of flexitime if and only if they participate in the labour market. The second period labour supply must be positive. The second period maximization problem is the same as that in the static case. The entry human capital level in the second period is:

$$\begin{aligned} h_2^f &\geq \frac{R_2}{b(T+a)} \\ \Rightarrow n_1^{f*} &\geq (\frac{R_2}{h_1 b(T+a)} - 1)\frac{1}{\delta} \end{aligned} \tag{B.16}$$

where n_1^{f*} is given by (3.18). The right hand side of inequality (B.16) gives the minimum level of first period working hours that guarantees second period participation. If workers do not work up to the level specified in (B.16), then cannot enjoy the benefit of flexitime for they do not participate in the second period.

Condition (B.9) may not hold in this case. Now flexitime is associated with low benefits and high costs. It may not be optimal for workers to take up flexitime at the costs of substantial wage reductions. From (B.9) it can be seen that the lower the ratio of $\frac{ab}{1-b}$, the more likely that the inequality does not hold and workers' do not choose to work with flexitime.

Combining (B.9) and (B.16), we can conclude that when flexitime is not very helpful, or is associated with substantial wage costs, we would only observe flexitime if

$$\sqrt{b}(T - \frac{a\sqrt{b}}{1-\sqrt{b}}) \leq \frac{R_2}{h_2^f} < b(T+a) \tag{B.17}$$

The left part of inequality (B.17) ensures that workers are better off when they are working with flexitime, and the right part of (B.17) is the participation constraint. h_2^f is the implied by (3.18) and (3.3). If inequality (B.17) does not hold, workers will work more (or equal) hours in the non-flexible world than in the flexible world[1].

From now on, I will discuss the situation when inequality (B.17) holds. Starting from second period, where workers are facing a static maximization problem, they will supply fewer working hours if

$$\begin{aligned} h_2^f &\leq \frac{R_2}{\frac{ab}{1-b}} \\ \Rightarrow n_1^{f*} &\leq (\frac{R_2}{h_1(\frac{ab}{1-b})-1})\frac{1}{\delta} \end{aligned} \tag{B.18}$$

where n_1^{f*} is given by (3.18). Inequality (B.18) suggests that workers who do not accumulate enough human capital in the first period work less in second period with flexitime than without flexitime. Combined with (B.10) and (B.11), it can be verified that the marginal utility of market work in the first period is also smaller when workers work with flexitime in this case. Workers' marginal utility

[1]If inequality (B.17) does not hold, there might be two situations. First, workers may participate in the non-flexible world but not in the flexible world. In this case, workers' labour supply is higher intensively in the non-flexible world. Second, workers participate in both worlds, but they do not choose to work with flexitime in the flexible world. In this case, workers' utility maximization problems in both worlds are the same, and workers supply the same amount of hours in flexible and non-flexible world.

of market work in the first period in both flexible world and non flexible world are given by (B.10) and (B.11). Comparing (B.10) and (B.11), the first three items are the same. Given $\frac{ab}{1-b} < T$, it follows that

$$\beta\delta bh_1(\frac{T+a}{2} + \frac{R_1}{2bh_1(1+\delta n_1)}) \quad < \quad \beta\delta h_1(\frac{T}{2} + \frac{R_2}{2h_1(1+\delta n_1)}) \tag{B.19}$$

and if inequality (B.18) holds,

$$\frac{T+a}{2} - \frac{R_2}{2bh_1(1+\delta n_1)} \leq \frac{T}{2} - \frac{R_2}{2h_1(1+\delta n_1)} \tag{B.20}$$

Combining (B.19), (B.20), (B.10) and (B.11), it follows that

$$\frac{\partial U^f}{\partial n_1} < \frac{\partial U^{nf}}{\partial n_1} \tag{B.21}$$

Inequality (B.21) suggests that if the relative benefit to cost ratio associated with flexitime is not high enough (i.e. if $\frac{ab}{1-b} < T$) and workers do not work long hours in the first period (B.18), working with flexitime decreases the marginal utility of working in the first period, which in turn leads to fewer working hours in both periods for workers in the flexible world. Besides, the right hand side of inequality (B.18) is an decreasing function of workers' initial human capital level h_1. Therefore, the higher the human capital level, the less likely that inequality (B.18) will hold, and the less likely that workers' working hours will respond negatively in both periods to flexitime. However, if inequality (B.18) does not hold, then it is not clear in what direction flexitime will change the marginal utility of market work in the first period and the overall effect of flexitime on labour supply is ambiguous. ■

B.5 Adding Union Membership

Table B.1: Workers' Labour Supply Equation (3.20) with Union Membership

		All workers	Female workers	Working mothers
		(1)	(2)	(3)
Male		11.089***		
		(.187)		
Flexitime		-.303**	.064	.694***
		(.119)	(.155)	(.231)
ln(wage)		-1.878***	-1.993***	-1.728***
		(.228)	(.286)	(.415)
Age		.852***	.775***	.163
		(.050)	(.068)	(.193)
Age squared		-.011***	-.011***	.00003
		(.0006)	(.0009)	(.003)
Union		1.183***	1.936***	1.750***
		(.154)	(.212)	(.327)
Married		-.572***	-1.921***	-1.008***
		(.161)	(.217)	(.361)
Children		-3.424***	-6.317***	
		(.174)	(.277)	
Non-labour income		-.0001***	-.0002***	-.0001**
		(.00003)	(.00005)	(.00004)
Education	First degree	-.531	-1.557**	-2.838**
		(.520)	(.735)	(1.400)
	Hnd teaching	-2.326***	-3.838***	-4.230***
		(.580)	(.841)	(1.444)
	A level	-3.022***	-4.682***	-5.479***
		(.529)	(.761)	(1.417)
	O level	-3.564***	-6.240***	-6.686***
		(.535)	(.773)	(1.456)
	Cse qualification	-4.622***	-8.704***	-9.044***
		(.619)	(.897)	(1.542)
	No qualification	-5.207***	-9.569***	-8.466***
		(.580)	(.833)	(1.524)
Constant		27.048***	33.203***	31.498***
		(1.013)	(1.434)	(3.749)
R squared		.22	.18	.04
No. of obs		50669	26430	10189

Source: BHPS, years 2001-2007.
The dependent variable is normal weekly working hours. Equation (3.20) is estimated by a random effects model. In this specification, union membership is added as an additional control variable.
Time dummies are also included in the regression to control for the aggregate shock of each year.
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at the 1% level.

Chapter 4

Flexitime, Job Satisfaction and Job Mobility

Abstract

This chapter investigates how the provision of flexitime affects workers' job satisfaction levels and job mobility decisions. When provided with flexitime, both male and female workers report higher overall job satisfaction, but female workers' positive response to flexitime is only observed when they have young children at home. Flexitime also decreases female workers' chances of quitting their jobs if they have young children. This suggests that female workers value flexitime as a family-friendly practice that helps them balance work and home production responsibilities. On the other hand, male workers' labour mobility decisions are not affected by flexitime, and the way they respond to flexitime has little to do with child care responsibilities. Most male workers who enjoy flexitime are high-rank employees that take senior positions in the company, while female workers with flexitime usually take up jobs that can provide flexitime at low costs like secretaries and administrative positions. There is also some suggestive evidence showing that job mobility is an important mechanism that workers adjust their flexitime status to desired levels.

Keywords: Quit, gender differences, work and home production balances

4.1 Introduction

As per the prediction of the compensating wage differential theory, all dimensions of a job affect workers' wages (Rosen, 1986). However, how workers value the non-pecuniary side of a job is not only reflected by the wage differentials that they would like to pay, but also how they may change their job mobility decisions given wage and non-wage job dimension combinations. Workers may attach different importance to different job dimensions: Clark (1997) finds that male workers tend to rank monetary payoffs as the most crucial factor that determines their job satisfaction while female workers may put the number of working hours as their first priority. With the increase of female participation rates across all major developing countries, it has become increasingly important to know which what factors female workers take into account when they make labour market decisions. The previous literature has emphasized the importance of working hours in workers' labour market decisions (Clark, 1997; Blundell et al., 2005), but few studies have explored the importance of working hours flexibility. This chapter investigates how workers' preferences towards non-monetary dimensions of the job (flexible working arrangements) can be reflected in their self reported job satisfaction levels and their job mobility decisions. The particular type of flexible working arrangement analysed in this chapter is called "flexitime". It is a practice that enables workers to choose when to start and end their work given fixed contract hours.

Job mobility is one of the most important mechanisms through which workers adjust their jobs features and labour supply decisions to desired levels (Farber et al., 1999; Altonji and Paxson, 1992). In a world with labour market frictions (such as asymmetric information), workers are not always allocated to the jobs that suit their preferences best. The conventional literature on job mobility predicts that a worker will quit her job if the lifetime income stream generated by an alternative job offer surpasses the current one (Farber et al., 1999). However, monetary incentives alone are not enough to explain workers' job mobility, or at least not enough to explain female workers' job mobility decisions, since they attach greater importance to the compatibility between work and child care duties. Blundell and Macurdy (1999) find that as much as 40% of full time female workers prefer to work fewer hours than their current contract hours. Altonji and Paxson (1992) find that workers realize their preferred working hours by changing their jobs. By giving workers the freedom to vary the starting and ending time of their work, flexitime may help workers feel less stressed given the same number of working hours so that they are more likely to be satisfied with their jobs, and

therefore less likely to quit.

This chapter contributes to the existing literature in the following respects. First, it analyzes the effect of a non-monetary job dimension–flexitime–on workers' job satisfaction levels and job mobility decisions using data from a nationwide survey. Second, it links workers' job satisfaction and job mobility behaviour together and shows to what extent factors that affect workers' job satisfaction levels may also affect their quit probabilities. Third, it analyses the gender differences in their responses to flexitime and conclude that flexitime means different things to male and female workers.

The main findings of this chapter can be summarized as follows. First, workers who work with flexitime report higher job satisfaction than those who do not have flexitime, controlling for relevant job and worker characteristics. Among female workers, the positive relationship between flexitime and job satisfaction is only present when they have young children to take care of. Male workers are in general happier with their jobs when working with flexitime, regardless of whether they have young children at home. Second, flexitime is also associated with a lower quitting probability among female workers when they have young children. For male workers, working with flexitime does not significantly affect their quitting probability. The gender differences in their reactions to flexitime could imply that workers may work with flexitime for different reasons. To male workers, flexitime is a non-monetary incentive and perhaps a signal of a good job. Flexitime is perhaps appreciated by male workers, but it is not crucial when they are making job mobility decisions. Third, workers who quit their jobs have a greater chance of experiencing a change in their flexitime status. This might imply that "flexitime constraints" existed in the labour market. It might suggest that it is difficult for workers to adjust their flexitime status within jobs. They need to change their jobs if they want to change their flexitime status.

The rest of this chapter is organized as follows. Section 4.2 reviews previous literature on job mobility. Section 4.3 discusses the conceptual framework and empirical specifications. Section 4.4 gives the empirical results. Section 4.5 concludes.

4.2 Previous Literature

There has been a large literature addressing the reasons that workers quit their jobs. Most studies in this area focus on the role of monetary payoffs. The central idea is straightforward: workers compare the expected income stream generated

by their current job and the best alternative job, and they will opt for the job that offers a higher payoffs, taking into account the potential risk of uncertainty and search costs (Farber et al. 1999). Farber et al. (1999) give a comprehensive review of the features of job mobility in the United States and the United Kingdom. They summarize that the probability of job mobility is decreasing with workers' tenure. Based on data from US and UK, they find most employment relationships are long lasting; jobs ending in relatively short periods are usually newly created ones.

Many theories have been put forward the explain the driving forces behind workers' job mobility behaviour. The first strand of theories on job mobility emphasizes the role of firm-specific human capital in workers' job mobility decisions (Topel, 1991). Workers accumulate specific human capital (possibly in the form of some firm-specific skills) which increases workers' productivity and may lead to further wage growth associated with tenure. After quitting, the worker loses all firm specific human capital and cannot enjoy the benefits brought by tenure. Therefore it is often observed that the quitting probability is positively related to workers' tenure. Topel (1991) develops a two-step estimator to obtain a lower bound estimation of the return to tenure using a longitudinal data set. He finds tenure significantly increases workers wages, which explains why senior workers are less likely to quit. Because it is costly to hire new employees who do not have any firm-specific human capital, firms design payment schemes so that workers' payments increase with seniority. Anticipating wage growth in the future, workers are less likely to quit their jobs when they have already spent a long time in the firm. Another group of theories attribute motivation of voluntary job turnover to the firm-worker match quality (Mortensen, 1978). Workers who learn of low quality matches quit early. Consequently, all the remaining matches are good quality ones and will last long. Farber et al. (1999) note that the firm-worker match quality can also be regarded a type of specific human capital.

Search also plays an important role in workers job mobility behaviour. On-the-job search enables workers to find possible outside opportunities, but also involves substantial costs. Burdett (1978) develops a model that incorporates dynamics on the job search, arguing that the probability of workers quitting their jobs depends on the quality of their outside opportunities, which in turn depends on the intensity of workers' efforts in job search. In this case, age and wage rates are the main determinants of workers' job mobility behaviour, while tenure does not matter much. Workers with high wages are less likely to quit than low-wage workers. Older workers are less willing to engage in the on-the-job

search behaviour than young workers, for they have less time left to repay the search costs.

Some studies find that unobserved heterogeneity among workers determines the probability of quitting (Farber et al., 1999; Topel and Ward, 1992). There are simply two different types of workers: "high mobility" types and "low mobility" types. Low mobility workers may have some features that make them more willing to stay with firms than high mobility workers. There is an overlap between the type theory and the specific human capital accumulation theory. For example, the existing heterogeneity may be driven by the fact that some workers are good at accumulating firm specific human capital, or less likely to exert effort on searching for new jobs, which leads to a lower probability of voluntary turnover. In this case, workers' "types" determine job mobility, and the effect of tenure is small (Topel and Ward, 1992).

Most empirical studies on the determinants of workers' job mobility focus on monetary payoffs and tenure. Abraham and Farber (1987) use instrumental variables approach to estimate a workers' earnings equation and a job duration function. They find a positive correlation between workers' job duration and their wages. Topel and Ward (1992) attempt to explain the frequent job mobility and rapid wage growth among American young men in their early careers. After controlling for individual heterogeneity, they conclude that wage is the driving factor of job mobility behavior. Galizzi and Lang (1998) confirm the hypothesis that future wage growth is the major determinant of workers' mobility decisions. They use information on the payment of workers with similar characteristics as an approximation of their outside wage offers. They find that workers are more likely to quit their jobs if they are paid less than other workers with similar characteristics. Gielen and van Ours (2010) find that the effect of wage on workers' job mobility is U-shaped. Lower-end workers are underpaid and are likely to receive job offers with higher wages than their current jobs. This may lead to high quitting rates among low wage workers. Workers on the higher end are also likely to quit because they can attract favorable job offers outside. They also find that workers with a high predicted probability of quitting are more likely to experience wage growth when they stay within the firm, which suggests that firms would like to offer higher wages to skilled workers to prevent turnover. Similarly, after controlling the selection into voluntary and involuntary quits, Perez and Rebollo Sanz (2005) find that voluntary quits are usually accompanied by large wage growth.

Compared to the substantial literature that documents the effect of wages and

tenure on job mobility, research on how non-monetary incentives affect workers' job mobility decisions is relatively sparse. But Clark (2001) and Rosen (1986) note that jobs contain far more elements than have been addressed by the conventional labour economics literature. Clark (2001) points out that worker-firm match quality can be reflected in job satisfaction levels. He argues that workers' self reported job satisfaction levels are good predictors of their future quits. Clark's (2001) research represents a novel strand of the literature on the determinants of quitting, which uses workers' job satisfaction as a "measure" of their job quality. Similar studies include Lincoln and Kalleberg (1996) as well as Akerlof et al. (1988).

Job satisfaction can only serve as an approximation of job quality and it is difficult to compare across workers. Some studies use objective measures of job attributes to analyze workers' quitting behaviour. Bartel (2002) investigates how unfavorable working conditions and repetitiveness affect workers' job mobility decisions. Young workers are more likely to quit if they are engaged in repetitive jobs, but they do not seem to mind bad working conditions so much as middle-aged workers do. On the contrary, middle-aged workers do not tolerate bad working conditions. Groot and Verberne (1997) consider the effect of less attractive working conditions on workers' job-to-job mobility patterns along with the age effect. They find that workers' job mobility rates decrease with ages because older workers have less time to make up for the costs of moving. Ophem (1991) develops a on the job search model that incorporates searching for non-wage elements to explain the relative importance of current wages, future wages and job characteristics in workers on the job search decision making process. They find that non-wage characteristics like promotion expectations, overtime, and commuting time significantly influence chances of mobility.

Other non-wage aspects of a job like fringe benefits (health insurance, life insurance, pensions) are also important factors that will influence workers' mobility decisions. These benefits usually cannot be carried to a new job when workers leave the firm. The potential loss of those benefits adds to the cost of mobility, which may decrease workers' chances of quitting. The phenomenon that workers are reluctant to quit their jobs for the sake of certain employer-specific benefits is termed "job lock". Madrian (1994) looks into the relationship between employer-provided health insurance, expected medical expenses and job mobility using a novel difference-in-difference approach. He compares the mobility differences between workers with and without employer-provided health insurance taking into account the differences in their expected medical expenses. Workers

with high expected future medical expenses are less likely to quit their jobs than workers with low expected future medical expenses (when provided with health insurance). He find that the provision of health insurance reduces the turnover probability by as much as 25%. Mitchell (1982) considers a broad range of fringe benefits including pensions and various kinds of insurance, and finds a significant negative relationship between mobility and fringe benefits, especially when the fringe benefits package includes a pension. Andrietti (2001) concludes that pension-covered workers are less likely to change their jobs than workers without pensions because they do not want to lose the pension benefits when they move jobs.

There are few economics studies discussing how flexible working arrangements may affect workers' job mobility, despite their importance in shaping workers' labour market behaviour. One exception is Connolly and Gregory (2008). They examine the relationship between occupational mobility and working part time. They find that part time work is often accompanied with a downward occupational mobility. Though this is not a direct estimation of the relationship between flexible working arrangements and job mobility, it to some extent shows the difficulties workers face when they want to work flexibly.

The current study extends the previous literature on job mobility by considering a job dimension-flexitime-that may affect workers' job mobility decisions. I also investigate whether flexitime is correlated with workers' overall job satisfaction level, for workers' job satisfaction is closely related to their job mobility decisions. There are few economics studies investigating the relationship between job flexibility and job satisfaction; two exceptions are Bender et al. (2005) and Asadullah and Fernandez (2008). Both studies try to explain the gender gap in workers' job satisfaction reported in previous job satisfaction literature. Clark (1997) shows that despite their disadvantaged labour market positions, female workers persistently report higher job satisfaction levels than male workers. Bender et al. (2005) point out that this gender difference might be because female workers are more likely to be self-selected into more flexible[1] jobs so that they can take better care of their family responsibilities. Using U.S data, they find that female workers who work in male-dominated firms do not report higher job satisfaction levels than their male counterparts. Asadullah and Fernandez (2008) find that even after including various measures of family-friendly policies, there is still a significant gender gap in job satisfaction levels. There also a couple of studies in sociology which documents the positive effect of flexitime on workers'

[1]They define "flexible" job as jobs that help workers with family responsibilities.

attitudes towards their work and organizational commitments (see Golden and Altman, 2007b for a review).

4.3 Conceptual Framework and Empirical Specifications

In this section, I describe a simplified version of Groot and Verberne's (1997) one period model with compensating wage differentials associated with non-wage elements of a job to explain how flexitime status may affect workers' job mobility decisions.

Assume that workers' utility obtained from a job consists of two elements, wage (W) and whether the job provides flexitime (F)

$$U = U(W, F) \tag{4.1}$$

where F is a dummy variable that takes value 1 if the job provides flexitime and 0 otherwise. Given the same wage, workers weakly prefer to work with flexitime:

$$U(W, 1) \geq U(W, 0) \tag{4.2}$$

For each worker, there is certain wage differentials ($D \geq 0$) that will induce the worker to value a job without flexitime same as she values a job with flexitime:

$$U(W - D, 1) = U(W, 0) \tag{4.3}$$

The amount of additional compensation needed to make workers indifferent between jobs with and without flexitime depends on worker's characteristics, i.e. how much does she value flexitime. Assuming it is costly for firms to provide flexitime[2], firms may charge a market price ΔW for workers who want to work with flexitime. Simple utility maximization tells that workers compare the wage differential charged by the firm (ΔW)to their own valuation and will choose to work with flexitime if

$$\Delta W \leq D \tag{4.4}$$

Inequality (4.4) simply means that workers will choose to work with flexitime if they value flexitime more than its market price.

[2]For example, new technology may be needed to record the actual working hours of the worker who takes flexitime, or the firm may need to hire additional staff that could cover the duty of the flexi-timers in case of emergency, or some administrative costs.

When workers are thinking about leaving the firm, they need to consider the whole compensation package including both wages and flexitime. Assuming that there are certain mobility costs (C) involved when workers decide to move to another job, and (W_a, F_a) represents the best alternative job offer, the net return of moving to another job is

$$U(W_a, F_a) - U(W, F) - C \tag{4.5}$$

where W_a is the alternative wage offer, and F_a is the alternative flexitime offer. Workers will choose to move if (4.5) is greater than 0,

$$U(W_a, F_a) - U(W, F) - C \geq 0 \tag{4.6}$$

Inequality (4.6) means that the utility gain from moving to another job must exceed the costs of quitting in order to induce workers to change jobs.

Thus, firms compete for workers in both monetary and non-monetary dimensions. Since flexitime enters positively into workers utility function, outside firms need to offer more favorable compensation packages (either provide flexitime or offer high wages) in order to induce workers who currently have flexitime to quit. In other words, flexitime acts as a disincentive to quit. Similarly, flexitime also makes it easier for firms which can provide flexitime to attract workers from competitors that do not provide flexitime.

We can also look at the problem dynamically. Suppose workers can accumulate specific human capital (e.g. firm specific skills) by staying with the same firms. Flexitime reduces workers' quitting probability in the current period, thus workers with flexitime are more likely to accumulate higher levels of specific human capital, which makes them even less likely to quit their jobs in the future. In this case, flexitime is not only a non-wage job dimension that discourages quitting, but also a mechanism that reinforces the role of specific human capital accumulation in workers' job mobility decisions.

According to this basic model, factors that affect workers' mobility decisions are: current and best alternative wage offer (W and W_a), current and alternative flexitime status (F and F_a), how much workers value flexitime (D), and their mobility cost (C).

$$Prob(quit = 1) = f(W, W_a, F, F_a, D, C) \tag{4.7}$$

Among those factors described in equation (4.7), current wage (W) and current

flexitime status (F) can be observed, but we cannot observe the best alternative offer and mobility cost. We only observe workers' alternative offer when they move to another job. For those who stay with their original employers, their alternative offers are never revealed. Therefore, we can only use workers' characteristics and their job history information to approximate those unobservable factors. We can assume that workers' best alternative wages (W_a) are largely determined by their productivity, which in turn is influenced by their educational achievements and labour market experiences. The possible flexitime offer (F_a) also depends on workers educational achievements[3]. In addition, how much flexitime is valued by each worker (D) depends on their parental status (i.e. whether they have children at home) and whether they take the main responsibility for child care. Factors affecting workers' mobility costs include workers' age and the industries they are working in. Groot and Verberne (1997) suggests that worker' ages decrease the probability of quitting because older workers have less time left to generate income to overcome the mobility costs than younger workers. Similar findings are also reported by Topel and Ward (1992); Gielen and van Ours (2010). Industries affect workers' mobility costs in the sense that they may contain information about how much effort the workers need exert to find new jobs. Workers in industries that feature higher unemployment rates may be more reluctant to quit their jobs. The wage compensation structure in each industry may also affect workers' chances of getting outside offers that trump the current one. Tenure is also included in workers' job mobility equation. It may affect wages via the specific human capital accumulation process. What is more, tenure is also associated with workers' chances of getting flexitime within the firm in the future. Unfortunately in the BHPS data set tenure is defined as how long the workers have been doing the job rather than how long the worker has been working with the employer, so the coefficient of "tenure" in the regression table needs to be interpreted with caution.

In summary, the job mobility equation estimated in this chapter is:

$$\begin{aligned} Prob(Quit_{it} &= 1|X_{it}, c_i) \\ &= \Phi(a + c_i + \beta Flexitime_{it} + \eta Flexitime * Children_{it} \\ &+ \sum_{m=1}^{M} \gamma_m P_{imt} + u_{it}) \end{aligned} \tag{4.8}$$

[3]In my second chapter, I find that flexitime is more frequently observed in professional and skilled jobs; there is a positive relationship between workers' educational level and the chances of working with flexitime.

where t is the time index, *Quit* is a dummy variable that takes value 1 if the worker reports that she quits the job, and 0 otherwise. X is the vector of regressors including both workers' and jobs' characteristics that may affect workers' mobility choice and full sets of time dummies. c_i is individual unobserved heterogeneity.

The second line of equation (4.8) further specifies the control variables. $Flexitime$ denotes worker's flexitime status, $Flexitime * Children$ is the interaction term of flexitime and children. Adding this interaction term enables me to know whether working parents respond to flexitime differently than workers without young children at home. P is the vector of all other measured factors that may affect workers' job mobility decisions. To be more specific, the vector P includes the following variables: $Children$, $Married$, Age, $Age\ squared$, $Female$, $ln(wage)$, $Hours$, $Tenure$, $Education$, $Industries$ and $Occupations$. $Children$ is a dummy variable that takes value 1 if the respondent has children under the age of 16 and 0 otherwise. $Married$ is a dummy variable which takes value 1 if the respondent is married and 0 otherwise. Age is the age of the respondent, $Age\ squared$ is the square of age, $Female$ is a dummy variable that takes value 1 if the respondent is female and 0 if the respondent is male, $ln(wage)$ is the natural logarithm of workers' real hourly wage, $Hours$ is the respondent's normal weekly working hours. $Tenure$ is the number of years that the respondent has been working with current job. $Education$ is measured by the highest qualification obtained by the respondent. The BHPS divides workers' educational degrees into 7 levels: higher degree (postgraduate degrees), first degree, hnd, hnc, teaching degree, A level qualification, O level qualification, Cse qualification, No qualification. $Industries$ records the industries of the respondent's employer, and $Occupations$ denotes the occupation of the respondent. Both industries and occupations are controlled at one digit level. $\Phi(.)$ is the standard normal *cdf*, and u_{it} is the error term.

In this chapter, equation (4.8) is estimated by a probit model with random effects using panel data. Farber et al. (1999) and Topel and Ward (1992) point out that some unobserved individual heterogeneity may determine that there are "high mobility" type workers and "low mobility" type workers. The advantage of using panel data when studying the determinants of workers' job mobility decisions is that it takes into account unobserved individual heterogeneity that may systematically affect the probabilities of voluntary job mobility (Madrian 1994).

However, treating the individual unobserved heterogeneity term c_i as an parameter to estimate using fixed effects in the probit models leads to biased estimates (Wooldridge, 2010, pg. 612). Wooldridge (2010) points out that consistent

estimation of equation (4.8) using a random effects model requires very strong assumptions about the distribution of individual unobserved heterogeneity (c_i). Particularly, traditional probit models with random effects assume that c_i is independent of all the control variables X_{it} and follows a normal distribution with mean 0 and variance σ_c.

$$c_i|X_i \sim Normal(0, \sigma_c) \tag{4.9}$$

Assumption (4.9) is very restrictive. It not only does not allow any correlation between the individual heterogeneity and control variables, but also specifies the distribution of c_i. One possible way to relax the assumption is to assume a normal distribution of c_i conditional on the time averages of all the other explanatory variables (Wooldridge, 2010, chap. 15). Instead of assuming (4.9), we assume that:

$$c_i|X_i \sim Normal(\psi + \overline{X_i}\xi, \sigma_a) \tag{4.10}$$

where

$$c_i = \psi + \overline{X_i}\xi + a_i \tag{4.11}$$

where σ_a is the variance of c_i conditional on the average of all explanatory variables. Intuitively, this means that we estimate the effect of the explanatory variable on dependent variable (in our case, the effect of flexitime on workers' quit probability) holding the time averages of all the control variables (Wooldridge, 2010, chap. 15). Wooldridge (2010) refers this estimation strategy as "Chamberlain random effects model". When using this model, we still need to assume a conditional normal distribution of unobserved factors (c_i), but we can at least allow certain types of correlation between the unobserved heterogeneity term and the explanatory variables implied by equation (4.11). Still, it is assumed that the error term (a_i) in equation (4.11) is not correlated with the explanatory variables. Compared to the conventional random effects probit models, the chamberlain random effects model has the advantage of allowing the correlation between unobserved factors and the explanatory variables and therefore may reduce the bias in the estimated coefficients. In practice, the Chamberlain approach is implemented by adding the time average of the explanatory variables ($\overline{X_i}$) (except the full set time dummies) into estimation equation (4.8) as additional regressors. Here in this chapter, I mainly report the regression results using the conventional random effects model. I also estimate equation (4.8) using Chamberlains' random effects model as a robustness check, and the results do not change.

4.4 Data and Empirical Results

4.4.1 Data and Sample Statistics

The data used in this chapter are from the British Household Panel Survey (hereafter BHPS) wave 11 to wave 17 (years 2001-2007). It is a comprehensive survey which interviews 10,000 respondents in Britain annually and follow the same individuals over the years. It contains rich information on respondents' labour force status, income, job characteristics and their labour market decisions over years.

The primary variable of interest is the job mobility variable *Quit*. The BHPS has an indicator recording whether an individual is holding a different job than at the previous interview. If the respondent reports she has a different job she left the old job intentionally, I code this as a quit. The BHPS records respondents' job mobility status based on their self-reported statistics, which is subjected to the criticism that respondents tend to claim they initiate the separation even when they are dismissed. McLaughlin (1991) points out that quits are usually followed by a more rapid wage growth and lower chances of experiencing involuntary unemployment immediately after the separation than layoffs. In this chapter, the main interest lies in how workers respond to working with flexitime when making job mobility decisions, so I only focus on workers' voluntary job turnover events (i.e. quits). One possible way to check the validity of these self-reported statistics in the BHPS may be to look at the subsequent job status of those who claim they quit their jobs. Workers who move to another job immediately after the separation are likely to be the true quits while those who are unemployed after the separations may be separations for other reasons. Clark (2001) uses the early waves of BHPS data, showing that most of the self-report quits are reliable according to their subsequent job status[4].

Table 4.1 displays the job status of workers who report separation for voluntary and involuntary reasons. The first block of table 4.1 displays the job status for workers that: (i) quit (ii) were dismissed sacked or made redundant (iii) left their jobs for other reasons[5]. The second block gives the average real hourly wages of all employed workers in their *new* jobs for each job mobility category.

In the current data set, only 2% of workers who say they quit their jobs are

[4]Clark (2001) shows that as much as 95% of the respondent who report they quit their previous job end up with going to another job in one year time.

[5]Other reasons include: promoted, temporary job ended, took retirement, stop for health reasons, left to have baby, children and home care, care of other persons in the household, move area, started college or university, other reasons (reasons that are not specified by the respondent).

unemployed by the time of the next BHPS interview; 96% have found new jobs and 2% have dropped out of the labor force because of other reasons. These numbers are very close to what have been found by Clark (2001) using earlier waves of the same data set. Among workers who are dismissed, sacked or made redundant, only 65% have another job by the time of the next interview, and 26% end up in the unemployment pool. Within the group of job separations for reasons other than quits and layoffs, 72% of the respondents are in employment after the ending of previous job spell, and only 8% of them are unemployed. Based on the statistics of respondents' after-job-separation job status, most self-reported quits were followed by another job, which to some extent validates the self-reported quitting events. What is more, the statistics also show that people who quit their jobs are different from those who are fired or made redundant. The latter group is much more likely to be unemployed than the former group. The average real hourly wages of the new jobs for workers who reports quits is £9.95, which is £3.75 higher than for workers who are dismissed. This suggests that workers who quit their jobs are more productive than those who are laid off. The average real hourly wage of workers who quit their jobs is £0.44 less than that of workers who left for other reasons. However, this result is not surprising considering that job separation for other reasons in the BHPS data also includes the "promotion" category. In summary, the statistics reported in table 4.1 show that respondents who quit their jobs are more likely to find another job and get high wages than those who leave their jobs involuntarily.

In order to reduce the self report bias on job mobility status, in this chapter, only those who have another job after they report quitting their previous job are treated as actual quits.

Family friendly practice like flexitime adds up to the costs of job mobility and therefore may reduce quitting probability, encouraging long term attachment between firms and employees. Figure 4.1 displays the relationship between quits and flexitime for all workers together and for full time workers, respectively. In both graphs, the vertical axis represents the fraction of workers that quit their jobs, and the horizontal axis lists different workers' types. Here I divide all workers into four groups: male workers with and without children under 16 years old, female workers with and without children under 16 years old. Within each group, I tabulated the incidence of quitting by their flexitime status.

As shown by figure 4.1, in most cases workers with flexitime have a lower probability of quitting than workers without flexitime. An exception is the female employees without young children group, where those with flexitime have

Table 4.1: Job Status After Quitting and Other Job Separation

		Quits	Dismissed or sacked or made redundant	Other reasons
Job status after quits	Employed	90.50%	59.35%	66.46%
	Self-employed	5.42%	5.57%	5.67%
	Unemployed	2.08 %	26.09%	7.07%
	Other job status	2.00 %	9.09%	20.80%
No.of obs		3,507	1,257	7,439
Mean of hourly wage		9.95	6.20	10.39

Source: British Household Panel Survey, years 2001-2007.
"Other job status" includes: retired, maternity leave, family care, full time student, sick and disabled, start government training programme.
"Other reasons" includes: promoted, temporary job ended, took retirement, stopped health reasons, left to have babies, children or home care, care of other person, move area, start college or university.

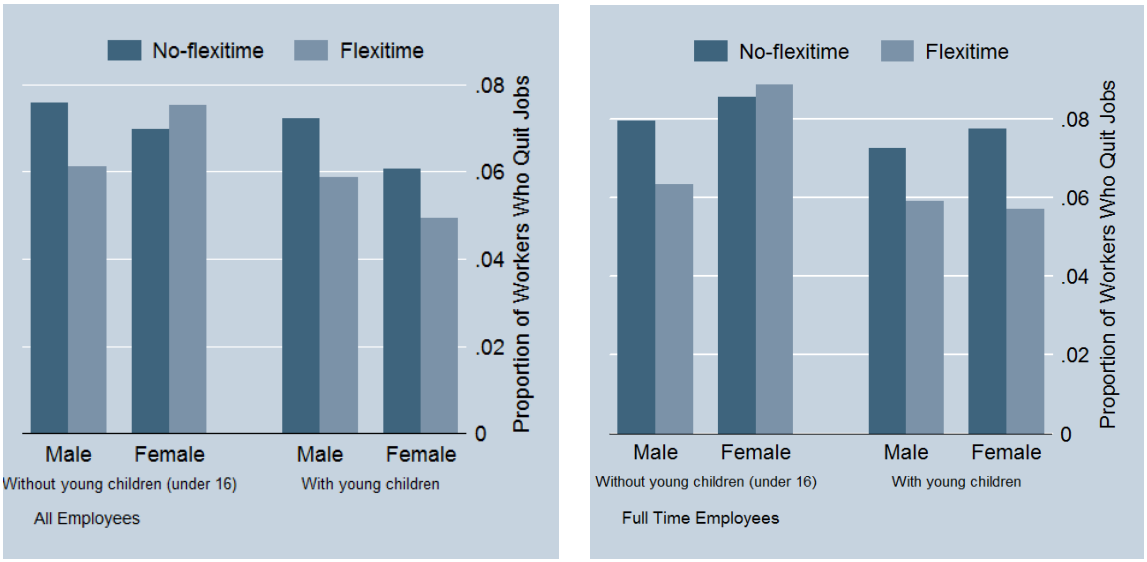
slightly higher chances of quitting than those who do not have flexitime (though the difference is very small). When only full time workers are kept in the sample, the differences in quitting rates between workers with different flexitime status are even more prominent. Among male workers, flexitime is consistently associated with a lower probability of quitting, but the difference has little to do with whether there are children in the household. Unlike male workers, the quit-flexitime relationship among full time female workers is closely related to their parental status. Full time female workers with young children are less likely to quit their jobs when working with flexitime than working without flexitime.

Table 4.2 gives the sample statistics of variables used in the chapter. Each year, around 6% to 7% of all employees report that they quit their jobs. The proportion of workers that worked with flexitime is around 15% to 22%. Average age of all workers in the sample is about 37. Female respondents account for 53% of the sample. 54% of the respondents in the sample are married. Around 36% of the respondents have children in the household. On average workers work around 33 hours each week. Average job tenure is around 4 to 5 years.

4.4.2 Flexitime and Job Satisfaction

Flexitime provides employees a way to balance work and home production responsibilities. However, little is known about how flexitime is appreciated by

Figure 4.1: Flexitime and Quits: Descriptive Statistics



Source: British Household Panel Survey, years 2001-2007.

Around 93% male workers are full time workers, and 62% female workers are full time workers.

Table 4.2: Sample Statistics of Variables in Job Mobility Equation

	wave 11 year 2001	wave 12 year 2002	wave 13 year 2003	wave 14 year 2004	wave 15 year 2005	wave 16 year 2006	wave 17 year 2007
Quit	.07	.07	.07	.07	.06	.06	.06
	(.26)	(.26)	(.26)	(.26)	(.25)	(.25)	(.25)
Wage	10.00	10.52	10.67	11.00	11.09	11.42	11.56
	(6.25)	(6.98)	(7.55)	(9.28)	(7.22)	(7.04)	(7.40)
Flexitime	.22	.14	.18	.15	.15	.15	.16
	(.42)	(.34)	(.37)	(.35)	(.35)	(.35)	(.35)
Age	37.28	37.56	37.84	38.09	38.12	38.92	38.87
	(12.11)	(12.16)	(12.29)	(12.45)	(12.52)	(12.36)	(12.51)
Married	.54	.54	.54	.53	.52	.53	.53
	(.49)	(.49)	(.49)	(.49)	(.50)	(.50)	(.50)
Children	.37	.36	.36	.36	.36	.36	.36
	(.48)	(.48)	(.48)	(.48)	(.48)	(.48)	(.48)
Male	.47	.47	.47	.47	.47	.47	.47
	(.50)	(.50)	(.50)	(.50)	(.50)	(.50)	(.50)
Hours	37.31	37.10	36.91	36.74	36.62	36.75	36.86
	(13.57)	(13.09)	(13.21)	(13.17)	(12.97)	(12.58)	12.79
Tenure	4.77	4.63	4.85	4.88	5.10	5.14	5.32
	(6.03)	(5.86)	(6.17)	(6.17)	(6.13)	(6.10)	(6.22)
No.of obs	9148	8127	7953	7750	7567	7195	7049

Source: British Household Panel Survey, years 2001-2007.
For each variable, both mean and standard deviation (in parentheses) are reported.

different types of workers. The relationship between flexitime and job satisfac-

tion is helpful in understanding what the most important job dimensions are for workers. More importantly, as argued by Freeman (1978) and Clark (2001), job satisfaction is also a good predictor of job mobility. Unsatisfied employees are more likely to leave their jobs than employees who are happy with their jobs. This section gives some descriptive evidence showing the effect of flexitime on workers' job satisfaction levels.

The job satisfaction model can be described as:

$$\begin{aligned} JS^*_{it} &= e + \alpha_i + \pi_1 Flexitime_{it} + \pi_2 Flexitime * Children_{it} \\ &+ \sum_{m=1}^{M} \varphi_m P_{imt} + \varsigma_{it} \\ JS_{it} &= j \text{ if } \mu_{j-1} < JS^*_{it} < \mu_j, j = 0, 1....6 \\ &\text{and} \quad \mu_{-1} = -\infty, \mu_0 = 0, \mu_j = \infty \end{aligned} \tag{4.12}$$

where JS^*_{it} is the latent job satisfaction variable, and JS_{it} is workers' actual reported overall job satisfaction level. e is a constant, α_i is workers' individual unobserved heterogeneity, ς_{it} is the error term in the latent job satisfaction equation. μ is the cutoff point. The rest of the notation in the latent job satisfaction equation are the same as defined in equation (4.8). Each job satisfaction variable is coded in 7 levels, 1 to 7, with the smallest number meaning not satisfied at all and biggest number meaning very satisfied with the jobs.

Table 4.3 reports the estimation results of equation (4.12) using an ordered probit model with random effects. Positive coefficient estimates unambiguously suggest higher chances of reporting the highest job satisfaction level and lower chances of reporting not satisfied with their jobs at all. It is not clear how will the probability of reporting a middle category satisfaction level changes (Greene, 2003, pg. 833).

According to table 4.3, the provision of flexitime is associated with higher levels of reported job satisfaction when all workers are kept in the sample. This suggests that workers working with flexitime tend to report higher levels of job satisfaction than workers without flexitime. This finding is not surprising given that flexitime may help workers with balancing work and home responsibilities, or provide a better way for them to enjoy leisure time. However, there are gender difference in their job satisfaction responses to flexitime. Male workers are happier with their jobs when working with flexitime than they are without flexitime, regardless of whether they have children at home. Whether female workers are happier with their jobs when they work with flexitime depends on whether they

Table 4.3: Flexitime and Overall Job Satisfaction

Dependent variable: overall job satisfaction			
	All workers	Female workers	Male workers
Flexitime	.071***	.031 [a]	.126***
	(.021)	(.028)	(.031)
Children*Flexitime	.038	.056	.031
	(.032)	(.043)	(.050)
Female	.187***		
	(.021)		
Age	-.055***	-.041***	-.082***
	(.004)	(.006)	(.007)
Age squared	.0007***	.0005***	.001***
	.00006	(.00008)	(.0009)
Children	.049**	.032***	.054**
	(.019)	(.026)	(.028)
Married	.110***	.143***	.050**
	(.018)	(.024)	(.029)
Hours	-.006***	-.008***	-.001
	(.0007)	(.0009)	(.001)
ln(wage)	.144***	.075***	.255***
	(.016)	(.022)	(.024)
Tenure	-.00004***	-.00005***	-.000049***
	(3.53e-06)	(5.19e-06)	(4.85e-06)
Education dummies	yes	yes	yes
Ind & Occ dummies	yes	yes	yes
Time dummies	yes	yes	yes
Log likelihood	-71920.943	-37294.064	-34436.733
No.of obs	53430	28243	25187

[a] *Flexitime* and *Flexitime* $*$ *Children* are jointly significant at the 5% level.
Source: British Household Panel Survey, years 2001-2007.
The dependent variable is workers' overall job satisfaction level. Equation (4.12) is estimated by an ordered probit model with random effects.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5%. ***: significant at 1% level.

have children in the household. This could be reflected by the joint significance of $Flexitime$ and $Flexitime * Children$ in female workers' job satisfaction equation. To this extent, it might be suggestive that the flexitime increases female workers' job satisfaction via the channel of helping them take better care of their children so that they can balance work and home responsibilities. These results seem counterintuitive in the sense that female workers benefit more from flexitime than male workers, given that they take the main responsibility for child care. There are at least two possibilities for the gender differences suggested in table 4.3. One might be that flexitime affects female and male workers in different ways. To male workers flexitime could act like a non-monetary incentive. It might be a signal of a good job, or a senior position in the company. To female workers, flexitime might act like a family-friendly policy, which helps them with child care. As a result, female workers will appreciate flexitime more if they have children in the household. Another tentative explanation might be that whether workers are happier when provided with flexitime depends on their relative expectations. Clark (1997) argues that women's low expectations can explain part of the existing gender gap in the job satisfaction levels. It might be the case that compared with male workers, female workers are more likely to take flexitime for granted. A substantial proportion of female workers work in industries or occupations where it is relative easy to obtain flexitime[6]. Observing that many other female workers are working with flexitime, female workers themselves may have a high expectation about flexible working conditions being provided at the work place. Therefore, we may not observe them report higher levels of job satisfaction when provided with flexitime.

Other coefficients estimates shown in table 4.3 seem to be in line with the previous literature. Female workers are more likely to report higher job satisfaction than male workers, though they are often observed to be in a more disadvantage situation. Real hourly wage has in a positive relationship with job satisfaction for all workers. Long working hours decrease workers' overall job satisfaction. This negative relationship is particularly significant in female workers' job satisfaction equation, suggesting that female workers particularly dislike working long hours.

Compared with Bender et al. (2005) and Asadullah and Fernandez (2008) on the relationship between job satisfaction and job flexibility, this chapter has the advantage of using panel techniques to control for individual unobserved heterogeneity. Besides, I also focus on the importance of children in affecting female

[6]According to BHPS data set, 17.87% of all employed female workers are working with flexitime.

workers' job satisfaction levels when they work with flexitime. To conclude, the estimation results in this section suggest that flexitime is associated with high levels of job satisfaction for both genders. In addition, there is some evidence suggesting that whether female workers appreciate flexitime is closely related to whether they have children to take care of.

4.4.3 Flexitime and Job Mobility

The previous section discussed how flexitime affects workers' overall job satisfaction levels controlling for various job and workers' characteristics. This section investigates whether the effect of flexitime on workers' job satisfaction levels is translated into workers' job mobility behaviour. If flexitime makes people happier with their jobs, it may also decrease their probability of quitting. Job-to-job mobility is one of the major mechanisms for workers to move to jobs that involve preferred amount of working hours (Blundell and Macurdy, 1999). Because the cost of providing flexitime may vary across firms, it might be difficult for employees to obtain flexitime within the firm even in the presence of government legislation that encourages employees to request flexitime from their employers. Therefore, it is expected that workers who do not have flexitime but have a strong preference for flexitime will leave their jobs for jobs that do provide flexitime. Meanwhile, since flexitime is not a portable job dimension, workers who already work with flexitime may be reluctant to leave current firms.

The job mobility equation is specified by equation (4.8), in which the dependent variable is a dummy variable coding workers' quitting behaviour. It takes value 1 if the respondent quits her job, and 0 otherwise. Equation (4.8) is estimated by probit with random effects.

Table 4.4 reports the estimation results of workers' job mobility equation (4.8). Again the workers are divided into two groups by gender. Most estimates are in line with the previous job mobility literature as well as the findings in the job satisfaction section. Factors which lead to higher job satisfaction also decrease the probability of quitting. For instance, high hourly wages reduce individuals' chances of quitting, and long working hours are associated with higher probability of quitting. Corroborating the findings of Farber et al. (1999), the probability of quitting declines with tenure. In the BHPS, the tenure variable is defined as the number of years the employee has been holding a *job* rather than the length of time the respondent stays in the *firm*. For instance, if the individual is promoted internally, then the tenure variable will reset to zero. Therefore the coefficient of the tenure variable should be interpreted as the effect of job tenure on the

Table 4.4: Estimation Results of Workers' Job Mobility Equation (4.8): All Workers

	All workers	Female workers	Male workers
	(1)	(2)	(3)
Flexitime	.001	.061	-.076
	(.038)	(.051)	(.058)
Flexitime*Children	-.088	-.152*	.006
	(.061)	(.081)	(.093)
Children	.044	.035	.026
	(.030)	(.043)	(.043)
Married	-.091***	-.148***	-.026
	(.028)	(.037)	(.043)
Age	.007	.006	.013
	(.008)	(.011)	(.011)
Age squared	-.0003***	-.0002*	-.0004**
	(.0001)	(.0001)	(.0001)
Female	-.015		
	(.028)		
ln(wage)	-.154***	-.159***	-.171***
	(.027)	(.040)	(.039)
Hours	.009***	.008***	.010***
	(.001)	(.002)	(.002)
Tenure	-.056***	-.063***	-.051***
	(.003)	(.005)	(.004)
Education dummies	Yes	Yes	Yes
Ind & Occ dummies	yes	yes	yes
Time dummies	yes	yes	yes
Constant	-1.267***	-1.102***	-1.423***
	(.211)	(.312)	(.291)
No. of obs	40152	21196	18956
Log likelihood	-9224.353	-4678.899	-4516.836

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is *Quit*. Equation (4.8) is estimated by a probit model with random effects.
Ind & *Occ* is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5%. ***: significant at 1% level.

quitting probability. Being married decreases the probability of quitting, and the effect is mainly driven by female workers.

When all workers are pooled together, flexitime is not significantly associated with the probability of quitting. This may suggest that overall, workers who work with flexitime are neither less or more likely to quit their jobs than workers without flexitime. The interaction term of flexitime and children clarifies the effect of flexitime on parents' labour mobility choices. It tells whether flexitime can reduce (or increase) working parents' probability of quitting. As mentioned above, people may work with flexitime for different reasons. Here in this chapter, I mainly explore how flexitime may affect workers' job mobility decisions as a family-friendly practice[7]. As suggested by the estimation results in column 2, table 4.4, flexitime has little effect on working parents' job mobility choices either.

Things are different when we estimate female workers' and male workers' job mobility equations separately. Comparing the results in column 3 and column 4 of table 4.4, it can be seen that flexitime is more likely to affect female workers' labour mobility choices. In female workers' job mobility equation, though the variable $Flexitime$ is not statistically significant, the interaction term $Flexitime* Children$ is significantly negative. This suggests that flexitime decreases female workers' chances of quitting if they have young children at home. In male workers' job mobility equation, neither $Flexitime$ nor the interaction term $Flexitime * Children$ is significantly correlated with their quitting probability. This implies that flexitime does not affect male workers' job mobility choices, even when they have children in the household. Based on the findings reported in table 4.4, a tentative conclusion may be drawn at this stage that flexitime is helpful and valued by working mothers as a tool to balance their work and child care obligations. Meanwhile, male employees also appreciate this practice (they report higher levels of job satisfaction when working with flexitime than they do without flexitime), but their responses to flexitime are not affected by whether they have children. It seems that the absence of flexitime is not a strong enough incentive for them to quit their jobs.

Estimation results reported in table 4.4 provide some evidence showing that flexitime can effectively reduce female workers' quitting probability if they have young children at home. This might suggest to female workers with children, flexitime is a helpful family-friendly practice. To this end, we may expect that female workers who work full time particularly need the help of flexitime if they

[7]This is also the stated objective of the UK government's encouragement of workers' flexitime requests (Hayward et al., 2007).

have children in the household. Therefore, in this section, I also estimate full time workers' job mobility equation (4.8) to see whether flexitime can effectively reduce the quitting probability of full time workers, and the results are reported in table (4.5).

Table 4.5: Estimation Results of Workers' Job Mobility Equation (4.8): Full time workers only

	All Workers	Female workers	Male workers
	(1)	(2)	(3)
Flexitime	-.0004	.056	-.074
	(.041)	(.056)	(.061)
Flexitime*Children	-.122*	-.222**	.006
	(.069)	(.100)	(.097)
Children	.081**	.094*	.034
	(.033)	(.051)	(.044)
Married	-.064**	-.122***	-.024
	(.031)	(.044)	(.044)
Age	-.011	-.023*	.003
	(.009)	(.014)	(.012)
Age squared	-.00006	.00009	-.0002
	(.0001)	(.0002)	(.0002)
Female	-.007		
	(.030)		
ln(wage)	-.193***	-.212***	-.192***
	(.031)	(.049)	(.041)
Hours	-.0009	-.008***	.005**
	(.002)	(.002)	(.002)
Tenure	-.052***	-.057***	-.050***
	(.004)	(.006)	(.005)
Education dummies	yes	yes	yes
Ind & Occ dummies	yes	yes	yes
Time dummies	yes	yes	yes
Constant	-.331	.542	-.978***
	(.232)	(.367)	(.307)
No. of obs	31452	13588	17864
Log likelihood	-7829.775	-3464.89	-4326.648

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is *Quit*. Equation (4.8) is estimated by a probit model with random effects. Only full time workers are kept in the sample.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5%. ***: significant at 1% level.

Qualitatively, most results are similar in tables 4.4 and 4.5. Flexitime has different effects on female and male workers' job mobility decisions. In female workers' job mobility equation, the coefficient of interaction term $Flexitime *$

Children is significantly negative at the 5% level. This suggests that flexitime reduces the quitting probability when they have children. Again, for male full time workers, flexitime has little to do with their job mobility decisions. In table (4.5), when all workers are kept together, the coefficient of the interaction term $Flexitime * Children$ is significantly negative. This suggests that controlling for gender and other personal and job characteristics, flexitime reduces the workers' voluntary job mobility if they have children. Given the gender differences in their response to flexitime, it is suggestive that this negative relationship is mainly driven by female workers.

4.4.4 Robustness Checks

Several other methods to estimate the relationship between flexitime and workers voluntary job mobility are also conducted to check the robustness of results reported in section 3.4.3. First, I adopt Chamberlains' random effects model by adding the time averages of explanatory variables[8] into the probit regression specified by equation (4.8). Intuitively, the objective is to estimate the effect of flexitime on workers' quit probability holding the time averages of all the other factors constant. In addition, I also estimate workers' job mobility equation using logit and linear probability models to see whether the estimation results depend on the econometric specifications. Table 4.6 displays the coefficient estimates of $Flexitime$ and $Flexitime * Children$ using different econometric specifications.

According to table 4.6, most alternative econometric specifications do not lead to significant changes in the estimation results of flexitime variables. The second panel in table (4.6) displays the coefficient estimates of flexitime and the interaction term of flexitime and children for female workers. Estimation results using both logit Chamberlain's probit models suggest that flexitime decreases female workers' probability of quitting their jobs if they have children in the household. The coefficient of the interaction term $Flexitime * Children$ has a p-value of 0.11. following what has been found in the previous section, flexitime has little to do with male workers quitting decisions, even when they have children in the household.

Some other variables may also affect workers' access to flexitime and, in turn, their job satisfaction levels and job mobility decisions. For instance, union membership may help workers bargain for favourable working conditions, such as

[8]Because $Flexitime * Children$ and $Flexitime$ do not vary over years very much within individuals, putting the time average of $Flexitime * Children$ and $Flexitime$ into the regression may lead to multicollinearity, so I do not include the time averages of $Flexitime$ and $Flexitime * Children$ in the regression when adopting Chamberlains' approach.

Table 4.6: Estimating the Job Mobility Equation Using Other Econometric Methods

	Chamberlain Probit	Logit Model	LPM
All workers			
Flexitime	.018	.013	.0004
	(.039)	(.08)	(.004)
Flexitime*Children	-.102*	-.165	-.007
	(.061)	(.122)	(.007)
No.of obs	41052	40152	40152
Loglikelihood/R squared	-8749.6575	9222.5369	.06
Female workers			
Flexitime	.076	.118	.001
	(.052)	(.100)	(.009)
Flexitime*Children	-.145*	-.290*	-.015
	(.082)	(.162)	(.012)
No. of obs	21196	21196	13405
Loglikelihood/R squared	-4438.8247	-4674.982	.06
Male workers			
Flexitime	-.052	-.127	-.007
	(.059)	(.114)	(.006)
Flexitime*Children	-.034	.018	.001
	(.95)	(.185)	(.01)
No. of obs	18956	18956	18956
Loglikelihood/R squared	-4259.0781	-4518.064	.06

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is *Quit*, the first row of this table specifies the model choice when estimating workers' job mobility equation.
Other control variables included are the same as specified in table (4.5)
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at 1% level.

flexitime, from their employers. Consequently, union members and non union members may respond differently to flexitime, and have different expectations from their jobs. Ignoring the effect of union membership may bias the estimation results. The BHPS records information about each respondent's union membership, and I include workers' union status as an additional control variable in workers' job satisfaction equation (4.12) and job mobility equation (4.8) respectively. The estimation results are reported in table C.1 and table C.2 in appendix C.

Comparing table 4.3 with table C.1, we can see that adding information on workers' union membership into the job satisfaction equation does not change the estimation results significantly. Flexitime is associated with higher levels of job satisfaction among male workers. As for female workers, the variable flexitime is jointly significant with the interaction term of flexitime and children. The variable *union* is negatively associated with workers' job satisfaction levels for both male and female workers. This suggests that union members tend to report lower job satisfaction than workers without union membership. This result is similar to what has been found in previous literature on job satisfaction (Clark, 1997; Asadullah and Fernandez, 2008; Freeman, 1978). Compared with non-union members, workers who have union membership may have higher bargaining power when negotiating contracts with their employers. They are also more likely to voice their discontent with their jobs. Freeman (1978) suggests that the negative relationship between union membership and job satisfaction is because union encourages workers to express their discontent and unhappiness with their jobs.

Table C.2 displays the estimation results of workers' job mobility equation (4.8). Workers' union status has been included as an additional regressor in the job mobility equation. The inclusion of variable *union* does not alter the coefficient estimates of $Flexitime$ and $Flexitime * Children$ significantly. We can see from table C.2 that working with flexitime significantly reduces female workers' chances of quitting when they have children at home. To reiterate: whether working with flexitime does not affect male workers' job mobility decisions, even when they have children. This is similar to what has been found in table 4.4, where flexitime only affects female workers' job mobility. Among all three specifications in table C.2, union is negatively associated with workers' chances of quitting their jobs. This suggests that workers with union membership are less likely to quit than workers without union membership. Combined with the results displayed in table C.1, we can see that compared with workers who do not have union membership, union members tend to report lower job satisfaction levels, but they are

less likely to quit their jobs. Freeman (1978) also report this seemingly counterintuitive finding, and he argues that union members are encouraged to report their unhappiness, make formal complaints about their jobs and get problems sorted out rather than simply quitting their jobs. In this case, as suggested by Freeman (1978), union acts as a "voice institution".

As suggested by tables C.1 and C.2, workers' union status does play an important role in workers' job satisfaction and job mobility decisions. Nevertheless, after the inclusion of union as additional regressor, the qualitative results do not change.

4.4.5 Discussion on Gender Differences

Estimation results in the previous section suggest that flexitime is one of the most influential factors that keep female workers in their jobs when they have young children. Among male workers, those who have flexitime report higher job satisfaction levels than those who do not have flexitime, but flexitime has little effect on their job mobility decisions. Results from tables 4.3 to 4.5 tell a consistent story. The major gender differences in the response to flexitime relate to child care responsibilities. According to the BHPS, in most British households, female members take the main responsibility for child care (see figure 1.3). Therefore, it is reasonable to expect that flexitime would be a helpful family friendly policy to female workers.

Another way to look at the gender differences in the response to flexitime is through the occupational distribution of people with and without flexitime. Table 4.7 displays the occupation distribution of flexi-timers of different gender. The BHPS divides all employees' occupation in to 9 major categories, from managerial positions to elementary jobs. The first row of table 4.7 lists four different worker types, and each column reports the percentage of given type of workers that work with the corresponding occupation. Workers with flexitime mostly concentrate in the top four occupations, suggesting a strong correlation of flexitime and human capital. However, we can see that most male flexi-timers fall into the top 3 occupations. Female flexi-timers mostly work in the secretarial and administrative occupations.

From the estimation results and the occupational distribution of male flexi-timers, it seems that male workers work with flexitime because they are good employees, or because they have senior positions in the company. Flexitime might be part of their compensation package and is a signal of good jobs. Female workers get flexitime mostly because of family reasons. In order to taking better

Table 4.7: Occupational Distribution of Flexi-timers by Gender

	Flexitimers		Non-flexitimers	
	Female	Male	Female	Male
Managers and senior officials	11.15	18.03	9.51	15.65
Professionals	10.15	16.95	11.71	10.90
Associate professionals	17.43	17.22	14.25	12.21
Secretary and administrative	36.19	14.66	17.48	4.43
Skilled trade	0.94	10.82	2.85	23.61
Personal service	6.40	1.87	16.01	2.28
Sales and customer service	9.41	3.92	12.84	4.46
Process, plant and machine operatives	1.43	8.20	2.61	13.96
Elementary occupations	6.90	8.33	12.74	12.49
No.of obs	5,231	4,059	26,326	27,806

Source: British Household Panel Survey, years 2001-2007.
Numbers in the table are percentages.

care of their children while keep participating in the labour market, female workers are self-selected to occupations that have higher chances of offering flexible working chances, i.e. the secretary and administrative occupations, which are not necessarily well paid jobs. Therefore, male workers with flexitime are more satisfied with their jobs when working with flexitime because they have good jobs, while female workers are more satisfied with their jobs when working with flexitime because flexitime helps them with their domestic responsibilities.

4.4.6 Flexitime Status After Quits

The analyses discussed above only show that there is a correlation between female workers' job mobility decisions and their flexitime status when they have children. As suggested above, the absence of flexitime may be one of the reasons that make female employees with children quit their jobs. This leads to an important question: what happens to those workers after they quit their jobs? If flexitime is an important factor that drives the female workers' job mobility, will female workers with children move to jobs that provide flexitime after they quit the previous job?

Because of the longitudinal features of the BHPS data, I am able to observe workers' job changes along with their flexitime status changes over time. First, I estimate an equation in which the dependent variable is the "upward" change of flexitime status, i.e. whether workers move from a no-flexitime status to flexitime

status. The independent variables are individual and job characteristics plus a dummy variable $Quit_{it}$, which denotes whether the respondent quits her job. The flexitime status equation estimated in this chapter is:

$$Mt\_flexitime_{it} = c + \alpha_{2i} + \varphi_2 Quit_{it} + \rho Quit * Children_{it} + \Sigma_{n=1}^{N} \lambda_n Z_{int} + \epsilon_{2it} \quad (4.13)$$

where c is the constant, t is the time index, α_{2i} is individual unobserved heterogeneity. $Mt\_flexitime$ is a dummy variable which takes value 1 if the respondent moves from a non-flexitime to flexitime status. The variable takes value 0 if the respondent's flexitime status is unchanged, or she moves from a flexitime status to a non-flexitime status. $Quit * Children$ is the interaction term of job mobility and children. It indicates whether working parents are more or less likely to move to jobs with flexitime when they quit their jobs. Z is the vector that consists of all the other factors that may have effects on the changes of workers' moving towards a more flexible job, and ϵ is the error term. Coefficient φ_2 gives the relationship between workers' job mobility choices and the chances of moving to a job with flexitime.

Table 4.8 tells whether quitting the current job is associated with higher chances of moving from a job without flexitime to a job with flexitime in the next period. For both genders, the coefficient estimates for *quit* are significantly positive. This suggests that workers who quit their jobs are more likely to move from a non-flexitime job to a job with flexitime than workers who do not quit. In other words, quitting acts as an important mechanism for workers to adjust their flexitime status to desired levels. According to table 4.8, children are one of the most important factors that drive female workers to move towards jobs with flexitime. The effect of children on male workers' flexitime status change is not statistically significant. This confirms the idea that male workers' flexitime-related decisions are not related to whether they have children in households. All these results show that the presence of children plays a crucial role in female workers' flexitime-related decisions. Female workers seem to attach more importance to family and child care obligations and seek for means that enable them to balance work and home production conflicts. That might be why they are more satisfied with their jobs when working with flexitime; if firms do not provide them with flexitime, they would like to quit and move to firms that do.

Another way to look at the results displayed in table 4.8 is that they reveal the constraints faced by workers when they want to work with flexitime. Though the British government started to give employees the right to request flexible working if they have young children at home in 2003, over the years there is not much

Table 4.8: The Effect of Quitting on Moving from Non-flexitime to Flexitime

	All workers	Female workers	Male workers
	(1)	(2)	(3)
Quit	.262***	.290***	.226***
	(.045)	(.061)	(.068)
Quit*Children	-.016	.022	-.053
	(.075)	(.099)	(.115)
Union	-.045*	-.038	-.059
	(.027)	(.035)	(.041)
Female	-.007		
	(.026)		
Children	.072***	.105***	.046
	(.027)	(.037)	(.043)
Married	-.046*	-.021	-.064
	(.026)	(.033)	(.042)
Age	-.016**	-.017*	-.010
	(.007)	(.010)	(.011)
Age squared	.0002**	.0002	.0002
	(.00009)	(.0001)	(.0001)
ln(wage)	-.058**	-.028	-.094**
	(.026)	(.036)	(.039)
Hours	-.008***	-.006***	-.010***
	(.001)	(.002)	(.002)
Tenure	-.007***	-.005*	-.008***
	(.002)	(.003)	(.003)
Education dummies	yes	yes	yes
Ind & Occ dummies	yes	yes	yes
Time dummies	yes	yes	yes
Constant	-.634***	-.574**	-.748***
	(.202)	(.288)	(.286)
Log likelihood	-8901.041	-4936.736	-3935.847
No of obs	40152	21196	18956

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is $Mt\_flexitime$, which takes value 1 if workers' flexitime status changes from no-flexitime to flexitime, and 0 otherwise. Equation (4.13) is estimated by a probit model with random effects.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at 1% level.

evidence showing that workers are getting more flexible working than before. Results in table 4.8 suggest that quitting is one of the most powerful predictors of the changes in workers' flexitime status. This could imply that it is difficult for workers to have their requests for flexible working (flexitime here) granted from their own employers, or that they face large costs of shifting to flexitime jobs within the same employer. Therefore, they need to move to other jobs if they want to work with flexitime. If there is not any flexitime constraint existing in the labour market, we will expect the coefficient associated with variable *quit* in equation (4.13) (i.e.φ_2) to be insignificantly different from zero, which could mean workers who do not work with flexitime have equal chances of getting flexitime staying with the same job or moving to another job. However, the results show that workers who quit are much more likely to move from jobs without flexitime to jobs with flexitime.

Apart from moving from a job without flexitime to a job with flexitime, there are another three possible states of workers' flexitime status evolution between two consecutive years, i.e.: moving from a job with flexitime to a job without flexitime, staying as a flexi-timer, staying as a non-flexi-timer. In the following, I estimate different versions of equation (4.13) with the other three possible states named above as the dependent variable, and the estimation results are reported in tables 4.9 to 4.11.

The estimation results displayed in table 4.9 show the effect of quitting on workers' probability of moving from flexitime to non-flexitime status. The dependent variable is $Mt\_non\_flexitime$, which takes value 1 if workers' flexitime status changes from flexitime to non-flexitime, and 0 otherwise. From table 4.9, it can be seen that quitting is positively associated with both genders' probability of experiencing a downward mobility in their flexitime status (i.e. from flexitime to non-flexitime), though in male workers' flexitime status change equation, the variable $Quit$ is jointly significant with the interaction term $Quit * Children$ at a 10% level [9]. Combined with the findings from table 4.8, a tentative conclusion is that quitting may lead to changes in workers' flexitime status in either direction. Workers who quit their jobs are more likely to experience a change in their flexitime status than workers who stay with their original employers. A possible explanation for this result might be that a change in the employer may be accom-

[9] I also estimate male workers' flexitime status change equation (the dependent variable is moving from flexitime to non-flextime), with the variable $Quit$ as a control but not the interaction term $Quit*Children$, then the coefficient of $Quit$ is significantly positive, suggesting that male workers who quit their jobs are more likely to move from flexitime to non-flexitime than workers who do not quit.

panied with changes in other job dimensions, including flexitime status (in either direction). Voluntary job mobility is an important mechanism in that workers adjust their flexible working arrangements to the desired level. In the second column, where all workers are kept in the sample, we can see that the coefficient of $Female$ is significantly negative, suggesting that female workers are less likely to move from flexitime to non-flexitime than male workers. This may provide some suggestive evidence on the importance of flexitime in female workers' lives.

Tables 4.10 and 4.11 report the effect of quitting on the probability of staying as flexi-timers and non-flexi-timers respectively. In both tables, quitting is negatively associated with the dependent variables. This suggests that quitting decreases the probabilities of having flexitime status unchanged. In other words, if workers quit their jobs, they are less likely to keep their original flexitime status than workers who stay with their original employers. Since according to tables 4.8 and 4.9, quitting is always accompanied by a change in workers' flexitime status, it is not surprising to find that workers who do not change employers are more likely to have their flexitime status remain unchanged compared with workers who quit their jobs. In table 4.10, the interaction term $Quit * Children$ is negatively associated with male workers' chances of remaining as flexi-timers, suggesting that when working fathers quit their jobs, they are less likely to remain as flexi-timers. A possible explanation for this might be that most working fathers need to support the family financially. If flexitime is costly to them, they are less willing to remain as flexi-timers when they leave for better jobs. However, this negative relationship does not show up in female workers' flexitime status change equation. In table 4.10 column 3, I also find that having children at home significantly increases female workers' chances of staying as flexi-timers, but has little effect on male workers' probability of remaining as flexi-timers. Similarly, as suggested by the third column of table 4.11, children also decrease female workers' probability of remaining as non-flexi-timers.

In summary, combining all four tables that describe the effects of quitting on workers' flexitime status evolution, I find that quitting is positively associated with changes in workers' flexitime status in either direction. Workers who leave their employers are more likely to experience a change in their flexitime status than workers who stay with the same employers. Similarly, workers who quit their jobs are less likely to remain in the same flexitime status than workers who do not quit. All these suggest that quitting helps workers adjust their flexitime status to the desired level.

Table 4.9: The Effect of Quitting on Moving From Flexitime to Non-Flexitime

	All workers	Female workers	Male workers
	(1)	(2)	(3)
Quit	.136***	.202***	.058[a]
	(.045)	(.061)	(.067)
Quit*Children	.009	-.061	.110
	(.074)	(.101)	(.108)
Union	-.049**	-.008	-.108***
	(.024)	(.033)	(.037)
Female	-.041*		
	(.024)		
Children	.058**	.075**	.027
	(.025)	(.035)	(.038)
Married	-.016	-.016	-.005
	(.024)	(.031)	(.037)
Age	-.019***	-.017*	-.018*
	(.007)	(.009)	(.010)
Age squared	.0002***	.0002*	.0002**
	(.00008)	(.0001)	(.0001)
ln(wage)	-.036	.014	-.078**
	(.024)	(.034)	(.035)
Hours	-.007***	-.009***	-.006***
	(.001)	(.001)	(.002)
Tenure	-.003	-.004	-.001
	(.002)	(.003)	(.002)
Education dummies	yes	yes	yes
Ind & Occ dummies	yes	yes	yes
Time dummies	yes	yes	yes
Constant	-.681***	-.602**	-.875***
	(.183)	(.676)	(.251)
Log likelihood	-10024.997	-5400.9129	-4588.789
No. of obs	40152	21196	18956

[a] The variable *Quit* is jointly significant with the interaction term $Quit * Children$ at 10% level.

Source: British Household Panel Survey, years 2001-2007.

The dependent variable is $Mt\_non\_flexitime$, which takes value 1 if workers' flexitime status changes from flexitime to non-flexitime, and 0 otherwise. The model is estimated by a probit model with random effects.

Ind & Occ is short for "Industries and Occupations".

For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at 1% level.

Table 4.10: The Effect of Quitting on Staying as Flexi-timers

	All workers	Female workers	Male workers
	(1)	(2)	(3)
Quit	-.248***	-.259**	-.236*
	(.091)	(.119)	(.143)
Quit*Children	-.309*	-.092	-.629**
	(.159)	(.203)	(.260)
Union	.176***	.100	.283***
	(.056)	(.072)	(.089)
Female	.055		
	(.071)		
Children	.130**	.212**	.089
	(.062)	(.083)	(.096)
Married	-.065	-.016	-.100
	(.061)	(.077)	(.103)
Age	.033*	.022	.056*
	(.019)	(.025)	(.029)
Age squared	-.0003	-.0002	-.0005
	(.0002)	(.0003)	(.0003)
ln(wage)	.044	.155**	-.131
	(.054)	(.074)	(.083)
Hours	-.007***	.003	-.022***
	(.003)	(.003)	(.005)
Tenure	-.012***	-.006	-.017***
	(.004)	(.006)	(.006)
Education dummies	yes	yes	yes
Ind & Occ dummies	yes	yes	yes
Time dummies	yes	yes	yes
Constant	-2.746***	-2.622***	-2.736***
	(.488)	(.663)	(.736)
Log likelihood	-7536.948	-4240.433	-3245.275
No. of obs	40152	21196	18956

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is $Stay\_flexitime$, which takes value 1 if workers stay as flexitimers, and 0 otherwise. The model is estimated by a probit model with random effects.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at 1% level.

Table 4.11: The Effect of Quitting on Staying as Non-flexi-timers

	All workers	Female workers	Male workers
	(1)	(2)	(3)
Quit	-.230***	-.299***	-.149*
	(.054)	(.073)	(.082)
Quit*Children	.094	.062	.119
	(.089)	(.119)	(.136)
Union	-.027	-.075	.051
	(.039)	(.051)	(.062)
Female	-.006		
	(.050)		
Children	-.096**	-.155***	-.068
	(.043)	(.058)	(.065)
Married	.046	-.036	.129*
	(.043)	(.056)	(.069)
Age	-.004	.002	-.020
	(.012)	(.017)	(.019)
Age squared	.00002	.00003	.0001
	(.0002)	(.0002)	(.0002)
ln(wage)	.072**	-.063	.239***
	(.036)	(.048)	(.055)
Hours	.012***	.008***	.019***
	(.002)	(.002)	(.003)
Tenure	.008***	.007*	.008*
	(.003)	(.004)	(.004)
Education dummies	yes	yes	yes
Ind & Occ dummies	yes	yes	yes
Time dummies	yes	yes	yes
Constant	.372	.218	.426
	(.315)	(.453)	(.453)
Log likelihood	-15442.158	-8395.398	-6977.773
No.of obs	40152	21196	18956

Source: British Household Panel Survey, years 2001-2007.
The dependent variable is $Stay\_non\_flexitime$, which takes value 1 if workers stay as non-flexi-timers, and 0 otherwise. The model is estimated by a probit model with random effects.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5% level. ***: significant at 1% level.

4.5 Conclusion

This chapter investigates the relationship between flexitime and workers' job satisfaction and job mobility decisions. Workers with flexitime report higher levels of job satisfaction than those who do not have flexitime. There is evidence suggesting that female workers' attitudes towards flexitime depend on whether they have children to take care of. Among female workers, flexitime decreases the chances of voluntary job mobility (quits) if they have young children at home.

I also find significant differences between genders in their responses to flexitime. Female workers' responses to flexitime are closely related to their child care obligations. Probably this is because in most households mothers are mainly responsible for child care, and they need flexitime to help them with child care obligations. Working mothers appreciate flexitime and their job attachments are to some extent determined by the availability of flexitime. Flexitime also makes male workers more satisfied with their jobs, but it does not particularly influence their job mobility decisions.

Since flexitime can induce working mothers stay with their jobs, there may also be concerns about whether such a decrease in job mobility is desired by the economy as a whole. Literature on "job lock" points out that some times workers choose to stay with their original jobs only because they want to enjoy certain non portable benefits provided by the firms (Madrian, 1994). As a result, firms attract workers that demand those benefits rather than high quality workers. However, this may be less of a problem in the case of flexitime. Within female workers, flexitime is usually observed among highly educated full time employees, because female workers who do not have good career prospects are more likely to choose part time jobs or opt out of the labour market. Therefore, a tentative conclusion may be that flexitime helps the firms to keep and attract high quality and productive female workers and improves overall efficiency. In addition, by promoting the job attachment in the current period, flexitime also helps workers accumulate more firm-specific human capital, which in turn makes it even less likely that workers will quit their jobs in the future. As a result, firms providing flexitime may suffer less turnover costs than those who do not provide flexitime. Given that flexitime reduces the probability of quitting, firms may also have more incentives to invest in general training activities that increase workers' general human capital levels. Consequently, both firms and workers may enjoy the benefits of increased general human capital levels.

Most existing literature on job mobility focuses on the effect of monetary payoffs and the role of specific human capital accumulation but ignores the im-

portance of compatibility between work and home production, which is crucial to female workers especially when they have children. This chapter contributes the current literature by addressing how a non-pecuniary aspect of a job may affect workers' job mobility decisions.

Appendix C

C.1 Job Satisfaction and Union Membership

Table C.1: Job Satisfaction and Union Membership

Dependent variable: overall job satisfaction			
	All workers	Female workers	Male workers
Flexitime	.073***	.031 [a]	.128***
	(.021)	(.029)	(.031)
Children*Flexitime	.038	.057	.030
	(.032)	(.043)	(.050)
Female	.190***		
	(.021)		
Union	-.095***	-.086***	-.083***
	(.017)	(.024)	(.027)
Age	-.054***	-.040***	-.081***
	(.004)	(.006)	(.007)
Age squared	.0007***	.0005***	.001***
	(.00006)	(.00008)	(.0009)
Children	.049**	.034***	.054**
	(.019)	(.026)	(.028)
Married	.111***	.146***	.050**
	(.018)	(.024)	(.029)
Hours	-.006***	-.008***	-.001
	(.0007)	(.0009)	(.001)
ln(wage)	.152***	.085***	.261***
	(.016)	(.022)	(.024)
Tenure	-.00004***	-.00005***	-.000047***
	(3.57e-06)	(5.23e-06)	(4.92e-06)
Education dummies	yes	yes	yes
Ind & Occ dummies	yes	yes	yes
Time dummies	yes	yes	yes
Log likelihood	-71906.622	-37287.557	-34431.892
No.of obs	53430	28243	25187

[a] *Flexitime* and *Flexitime* $*$ *Children* are jointly significant at the 5% level.
Source: British Household Panel Survey, years 2001-2007.
Workers' union membership status is included as an control variable.
The dependent variable is workers' overall job satisfaction level. Equation (4.12) is estimated by an ordered probit model with random effects.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5%. ***: significant at 1% level.

C.2 Job Mobility and Union Membership

Table C.2: Estimation Results of Workers' Job Mobility Equation (4.8) with Union Membership

	All workers	Female workers	Male workers
	(1)	(2)	(3)
Flexitime	.003	.062	-.072
	(.038)	(.051)	(.058)
Flexitime*Children	-.087	-.147*	-.003
	(.061)	(.081)	(.093)
Union	-.215***	-.201***	-.228***
	(.029)	(.040)	(.044)
Children	.047	.039	.032
	(.030)	(.043)	(.043)
Married	-.091***	-.145***	-.027
	(.028)	(.037)	(.043)
Age	.009	.008	.016
	(.008)	(.011)	(.011)
Age squared	-.0003***	-.0003*	-.0004***
	(.0001)	(.0001)	(.0001)
Female	-.006		
	(.028)		
ln(wage)	-.132***	-.135***	-.155***
	(.028)	(.040)	(.039)
Hours	.009***	.008***	.009***
	(.001)	(.002)	(.002)
Tenure	-.053***	-.061***	-.048***
	(.003)	(.005)	(.004)
Education dummies	Yes	Yes	Yes
Ind & Occ dummies	yes	yes	yes
Time dummies	yes	yes	yes
Constant	-1.381***	-1.220***	-1.520***
	(.211)	(.313)	(.292)
Log likelihood	-9196.55	-4665.953	-4502.65
No. of obs	40152	21196	18956

Source: British Household Panel Survey, years 2001-2007.
Workers' union membership status is included as an control variable.
The dependent variable is *Quit*. Equation (4.8) is estimated by a probit model with random effects.
Ind & Occ is short for "Industries and Occupations".
For each variable, a coefficient is reported, and the robust standard error is reported in the parentheses. Asterisks denote significance levels. *: significant at the 10% level. **: significant at the 5%. ***: significant at 1% level.

Chapter 5

Conclusion

This thesis explores the relationship between flexitime and workers' labour market outcomes. I find that flexitime is closely related to workers' compensating structures, labour supply and job mobility decisions.

The second chapter suggests that a subset of workers (workers with high labour incomes) would like to sacrifice part of their wages in exchange for flexitime. First, this shows that it is important to take into account the income effect when estimating the compensating wage differentials associated with flexitime. Though flexitime might be a helpful family-friendly practice, it might be the case that only some workers' are able to "afford" it. This negative compensating wage differentials effect also suggests that flexitime is a desirable job amenity to workers. By offering flexitime to their employees, firms might be able to save certain labour costs, or become more attractive to workers than those who do not provide flexitime. In addition, it implies that at least some workers need to bear certain costs in order to work with flexitime. However, I find little evidence suggesting the existence of compensating wage differentials for flexitime when all workers are pooled together. A possible explanation for the insignificant relationship between flexitime and wage might be that the benefits associated with flexitime give firm incentives to provide flexitime at a low price. Though the descriptive statistics show that female workers are more likely to have flexitime than male workers, there is not enough evidence to suggest that female workers and male workers would like to pay different prices for flexitime. This indicates that flexitime has little explanatory power with regards to the existing gender wage gap.

The third chapter explores whether flexitime affects workers' labour supply decisions. I find that workers will increase their labour supply when working with flexitime if the benefits derived from flexitime (increased child care production efficiency) are large enough relative to the costs (wage reduction costs). Flexi-

time saves time spent on home production so that workers' can devote more time to the market work. However, if the wage reduction cost associated with flexitime is too high, flexitime may act as a disincentive to market work. Empirical evidence confirms that flexitime is associated with a higher number of working hours among working mothers. Since 2003, the British government put forward legislation that gives workers the right to request flexible working from their employers. However, the legislation does not specify that workers can enjoy flexible working schedules without suffering any costs. Over years, the proportion of workers working with flexible working arrangements did not increase much after the legislation. In effect, it might be the case that the cost of working with flexitime is so high that workers are reluctant to request it from their employers. From the analysis in the third chapter, it can be seen that in order for workers to make full use of the flexible working arrangements to balance their work and domestic responsibilities, it is important that firms provide those arrangements at a low price. In addition, the provision of flexitime may also increase the overall economic efficiency by encouraging more female workers to be engaged in full time work. In the British labour market, a substantial proportion (around 40%) of female workers are working part time. As pointed out by Connolly and Gregory (2008), many workers who shift from full time jobs to part time jobs end up in occupations that are below their human capital levels. The provision of flexitime reduces the conflict between work and domestic responsibilities so that female workers are more likely to be engaged in full time work when provided with flexitime. In this case, flexitime may reduce the efficiency loss resulting from female workers' moving to part time jobs. When combined with a human capital accumulation process, flexitime has more profound influence on workers' labour supply decisions. By encouraging current period labour supply, flexitime helps workers to accumulate more human capital which will be translated into higher future wages. In addition, workers may also increase their labour supply even prior to their access to flexitime because of the human capital accumulation process. As a result, flexitime may increase workers' life time labour supply. In summary, if provided at a low price, flexitime can serve as effective non-monetary incentive to encourage workers' labour supply and human capital accumulation.

The effect of flexitime on workers' labour market decisions is also reflected in their job mobility decisions. In the fourth chapter, I find that flexitime decreases the probability of quitting among female workers when they have young children at home. Flexitime increases workers' mobility costs, especially when flexitime is helpful with domestic responsibilities. Therefore, workers who work with flexitime

are more reluctant to leave their jobs than workers without flexitime. To this end, this implies that firms compete in both monetary and non-monetary job dimensions, and they can use flexitime as an incentive to attract good workers from their competitors[1]. More importantly, flexitime can help firms reduce their turnover costs by encouraging long lasting employment relationship with their current employees (especially working mothers). We can also look this issue in a dynamic way. Because flexitime encourages workers to stay within the same firm, workers may also accumulate more specific human capital (such as firm specific skills). As pointed out by Farber et al. (1999), the accumulated specific human capital also acts as an incentive for workers to stay within the same firm. In other words, flexitime reinforces the effect of specific human capital on workers' job mobility behaviour. In addition, by reducing the probability of quitting, flexitime may also give firms additional incentives to provide general training to workers for them to accumulate general human capital (general skills). Conventional literature on firm-provided general training argues that firms are reluctant to provide workers with general training because workers capture the entire benefits and firms do not if workers leave (Becker, 1975, chap. 2). If the provision of flexitime can induce workers to stay within the same firm, then firms may be more likely to invest in general trailing activities. As a result, both firms and workers can share the returns of increased general human capital.

To conclude, the findings of this thesis suggest that the provision of flexitime is beneficial to workers, firms and the economy as a whole. To workers, flexitime enables them to rearrange their time so that they can balance their work and home production in a more efficient way. As a result, they may have more time to participate in the labour market. In addition, flexitime also helps them accumulate more human capital which could be beneficial to their future career development. To firms, the provision flexitime may help them attract good workers and reduce the probability of workers' quitting their jobs. There is also evidence suggesting that at least some workers would like to work with flexitime at the price of reduced wages. Finally, by promoting workers' labour supply and job attachments, flexitime may reduce the efficiency loss resulting from downward occupational mobility.

[1]The descriptive statistics in chapter 2 show that workers with high human capital levels (high educational achievements) are more likely to work with flexitime. Combined with the findings of chapter 4, this may suggest that flexitime can help firms attract (or keep) workers with high human capital.

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