

The Impact of Family Characteristics on Reactions to Compensation Incentives

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Abstract

This dissertation examines the impact of family characteristics on workers' reactions to compensation incentives. Workers' reactions to incentives refer to workers' job choices based on incentives and workers' effort supply in the job with incentives. Developing a theoretical model that extends the standard model of effort, this dissertation explicitly incorporates family characteristics (*i.e.*, the employment status of spouse, child characteristics such as the number of children and the age of child, and the presence of alternative family income sources) into a worker's effort supply function. The key theoretical linkages in the model involve income targets, loss aversion, and time and energy constraints. The model predicts that these family characteristics would have impacts on workers' effort through three theoretical channels. The model also implies that workers associated with different family characteristics would sort themselves into different jobs based on the presence of incentive pay.

The reduced-form relationships between family characteristics and reactions to incentives are analyzed using data from the Panel Study of Income Dynamics (PSID) and the American Time Use Survey (ATUS). The results show that workers with different family characteristics, such as the number of children, sort themselves into different jobs based on the presence of incentive pay in the job. Moreover, the results weakly support the importance of family characteristics on workers' effort supply as measured by the amount of incentive pay the worker received in their job. Furthermore, using detailed time use variables from the ATUS reveals the role of an underlying mechanism—time constraints on work—by which the relationships occur. By shedding light on a previously

unexplored role that family characteristics play, this dissertation adds a novel perspective to heterogeneous responses to compensation incentives by workers.

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Chapter 1 Introduction

Many important empirical phenomena on how different family characteristics such as marital status and child characteristics might influence workers' job performance have drawn people's attention for a long time. For example, there has been a comparison of job performances and career outcomes between single workers and their married co-workers in the workplaces. Some articles in the popular press point out single women might be working harder than their married co-workers because single women could take more work or work overtime, while not needing time-off for family needs.¹ In addition, some studies show that there is a wage gap between married men and single men: married men appear to earn 10 to 20 percent more than single men doing the same job (Korenman & Neumark 1991; Ginther & Zavodny 2001). One possible reason is that marriage increases married men's productivity so that married men could work harder and earn more per hour. Another example is related to the debate about whether having a child will influence a worker's performance or not. Some research does find that mothers reported reduced self-reported work effort if having preschool-age children (Bielby & Bielby 1988); while some research does not find significant evidence: there are no differences between mothers and non-parents on self-reported work effort (Kmec 2011). Moreover, being parents would influence workers' time allocations among work and

¹ The articles include social media reports such as the article by Hillary Crosley (the link is http://www.theroot.com/articles/culture/2013/06/are_single_women_working_harder_than_married_coworkers.html) and the article by SBrinkmann (the link is <http://www.womenofgrace.com/blog/?p=23189>), in which the "Generation Juggle" survey conducted by *Red Magazine* is discussed.

other non-work activities. According to the analysis in a Pew Research Center report (Wang, 2013), parents find spending time on caring for children to be much more meaningful and also exhausting than spending time at work. Thus, to sum up, these aforementioned phenomena show that workers with different family characteristics could have different performance levels at work, but these phenomena are not in the context of incentives.

Moreover, motivating employees through an appropriate incentive is the core problem in the personnel economics. Previous empirical studies focus on how strongly workers react to different incentive schemes, including piece rates (Lazear 2000; Shearer 2004; Freeman & Kleiner 2005), tournaments (Ehrenberg & Bognanno 1990), and other forms of incentives such as bonuses, efficiency wages, and team incentives (Prendergast 1999; Bandiera et al. 2007). On this basis, employers can design different types of reward programs to motivate workers. In the literature, workers' reactions to incentives usually refer to how much effort they put into work. In addition, workers also react to incentives by making job choices based on whether they receive incentive pay in the job. These are the two types of workers' reactions to compensation incentives studied in this dissertation.

In the standard model of effort supply, the worker chooses the level of effort that maximizes their utility function after observing the compensation scheme. At the same time, the worker will decide whether to participate in exerting effort by comparing the offered incentive with the outside options. Thus, as long as the participation constraint is satisfied, the optimal effort level will be achieved when the marginal benefit equals the

marginal cost of effort. However, there are several limitations of the standard approach to modeling effort supply. One limitation is that the determination of the marginal utility of income and the marginal cost of effort is taken as given in the standard model. This ignores other factors that might influence the marginal benefit and the marginal cost of effort. Also, the determinants of the worker's time and energy, which is presumably critical when the worker decides how hard to work, are not explicitly modeled. Moreover, the standard model doesn't recognize that workers should make job choices based on whether they receive incentive pay in the job. But if differences across workers affect the attractiveness of different incentive plans, then workers should sort themselves into jobs with different attributes, such as working environments, worker skills and other job requirements, based on the theory of equalizing differences (Brown 1980; Rosen 1986).

Therefore, it is essential to further understand whether workers react differently when they face the same incentives and what factors influence workers' heterogeneous reactions to compensation incentives. It is an important question but there is limited existing research on this topic. The purpose of this dissertation is to explore some potential factors in determining workers' reactions to compensation incentives and the underlying reasons why the relationships occur. This dissertation focuses on one important set of factors—family characteristics. Family characteristics have long been explicitly incorporated into the labor supply optimization problem. For example, spouse's earnings and child-related factors, such as the number of children, costs of child care and the timing of having children, matter to the labor supply decision (Mroz 1987; Eckstein & Wolpin 1989; Ermisch & Wright 1993; Jacobsen *et al.* 1999; Tekin 2007). There are

reasons to believe that family characteristics might have impacts on workers' effort supply as well. Another reason to focus on family characteristics is that a limited number of studies mentioned earlier show that family characteristics, including having a spouse and children, may affect work effort. However, this earlier research does not deeply investigate how a range of family characteristics affects workers' effort supply decisions in response to incentive compensation. Furthermore, there is little existing research on the effects of family characteristics on workers' job choices based on the presence of incentives.

This dissertation, therefore, extends the standard model of effort to explicitly incorporate family characteristics into a worker's effort supply function. The theoretical model in this dissertation focuses on illustrating some of the possible relationships between family characteristics and worker's reactions to incentives. Specifically, family characteristics include the employment status of spouse, child characteristics, such as the number of children and the age of child, and the presence of alternative family income sources. These family characteristics can affect workers' reactions to incentives through several possible theoretical mechanisms. Three key avenues—target income, loss aversion, and time and energy constraints—are included in the model. Moreover, this model also implies that workers with different family characteristics choose different types of jobs based on the presence of compensation incentives in the job.

Motivated by the theoretical model, the reduced-form relationships between family characteristics and workers' reactions to compensation incentives are analyzed using data from the Panel Study of Income Dynamics (PSID) and the American Time

Use Survey (ATUS). First, the results show that workers with different family characteristics sort themselves into different jobs based on the presence of incentive pay in the job. Specifically, some family characteristics, including spouse employment status, the number of children, and the age of child, significantly associate with workers' job choices relates to the incentive pay. Moreover, the regression results are weakly supportive of the importance of family characteristics on workers' effort supply measured as the amount of incentive pay the worker received in their job. Furthermore, this dissertation explores some underlying mechanisms by which the relationships occur using detailed time use variables from the ATUS. The time constraints on work is measured as time spent on different activities including household, caring for other people, socializing and sports in this dissertation. The results show that the time constraints on work significantly associates with the workers' reactions to incentives especially workers' job choices based on the presence of incentive pay, when family characteristics are included in the regressions at the same time.

The remainder of this dissertation proceeds as follows: Chapter 2 reviews the current literature on effort supply and related studies on the role of family characteristics and briefly reviews the theory of equalizing differences; Chapter 3 presents the theoretical model; Chapter 4 describes the PSID and the ATUS datasets and variables and summary statistics of each sample; Chapter 5 presents the regressions results in terms of the effects of family characteristics on workers' job choices based on incentives; Chapter 6 reports the empirical results on the effects of family characteristics on workers' effort supply; finally, Chapter 7 concludes the dissertation.

Chapter 2 Literature Review

As mentioned in the Introduction, this dissertation studies two types of workers' reactions to compensation incentives. The first type is workers' decisions of making job choices based on whether they receive incentive pay in the job. The second type refers to how much effort workers put into their work. This chapter first reviews current empirical studies about the incentive effects on workers' effort. Then this chapter reviews some related studies on the role of family characteristics, including some studies on the effects of family characteristics on labor supply and several existing studies about the relationships between family characteristics and work effort and productivity. In the end of this chapter, some studies on the theory of equalizing differences are briefly reviewed.

2.1 Effort Supply Studies

Usually, workers' reactions to incentives refer to how much effort they put into work. In terms of workers' effort supply, previous empirical studies have focused attention on how strongly workers react to different incentive schemes, including piece rates, tournaments, and other forms of incentives such as bonuses, efficiency wages, and team incentives. Then employers can design different types of reward programs to motivate workers based on workers' reactions to different types of incentives.

Specifically, there is evidence showing that piece rates can induce workers' effort and raise their productivity (Lazear 2000; Paarsch & Shearer 2000; Shearer 2004; Freeman & Kleiner 2005). For example, Lazear (2000) uses data from the Safelite Glass Corporation to estimate the incentive effects on productivity of a change from fixed

wages to piece rates in the compensation system. The results show that the switch from wage to piece-rate pay caused a 44 percent increase in productivity (*i.e.*, output per worker) and half of the increase in productivity was from the incentive effects (*i.e.*, the average workers producing more due to the piece rates). Consistent with Lazear's results, Paarsch & Shearer (2000) find that incentives caused a 22.6 percent increase in productivity using daily data collected from the payroll records of a British Columbia tree-planting firm and Shearer (2004) also finds a 20 percent increase in worker productivity when workers are paid piece rates rather than fixed wages using data from a field experiment. As well, Freeman & Kleiner (2005) show that the switch from piece rate to time rate modes of compensation increased profits but decreased productivity. In addition, piece rates could produce wage premiums for piece-rate workers if piece rates raised worker's productivity (Seiler 1984; Brown 1992; Parent 1999). For instance, Seiler (1984), Brown (1992), and Parent (1999) all find that piece-rate workers earned more, on average, than fixed wages or time-rated workers due to a direct incentive effects on effort. In each of those papers, the authors use a large data set—data from the U.S. Bureau of Labor Statistics' Industry Wages Surveys (Seiler 1984 and Brown 1992) or a wave of the National Longitudinal Survey of Youth (Parent 1999)—to compare workers' performances under different compensation systems (*i.e.*, piece rates and fixed wages or time-rated wages).

Moreover, some studies have shown that tournaments have incentive effects on an individual's performance such as workers' output (Knoeber 1989; Ehrenberg & Bognanno 1990 a, 1990 b; Becker & Huselid 1992; Knoeber & Thurman 1994). For

example, using data from the 1984 United States Professional Golf Association (PGA) Tour and from the 1987 European PGA Tour, Ehrenberg & Bognanno (1990 a, 1990 b) find strong evidence that the level and structure of prizes in PGA tournaments influence players' performance. Specifically, the higher is the total prize money in a tournament, the lower are the player's scores, in other words, the higher is their output and effort. Following Ehrenberg & Bognanno (1990 a, 1990 b), Becker & Huselid (1992) show that the tournament spread has incentive effects on individual performance using a panel data set from auto racing, but they also find that the prize distribution has little influence on individual performance. These results support that tournaments have incentive effects on individual's output. There are few studies testing the tournament theory outside the sports context. Knoeber (1989) and Knoeber & Thurman (1994) study the broiler chicken industry, in which explicit tournaments are used to reward contract producers of broiler chickens. The results of these two papers support the predictions of tournament theory, especially that the level of prize has positive effects on producer's performance measured as the weight of chickens.

Besides piece rates and tournaments, workers also respond to other forms of compensation incentives, such as bonuses, efficiency wages and team incentives that reward their efforts and performance (Prendergast 1999; Bandiera et al. 2007). For example, Groshen & Krueger (1990) use BLS data on 300 hospitals in 1985 to test the relationship between supervision and efficiency wages. In the paper, Groshen and Krueger find evidence to support the efficiency wage theory: if the firms pay workers wages higher than the average market, then the cost of job loss is large, so workers would

exert effort instead of shirking at the efficient level. Additionally, studies consistently show that using profit-sharing plans including Employee Stock-Ownership Plans and bonuses, which is one of the most used team compensation schemes, increases the firm's productivity by 4-5 percent with available estimates, especially compared with the firms that do not use these schemes (Knez & Simester 1992; Kruse 1993; Jones & Kato 1995).

However, although previous studies provide evidence that incentives have significant effects on workers' effort and productivity, they didn't explore what factors influence workers' effort supply decisions. Moreover, these studies have only paid attention to one type of workers' reactions to incentives: how much effort workers put into work.

2.2 Related Studies on the Role of Family Characteristics

Because there are limitations of the empirical effort supply studies and the standard model of effort supply, it is essential to further understand what factors influence workers' heterogeneous reactions to compensation incentives. Moreover, several factors could have impacts on workers' reactions to incentives, and this dissertation focuses on exploring the role of one important set of factors—family characteristics, such as the employment status of spouse and child characteristics. One reason is that family characteristics have long been explicitly incorporated into the labor supply optimization problem. There is sufficient evidence showing that family characteristics are key determinants of workers' labor supply. Thus, we have reasons to believe that family characteristics could influence workers' decisions on effort supply

and job choices as well. Another reason for focusing on family characteristics in this dissertation is that a limited number of studies show that some family characteristics may affect work effort and productivity. Therefore, we need further study on the relationships between a range of family characteristics and workers' reactions to incentives, including not only workers' decisions on effort supply but also workers' job choices based on the presence of incentive pay in the job. This section reviews related labor supply studies especially studies on the effects of family characteristics on labor supply and current studies about relationships between family characteristics and work effort and productivity.

2.2.1 Related Labor Supply Studies

In the labor supply literature, family characteristics have long been explicitly modeled into the labor supply maximization problem. Previous studies have shown that spouse's earnings and child-related factors, such as the number of children, costs of child care, and the timing of having children, matter to workers' labor supply decision (Eckstein & Wolpin 1989; Jacobsen *et al.* 1999; Lundberg & Rose 2002).

For example, Eckstein & Wolpin (1989) present a dynamic model of married women's labor force participation and fertility. They use the National Longitudinal Surveys to estimate the effects of schooling, fertility, husband's income and work experience on wages. They find that the presence of young children substantially reduces women's future labor force participation; while the number of years of women's schooling has positive effects on their participation.

Jacobsen *et al.* (1999) use twin births as a natural experiment to test the effects of fertility timing (*i.e.*, an unplanned birth child) on married women's labor supply. The results show a small but still statistically significant impact of an unplanned birth on married women's labor supply behavior and earnings and especially significant short-run effects of fertility shocks on labor supply and earnings. But they don't find significant impacts of having twins in the first birth on the occupational choices of married women.

Meanwhile, few studies have attempted to provide evidence on the effects of marital status and parenthood on men's labor supply. For example, Lundberg & Rose (2002) use data from the Panel Study of Income Dynamics (PSID) to examine the effects of having children on men's labor supply and hourly wages. They find that having a child significantly increases the hourly wage rates and annual hours of work for men. Specifically, on average, a child increases a man's annual hours of work by 38 hours per year. But the significant positive incremental effects of children are limited to the first two children according to their results.

Moreover, some studies show evidence that family characteristics could influence people's choices of labor supply, especially choosing either full-time or part-time jobs. For instance, Tekin (2007) examines the effects of the price of child care and wages on the part-time and full-time employment decision. Using data from the 1997 National Survey of America's Families, he finds that the childcare price has a significant negative effect on the overall employment for single mothers and the full-time wage rate has a positive effect on the overall employment for single mothers. His results also indicate that

single mothers who are employed full-time are more sensitive to the price of childcare than those who are employed part-time.

2.2.2 Studies about Family Characteristics and Work Effort and Productivity

As mentioned earlier, some existing empirical evidence shows that there might be relationships between some factors including family characteristics and people's work effort, productivity and career outcomes. Researchers have been trying to explore the effects of family characteristics on workers' job behaviors and performance. For example, Becker (1985) develops a model of energy allocation, which asserts that different activities demand different energies on the basis that the energy of a person is limited. If the person spends more energy on non-work activities such as household activities, caring for family members and leisure, he or she will have less energy to spend on work. According to Becker's model, married women could spend less effort on each hour of market work than married men, even when they work the same number of hours, if they need to spend more energy on non-work activities. Effort is defined as the amount of physical and mental energy devoted to work in Becker's model. Becker's reasoning is that child care and housework demand more effort than leisure and other household activities and those activities demand more energy from women than men. But Becker's work does not rely on any empirical research.

Related to Becker's model, researchers have done several empirical studies to provide evidence on factors affecting worker's effort. For example, there is a debate on the topic whether having a child influences worker's job performance or not. Some

studies show that having a child may affect self-reported effort or energy put into work. One study is done by Bielby and Bielby (1988). They find that having preschool-age children reduces mothers' self-reported work effort, using data from the 1973 and 1977 Quality of Employment Surveys. But they don't find significant effects of having school-age children on work effort for either men or women. In their study, the self-reported work effort is a composite measure as the mean of the sum of three items, each measured on a scale ranging from one to four. The first item is: "My job requires that I work very hard." The second one is: "Altogether, how much effort, either physical or mental, does your job require?" And the third time is: "And how much effort do you put into your job beyond what is required." However, some research doesn't find significant evidence in terms of the effects of having a child on work effort. For instance, Kmec (2011) uses data from the second wave of the National Survey of Midlife Development in the U.S. to compare some pro-work behaviors, such as work effort, work intensity and job engagement, among mothers, fathers, and non-parents. He does not find differences between mothers and non-parents of both sexes on self-reported work effort, holding net of all individual, job and family controls. In his study, the self-reported work effort is measured by the respondent's answer to the question: "Using a 0-10 scale where 0 means 'no thought or effort' and 10 means 'very much thought and effort,' how much thought and effort do you put into your work situation these days?"

Moreover, some research has shown that family characteristics may affect worker's productivity (see Manchester, Leslie & Dahm 2014). One related phenomenon is that there is a well-known marital wage premium for men. Researchers have long

noticed that married men earn substantially more per hour worked than men who are not currently married. Generally, married men appear to earn 10% to 20% more than comparable single men, even doing the same job (Korenman & Neumark 1991; Ginther & Zavodny 2001). For example, Korenman & Neumark (1991) present descriptive statistical evidence showing that never-married or single men appear to have much lower wages than married and divorced or separated men using the National Longitudinal Survey (NLS) of Young Men. They also find significant annual earnings differentials (about 12 percent marriage premiums) between single men and married and divorced men using cross-sectional data from a company personnel file. Ginther & Zavodny (2001) also report a large positive return to marriage for white men from their cross-sectional estimates. But there has been disagreement about why the marital wage premium for men exists among researchers. One possible reason of the marriage premium for men is that marriage increases men's productivity so that married men could work harder and earn more per hour; in other words, marriage makes workers more productive (Greenhalgh 1980; Kenny 1983; Becker 1985).

However, there are several limitations of current research about the relationships between factors including family characteristics and worker's effort and performance. First, although those studies have shown that family characteristics might affect worker's effort and productivity, they are not in the context of compensation incentives. Second, this earlier research does not deeply investigate how a range of family characteristics affects workers' effort supply decisions in response to incentive compensation. Most of the studies focus on one or two family characteristics and examine their effects on

worker's performances. Third, to my knowledge, there is limited existing research on the effects of family characteristics on workers' job choices based on the presence of incentives, which is also a type of workers' reactions to incentives.

2.3 Brief Review on the Theory of Equalizing Differences

As mentioned above, workers might also react to compensation incentives by choosing different jobs based on whether they receive incentive pay in the job. One possible reason is that workers choose jobs with different attributes on the basis of their preferences for those attributes, according to the theory of equalizing differences (Brown 1980; Rosen 1986). The theory of equalizing differences states that workers are willing to accept less attractive jobs if the employers compensate through differences in wage rates (Brown 1980). Rosen (1986, pp. 641) defines the theory of equalizing differences as "observed wage differentials required to equalize the total monetary and nonmonetary advantages or disadvantages among work activities and among workers themselves". Thus, workers with given personal characteristics make choices among jobs with different wage and non-wage attributes (Brown 1980).

Empirical studies have tested the theory of equalizing differences, especially a central point that workers sort into jobs with different attributes based on their preferences (Brown 1980; DeLeire & Levy 2004; Grazier & Sloane 2008; Krueger & Schkade 2008). Measurable job attributes include working conditions such as risks to life and health and working environments, job requirements such as special work-time scheduling, worker skills, and the composition of pay packages such as vacations,

pensions, and other fringe benefits. For example, Brown (1980) develops a model of labor market choice that emphasizes equalizing differences and uses the longitudinal data from the NLS Young Men's sample to test the model. The empirical results show that the risk of death has a significantly positive relationship with wages, the repetitive work and bad working conditions have negative effects on wages. But after including the individual-specific intercepts in the regressions, the risk of death variable loses its significant positive effects and the effects of repetitive work and bad working conditions become less negative. Thus, Brown's results did not provide sufficient significant evidence that the job characteristics might generate equalizing differences. Moreover, using data from multiple sources including the March Current Population Surveys and the Dictionary of Occupational Titles, DeLeire and Levy (2004) estimate conditional logit models of occupation choice as a function of the risk of death on the job. The risk of death on the job is measured as injury risk and other job attributes such as job requiring physical strength, working environments, and creative skills. Their empirical analysis shows a significant positive relationship between a worker's low willingness to trade risks and safety for wages and occupations with low earnings risk. In the analysis, they use family structure as a proxy for willingness to trade risk and safety in the job for wages. Their results support the hypothesis that workers sort into jobs on the basis of their preferences. Following DeLeire and Levy (2004) for the U.S., Grazier and Sloane (2008) also find that the death and major injury rate of an occupation has a significant effect on workers' occupational choices in the U.K., using data from multiple datasets including the Labour Force Survey, Health and Safety Executive, and the Skills Survey in

U.K. As well, Krueger and Schkade (2008) present evidence to support the sorting hypothesis of workers choosing jobs based on individual characteristics and job attributes using data from the U.S. and France. Their results show that workers who are more gregarious tend to be employed in jobs that involve more social interactions. They use workers' behaviors when they are not working such as how they spend their time to infer their preferences.

Therefore, according to the theory of equalizing differences and related empirical evidence, if differences across workers affect the attractiveness of different incentive plans, then workers should sort themselves into jobs based on whether they receive incentives in the job.

Chapter 3 Theoretical Model

This chapter first focuses on presenting the standard effort supply model and the limitations of the model. Second, this chapter describes the theoretical linkages between three theoretical mechanisms and effort supply and then the theoretical relationships between family characteristics and these mechanisms. Moreover, this chapter presents the completed extended theoretical model, which is illustrative, that incorporates family characteristics and theoretical mechanisms into the effort supply function. Last, the extended model for a particular job is presented and the implied theoretical relationships between family characteristics and workers' job choices based on the presence of incentives on the basis of the extended model is also described in this chapter.

3.1 Standard Effort Supply Model and Limitations

Theoretically, the economic literature has paid a lot of attention to how to model worker's effort supply. This section presents the standard theoretical model of effort supply and discusses several limitations of the model. In the literature, the worker's effort optimization problem is modeled as maximizing the utility function:

$$\max_{\{e\}} U(w(e), e) = w(e) - c(e)$$

$$s. t. \quad U(w(e), e) \geq \underline{u}$$

where

- $U(\cdot)$ is the utility function
- e is worker effort

- $w(.)$ is the pay function of effort from the firm through the compensation scheme
- $c(.)$ is the disutility/cost function of effort, which is increasing and convex in e
- \underline{u} is the reservation utility of the worker.

The solution of this maximization problem is e^* , which is the worker's optimal effort level. In this standard model of effort supply, the worker chooses the level of effort that maximizes their utility function after observing the compensation scheme. The compensation including wage and incentives is offered by the firm through some specific mechanisms (Prendergast 1999). At the same time, the worker will decide whether to participate in exerting effort by comparing utility derived from the offered incentive with the outside options. The worker will take the current incentive only if it ensures a utility level, which is as high as the outside utility level (*i.e.*, the reservation utility). In other words, the worker will make the decision on the basis of the satisfied participation constraint. Thus, the worker's optimal effort level will be achieved when the marginal benefit of effort equals the marginal cost of effort, under these given constraints.

However, as noted previously in this dissertation, there are several limitations of the standard approach to modeling effort supply. First, the determination of the workers' marginal utility of income and disutility of effort (*i.e.*, the marginal cost of effort) is taken as given and unaddressed in the standard model. The determination affects the workers' levels of effort supply. Moreover, the determinants of the marginal benefit of income and marginal cost of effort might vary across workers. There are other factors, such as family characteristics, which might influence the marginal benefit of income and the marginal

cost of effort. Then the workers would choose different levels of effort when they face the same compensation incentives. But the standard model just ignores those potential determinants of marginal utility of income and the disutility of effort.

Second, the determinants of the worker's time and energy are not explicitly modeled. In the standard model of effort, the worker's time and energy constraints for work are captured by the disutility function of effort. Thus, the role of time and energy constraints in the effort supply problem can't be explicitly analyzed. But time and energy is likely critical to a worker's decisions on how hard to work. For instance, if you have to spend a lot of your time and energy on non-work activities such as taking care of children and household activities, then you would have less time and energy you could spend on work. In this case, your effort level is constrained because of your limited time and energy. Therefore, it's important to explicitly model the determinants of the worker's time and energy, such as family characteristics, and analyze the effects of the determinants on worker's effort through the time and energy constraints on work.

Third, the standard model of effort supply does not recognize that workers should make job choices based on whether they receive incentives in the job. If differences across workers affect the attractiveness of different incentive plans, then we should also recognize that workers would choose different jobs associated with the presence of incentive pay in the job. According to the theory of equalizing differences (Brown 1980; Rosen 1986), workers should sort themselves into jobs with different attributes, such as working environments, worker skills and other job requirements, based on their

preferences for those attributes. But the standard model doesn't consider this type of workers' reactions to compensations incentives.

3.2 Theoretical Linkages between Family Characteristics, Theoretical Mechanisms and Effort Supply

As explained in previous section 2.2, it's essential for us to further understand what factors influence workers' heterogeneous reactions to compensation incentives due to the limitations of the standard model of effort and current empirical studies. This dissertation focuses on family characteristics for one main reason that there is an important set of family characteristics such as the employment status of spouse and child-related characteristics, which might play a significant role, but has not been studied in the literature of effort supply. To explore the role of family characteristics in shaping workers' reactions to compensation incentives, this dissertation proposes that family characteristics might affect workers' effort supply decision through three theoretical mechanisms: worker's target income, loss aversion, and time and energy constraints on work. This section describes the theoretical linkages between the three mechanisms and effort supply and the theoretical linkages between family characteristics and the three mechanisms, separately.

3.2.1 Theoretical Linkages between Theoretical Mechanisms and Effort Supply

A number of potential factors could have impacts on a worker's marginal benefit of income and marginal cost of effort. Rather than taking the determination of an

individual's marginal utility of income and the disutility of effort as given, this dissertation includes three possible theoretical mechanisms—target income, loss aversion, and time and energy constraints on work—as determinants of worker's marginal benefit of income and marginal cost of effort in the model. Specifically, the target income and loss aversion might influence an individual's marginal utility of income; while the third mechanism—time and energy constraints on work—can affect an individual's disutility of effort. Therefore, these three theoretical mechanisms can affect effort supply by influencing the marginal utility of income and the disutility of effort.

3.2.1.1 Theoretical Relationships between Target Income and Worker's Effort

The first factor I add to the standard model is target income, which would influence the worker's marginal utility of income. Everyone might have his or her own target income. The same incentive could have different impacts on effort supply due to different target incomes people have. According to the reference dependent preferences model, workers, especially the ones exhibiting loss-averse preferences, might have a reference point or reference level (Fehr & Goette 2007). The reference point could be a variety of things, such as expected earnings and expected time spent on work, set by the individual. In the model of this dissertation, the reference point is the target income the individual expects in order to meet his or her financial needs. After observing the compensation scheme provided by the firm, rather than comparing only with the cost of effort, workers also compare their received incomes with their own target incomes. Thus,

heterogeneous workers would treat the same income differently due to the differences between the received income and different target incomes they have.

Moreover, the distance between the income and the target income is hypothesized to affect the strength of the incentive to a particular worker. The literature suggests that the person would experience an additional psychological cost if she or he falls short of the target (Bell 1985; Loomes & Sugden 1986; Delquie & Cillo 2006; Koszegi & Rabin 2006, 2007; Fehr & Goette 2007). Workers who are below their target reference income will perceive their current performance as a loss, so that they exert more effort to increase their performance (Heath, Larrick & Wu 1999; Fehr & Goette 2007). In this case, workers would work harder to earn more from the incentive pay so that they can catch up to their target incomes. Thus, workers with different target incomes would choose different optimal effort levels, even though the compensation incentive appears to be the same, holding other things the same.

Therefore, after incorporating the target income into the standard model of effort supply, the worker's utility function is turned into the following format:

$$U = w(e) - T - c(e)$$

where T is the reference target income.

3.2.1.2 Theoretical Relationships between Loss Aversion and Worker's Effort

Another factor—the degree of loss aversion—is added into the model as a factor affecting the worker's effort supply by influencing the marginal benefit of income, combined with target income. Individuals with loss aversion would feel more strongly

about avoiding a loss of one unit than making a gain (Kahneman & Tversky 1979; Goette, Huffman & Fehr 2004). As mentioned earlier, the person would experience an additional psychological cost if falling short of the target income; while it will not happen if above the target. Thus, it is reasonable to assume that the individual has stronger loss aversion when the received income is below the target than above the target income. In the extended model of this dissertation, the degree of loss aversion is set up as larger than one only if the received income is below the worker's target income; while the degree of loss aversion is set up as one if the income is equal or above the worker's target income.

Moreover, individuals exhibiting different degrees of loss aversion place different levels of importance on the same level of target income. Usually, the stronger the loss aversion is, the more important it is to achieve the target income level. The worker with higher degree of loss aversion will feel more strongly about avoiding a loss and suffer a larger psychological loss from not meeting the target income, than the one with lower degree of loss aversion. In this situation, workers with higher degree of loss aversion would work harder to catch up with the target income (Gill & Prowse 2012). Thus, workers even with the same level of target income choose different levels of effort, due to different degrees of loss aversion they have.

The presence of loss aversion requires uncertainty. If there is no uncertainty, then people will work hard enough to get their target income, and with the necessary level of effort they reach their target with certainty. One possible source of the uncertainty is the random difficulty of reaching a certain performance level, which could be the worker's

target income. This could be uncertain due to economic shocks, uncertain supervisor evaluations, or outcomes that depend on co-worker behaviors.

Thus, combining with the target income, after adding the loss aversion into the model, the worker's utility function is as follows:

$$U = \begin{cases} w(p(e, \eta)) - T - c(e, \eta), & \text{if } w(e) \geq T \\ \gamma[w(p(e, \eta)) - T] - c(e, \eta), & \text{if } w(e) < T \end{cases}$$

where the loss aversion $\gamma = 1$ if $w(e) \geq T$ and $\gamma > 1$ if $w(e) < T$; p is a worker's performance observed by the employer; η is the random difficulty of reaching a certain performance level.

3.2.1.3 Theoretical Relationships between Time and Energy Constraints on Work and Worker's Effort

The third factor incorporated in the model as a potential determinant of the worker's marginal cost of effort is the worker's time and energy constraints on work. In the standard model of effort supply, the constraints of time and energy are captured by the disutility function of effort $c(e)$. But the previous literature does not pay much attention to how the function $c(e)$ is determined. This dissertation considers time and energy constraints on work as one possible determinant of the disutility function of effort on the basis of the assumption that different activities might demand different quantities of energy (Becker 1985). According to the assumption, energy is allocated among various household and market activities and the total amount of an individual's energy is limited. Thus, resource constraints for work depend on the allocation of time and energy among all activities. The more resources demanded and spent on non-work activities such as

household work, taking care of children, and leisure, the less time and energy available for work. More time and energy constraints on work, in turn, will decrease the inputs into effort supply and increase the cost of effort. In this case, the worker couldn't put more effort into work even if he or she wants to, due to the time and energy constraints on work. So facing the same incentive, a worker will exert less effort when she or he has less time and energy to put into work.

Therefore, after adding time and energy constraints on work into the model, the worker's utility function is as follows:

$$U = \begin{cases} w(p(e, \eta)) - T - c(e, \eta; t, E), & \text{if } w(e) \geq T \\ \gamma[w(p(e, \eta)) - T] - c(e, \eta; t, E), & \text{if } w(e) < T \end{cases}$$

where t is the time constraint on work and E is the energy constraint on work.

3.2.2 Theoretical Linkages between Family Characteristics and Theoretical Mechanisms

Through the three theoretical mechanisms, family characteristics (*i.e.*, the employment status of spouse, child characteristics including the number of children and the age of child, and the presence of alternative family income sources) might have effects on workers' effort supply. This section describes the potential theoretical linkages between these family characteristics and the three mechanisms to explain how the family characteristics could affect the three theoretical avenues.

3.2.2.1 Theoretical Relationships between Family Characteristics and Target Income

These family characteristics could influence the worker's target income as follows:

First, the employment status of a worker's spouse might have positive or negative effects on the individual's target income. For example, having a working spouse would decrease the worker's target income due to several possible reasons: one reason is that the working spouse could reduce the individual's financial pressure by having earnings to help family's financial needs. To the opposite, having a stay-at-home spouse could increase the worker's financial pressure if the financial needs of the family will not change. In this case, the worker would have higher target income to achieve.

Second, child-related characteristics could influence the worker's target income as well. For instance, the number of children might have positive effects on the individual's target income. The reason could be that the number of children positively associates with the financial needs of the family since more children demand more money, holding the other conditions the same. Then the worker needs to earn more from work to meet the financial needs. In other words, the reference target income increases. Moreover, having different ages of children might influence the worker's target income. The financial needs of different ages of children vary from different sources. For example, having a very young child needs money in terms of childcare activities; while having a school-aged child needs money to afford education. So the amount of financial needs would vary due to different circumstances and then the amount of financial needs would influence the worker's target income.

Third, having alternative family income sources would decrease the worker's target income. If there are alternatives of family income sources, then the family income will be increased. At the same time, holding other conditions the same, the financial needs of the family will not change. Then the worker could earn less from work to meet the financial needs. In other words, the reference target income decreases.

3.2.2.2 Theoretical Relationships between Family Characteristics and Loss Aversion

The degree of loss aversion can vary across individuals with different family characteristics due to the following possible relationships:

First, the employment status of spouse would influence the worker's degree of loss aversion. Specifically, the worker who has a stay-at-home spouse might exhibit stronger loss aversion than the worker who does not have a spouse or the worker who has a working spouse. The reason could be that the worker who has a stay-at-home spouse worries more to fall behind the target income, because the financial loss (*i.e.*, not catching up with the target) would affect both the worker and the spouse, holding target income and other things constant. But the worker without a spouse does not need to worry about influencing another person; while the worker with a working spouse might feel less stressful of the financial loss, because she or he could have additional financial support from the earnings of the working spouse.

Second, the number of children might positively associate with the worker's loss aversion. The more children the worker has, the stronger feeling she or he has to avoid a loss. One possible reason is that having more children makes the worker more afraid of

not meeting the target, because the financial loss would influence not only her or him but also the children, especially compared with the worker who does not have a child.

Third, the presence of alternative family income sources might be negatively associated with the worker's degree of loss aversion. If the worker has alternative family income, then she or he would have fewer financial pressures and would exhibit weaker loss aversion, compared with the worker who doesn't have any other income resources.

In addition, future work could theoretically explore the possibility that the random difficulty of reaching a performance level is a function of family characteristics as well.

3.2.2.3 Theoretical Relationships between Family Characteristics and Time and Energy Constraints on Work

Time and energy constraints on work could be influenced by family characteristics as follows:

First, the employment status of spouse might have bidirectional effects on the individual's time and energy constraints on work. According to the "wife/spouse as a resource" theory (Talbert & Boss 1977), the traditional stay-at-home wife could increase the productivity of her spouse through several possible channels, such as reducing his household responsibilities which leaves him more available for work and providing emotional support. Thus, the stay-at-home spouse could increase the worker's resources for work; in other words, reduce the worker's time and energy constraints on work. Conversely, in the presence of having a working spouse, the worker needs to take more household responsibilities and workload compared with the worker having a stay-at-

home spouse. Thus, the worker would have fewer available resources for work and more time and energy constraints on work.

Second, child-related characteristics might affect the worker's time and energy constraints on work. For example, having children demands time and energy from the worker to take care of, play with or educate children. The more children the worker has, the more time and energy need to spend on children, and then the less time and energy could spend on work. Thus, the number of children might have a positive relationship with time and energy constraints on work. Moreover, having different ages of children demands different amount of time and energy depends on different activities needed from the parents. For example, having relative younger children demands more resources for childcare activities so that the available amount of time and energy for work will decrease; in other words, the time and energy constraints on work will increase. As well, having school-aged children demands more time and energy from parents on education-related activities so that the available amount of time and energy for work will decrease.

3.3 Extended Theoretical Model

3.3.1 Theoretical Model of Family Characteristics and Effort Supply

On the basis of the theoretical linkages between the three mechanisms and worker's effort supply and the theoretical relationships between these family characteristics and three theoretical mechanisms, this dissertation develops a full theoretical model of effort supply, which incorporates these family characteristics and the three mechanisms. This extended model is intended to be illustrative and motivational,

not a structural model to be estimated. That is, this model focuses on showing some possible relationships between family characteristics and workers' reactions to incentives in order to motivate the empirical analyses, but except for time and energy constraints, these specific theoretical channels are not directly tested in the empirical analyses.

Therefore, firstly the standard utility function $U = w(e) - c(e)$ can be extended by explicitly modeling the importance of family characteristics (*i.e.*, the employment status of spouse, child characteristics, and the presence of alternative family income sources) via three theoretical avenues: target income, loss aversion, and time and energy constraints as follows:

$$U = \begin{cases} [w(p(e, \eta)) - T(S, CHD, ALTINC)] - c(e, \eta; t(S, CHD), E(S, CHD)), & \text{if } w(e) \geq T \\ \gamma(S, CHD, ALTINC)[w(p(e, \eta)) - T(S, CHD, ALTINC)] - c(e, \eta; t(S, CHD), E(S, CHD)), & \text{if } w(e) < T \end{cases}$$

where

- $U(.)$ is the utility function
- $w(.)$ is the pay function
- $p(.)$ is the function of performance observed by the firm
- e is worker effort
- η is the random difficulty of reaching a certain performance level
- $T(.)$ is the reference target income function
- S is the spouse's employment status
- CHD is a set of child characteristics including the ages and the number of children

- *ALTINC* is the presence of alternative family income sources
- $c(.)$ is the cost function
- $t(.)$ is the time constraint function
- $E(.)$ is the energy constraint function
- γ measures the degree of loss aversion function; $\gamma = 1$ if $w(e) \geq T$ while $\gamma > 1$ if $w(e) < T$.

This extended descriptive utility function yields the maximization problem of worker's effort supply as:

$$\max_{\{e\}} E(U) = E\{\gamma(S, CHD, ALTINC)[w(p(e, \eta)) - T(S, CHD, ALTINC)] - c(e, \eta; t(S, CHD), E(S, CHD))\}$$

s. t. $U \geq \underline{u}$

where

- $E(U)$ is the expected utility
- $\gamma = 1$ if $w(e) \geq T$; $\gamma > 1$ if $w(e) < T$
- \underline{u} is the reservation utility of the worker.

The solution of this maximization problem is the worker's optimal effort level e^* . This new model is not a structural model to be estimated; instead, the model captures the possible relationships between family characteristics and the worker's decision of effort supply in the context of incentives, through three important mechanisms. Thus, workers with different family characteristics may choose different levels of effort when facing the same incentives, due to the potential linkages between family characteristics and effort supply.

3.3.2 Theoretical Linkages between Family Characteristics and Job Choices

Generally, different jobs have different types of pay function. Also, a worker might have different cost function, target income and degrees of loss aversion if the worker has different jobs. Thus, for a particular job j (*i.e.*, the job index) when having the variable incentive pay, the worker's utility function is:

$$U = \gamma_j(S, CHD, ALTINC)[w_j(p(e, \eta)) - T_j(S, CHD, ALTINC)] - c_j(e, \eta; t(S, CHD), E(S, CHD))$$

which implies that the utility levels vary across jobs for a particular worker. Therefore, the worker chooses different types of jobs based on different levels of utility related to incentive pay in the job.

Moreover, the worker also chooses different levels of effort to maximize the utility for each job. The extended maximization problem for a particular job j is:

$$\begin{aligned} \max_{\{e\}} E(U) &= E\{\gamma_j(S, CHD, ALTINC)[w_j(p(e, \eta)) - T_j(S, CHD, ALTINC)] - c_j(e, \eta; t(S, CHD), E(S, CHD))\} \\ s. t. \quad U &\geq \underline{u} \end{aligned}$$

Furthermore, on the basis of the theoretical linkages between family characteristics and a worker's effort supply decision in the extended model for a particular job and the theory of equalizing differences (Brown 1980; Rosen 1986), family characteristics could also affect workers' decisions on making job choices based on the presence of incentive pay in the job before starting the jobs, through the three mechanisms.

For example, a worker having a stay-at-home spouse might be more likely to choose the job with incentives. One possible reason is that the worker might have higher target income, stronger loss aversion, and less time and energy constraints on work so

that she or he could put more effort to earn more from the incentive pay. While a worker having a working spouse might be more likely to choose the job without incentives due to the lower target income to achieve and more time and energy constraints on work.

Moreover, the number of children might have bidirectional effects on a worker's job choices based on incentives. Specifically, a worker having more children might choose a job with incentives because she or he needs more money to meet higher target income and she or he wants to earn more from the incentive pay by working harder if they could have the job. However, there are chances that this worker having more children might choose a job without incentive pay. One possible reason is that having more children demands more time and energy and leaves the worker fewer resources for work. In this case, the worker would not choose the job with incentives because she or he could not put more effort to earn more from the incentive pay due to the constraints. Also, having children at different ages might influence the workers' job choices based on incentives. For instance, a worker having an older child would sort herself or himself into jobs with incentives because of less time and energy constraints on work comparing with the worker having a younger child demands more time and energy for childcare activities.

In addition, a worker having alternative family income sources might be more likely to choose the job without the presence of incentives, for the reason that the worker might have lower target income so that she or he doesn't need to earn more from the incentive pay.

Therefore, to sum up, the extended theoretical model could predict that workers with different family characteristics react differently to compensation incentives,

including making effort supply decisions and making job choices based on the presence of incentives in the job, through several channels. In the model, theoretical mechanisms involve target income, loss aversion, and time and energy constraints on work, which influence workers' decisions on job choices and their levels of effort. Furthermore, since these theoretical possibilities between family characteristics, theoretical mechanisms, workers' job choices and effort supply illustrated in the theoretical model are uncertain, the reduced-form relationships between family characteristics and workers' reactions to compensation incentives need empirical testing.

Chapter 4 Data

In order to analyze the reduced-form relationships between family characteristics and worker's reactions to compensation incentives, this dissertation conducts the analysis using data from two sources—the Panel Study of Income Dynamics (PSID) and the American Time Use Survey (ATUS). One difficulty of doing the empirical analysis is to measure worker's effort supply. Ideally, it would be better to observe how much real effort workers put into work. But it is very hard to observe and measure each worker's effort including working hours, working intensity and working energy in the job, especially in a large representative sample. Therefore, instead, this dissertation measures worker's effort supply as the amount of incentive pay the worker received in the job. The underlying assumption is that the amount of incentive pay positively associates with the worker's level of effort put into the job. In other words, the more effort the worker exerts, the more she or he will earn from the incentive pay. Thus, the amount of incentive pay is used as the proxy of worker's effort supply in this analysis. Moreover, following the same logic, this dissertation measures worker's job choice based on incentives as the presence of incentive pay in the job. If the worker has received incentive pay from the job, then this analysis assumes that the worker chose the job with incentives. Otherwise, it assumes that the worker chose the job without incentives.

Both the PSID and the ATUS datasets used in this dissertation contain information on the presence of incentive pay in the job, the amount of incentive pay workers received in their job, and these family characteristics including the employment status of spouse, the number of children, and the ages of children. This chapter describes

the PSID dataset, measurements of key variables using the PSID and summary statistics of the PSID sample and four sub-samples used in this dissertation in section 4.1; and then describes the ATUS dataset, measurements of key variables using the ATUS and summary statistics of the ATUS sample used in the analysis in section 4.2.

4.1 The Panel Study of Income Dynamics (1975-2010)

4.1.1 Brief Introduction to the PSID

The Panel Study of Income Dynamics (PSID) is the longest running longitudinal household survey in the world. The study started in 1968 collecting information on a nationally representative sample of over 18,000 individuals from almost 5,000 households in the United States. And it continued by following each individual continually in successive years until 1997 and in every two years since 1997. The PSID collects information on these individuals and their descendants regarding employment, income, expenditures, health, marriage, childbearing, child development, education and a lot of other topics such as wealth, pensions, and housing characteristics.² This dissertation uses the 36 waves (for the years 1975-2010)³ of the PSID for the reason that there is only full information on the amount of incentive pay workers received in their jobs since

² Source: <https://psidonline.isr.umich.edu/Guide/Brochures/PSID.pdf>.

³ In the PSID, data on income from bonuses, commissions, tips, and overtime during year t are asked in interview year $t+1$. Thus, this dissertation actually uses data covering interview years 1976-2011.

1975.⁴ For this analysis, the sample consists of only household heads between the ages of 18 and 65 for the years 1975-2010.⁵

4.1.2 Measurements of Variables using the PSID

The analysis conducts the key variables including the dependent variables and family characteristics from the PSID as follows:

Identifying Worker's Reactions to Compensation Incentives: The Presence of Incentive Pay and The Amount of Incentive Pay.

First, the presence of incentive pay is constructed as an incentive pay indicator variable. The incentive pay indicator variable is created by looking at whether the household head receives income from bonuses, commissions, tips, or overtime pay in the job. The amounts of bonuses, commissions, and tips vary by workers' discretionary effort. Thus, this is a decent measure of incentive pay for the reason that bonuses, commissions, and tips provide incentives for workers to exert more effort.⁶ This variable is mainly determined from the question "Did you/HEAD have any income from bonuses,

⁴ In the PSID, there is no question about the amount of income derived from the incentive pay heads received in interview year 1968 and 1969. From interview year 1970 through 1975, the questions were asked about the bracketed amount of head's income from the incentive pay including bonuses, commissions and overtime for the previous calendar year. Therefore, there is only full information on the amount of incentive pay heads received for the previous calendar year since interview year 1976.

⁵ This dissertation focuses on heads of households stems from the fact that only heads are asked about their income derived from the incentive pay, such as bonuses, commission, tips, and overtime in the PSID. Within each wave of the PSID data, each family unit has one and only one current household head. The household head may change over time if other changes affect the family.

⁶ It is not ideal that overtime pay is included in the incentive pay measure, but that's how the question is worded in the PSID.

overtime, tips, or commissions in (previous calendar year)?”⁷ The two categories of responses: Yes or No are used to determine whether the incentive pay presents in the job for each year. Individuals who didn’t report or respond this information are excluded from the analysis.

Second, the worker’s effort supply is measured as the amount of incentive pay including bonuses, commission, tips, and overtime pay the heads received from 1975 through 2010.⁸ The analysis deflates nominal values of the amount of incentive pay to real values for each year. The formula for obtaining a series of real values of the amount of incentive pay is given by dividing nominal values by the Consumer Price Index (CPI)

for that same year is: $Real\ Value\ of\ the\ Amount\ of\ Incentive\ Pay = \frac{Nominal\ Value}{CPI/100}$.⁹

⁷ In the PSID, for interview years 1976-1992, individuals were asked the amount of income they received from bonuses, commissions, and/or working overtime over the previous calendar year. The question was “Head’s income from bonuses, overtime, and/or commissions in (previous calendar year)”. Individuals are classified as having had an incentive pay if they reported non-zero amount of this income. Otherwise, the individuals are coded as not receiving the incentive pay in their job. In the interview year 1993, there were separate questions about the amounts of income earned from bonuses, tips, commissions, and overtime in 1992. Individuals are classified as receiving the incentive pay if they reported non-zero amount of either type of income. Otherwise, the individuals were coded as not receiving the incentive pay. Starting with interview year 1994, the question “Did you/HEAD have any income from bonuses, overtime, tips, or commissions in (previous calendar year)?” was asked directly. So this dissertation uses the answer to this question as the measure of the presence of incentive pay.

⁸ For interview years 1976-1992, the analysis directly uses “Head’s income from bonuses, overtime, and/or commissions in (previous calendar year)” as the amount of incentive pay received in the job. Starting with the interview year 1993, there are separate questions about the amounts earned from bonuses, tips, commissions, and overtime for the previous calendar year. For the sake of comparability with the pre-1993 years, adding reported amounts of income from bonuses, tips, commissions, and overtime together generates the aggregate amount of incentive pay. In this way, the analysis is able to have the amount of aggregate incentive pay received in the job for each year of the survey.

⁹ The Consumer Price Index data is in Appendix Table 1. Base year is chained; 1982-1984 = 100.

Then the analysis uses the logarithm of real value of the amount of incentive pay received in the job. Moreover, the worker's reactions to different types of incentives are measured as the amount of bonuses, commissions, tips, and overtime from those separate questions for years from 1992 to 2010. The reason of using data from this time period is that there are separate questions about the amounts earned in bonuses, tips, commissions, and overtime for the previous calendar year in the PSID only starting with the interview year 1993. The analysis uses the logarithm of real values of the amount of different types of incentives separately. Therefore, the individuals who reported zero amount of incentive pay are not included in the analysis in terms of the effects on worker's effort supply, but they are included in the analysis in terms of the effects on worker's job choices based on incentives.

Measurements of Family Characteristics. In the PSID, family characteristics including the employment status of spouse, the number of children, the ages of children, and the presence of alternative family income sources are available.

Specifically, the employment status of spouse is accessed by the question "We would like to know about what WIFE/ 'WIFE' is working now, looking for work, retired, keeping house, a student, or what?" The workers are categorized into three groups as: no spouse, having a working spouse and having a not-working spouse based on their responses. The number of children refers to "number of persons now in the Family Unit under 18 years of age". For the ages of children, four indicator variables are created to represent the presence of child between the ages of zero and five, between the ages of six and eleven, between the ages of twelve and seventeen, and age 18 and above living in the

family unit, separately.¹⁰ The presence of alternative family income sources is measured by the indicator for the presence of other income receiver in the family unit.¹¹

Control Variables. The analysis controls for gender, education measured as the highest grade level completed, potential labor market experience¹² and its square, union member status, race, industry, occupation, state, and year in the regressions. Specifically, union member status is assessed by the question “Do you belong to that labor union?—Current main job”. The two categories of responses: Yes or No are used to determine whether the worker belongs to a labor union in the job. Race is categorized into eight groups as: White, Black or African-American, American Indian or Alaska Native (native American), Asian or Native Hawaiian or Pacific Islander, Latino, Race other than black or white, Other, and two or more races mentioned. Industry includes thirteen categories: not working, Agriculture or Forestry or Fishing, Mining, Constructing, Manufacturing, Transportation or Communications or other Public Utilities, Wholesale and Retail Trade, Finance or Insurance or Real Estate, Business and Repair Services, Personal Service, Entertainment and Recreation Services, Professional and Related Service, and Public Administration. Occupation includes ten categories: not working, Professional or Technical or Kindred workers, Managers and Administrators (except Farm), Sales

¹⁰ To construct these four indicators for the presence of child at different ages in the family unit, this dissertation utilizes information on the age of youngest child from the question “Age of youngest person now in the family unit under 18 years of age” and the age of the head’s own child calculated using the responses of the question “What is full birthdate (*i.e.*, year, month, day) of each child listed?”

¹¹ In the PSID, data on the presence of other income receiver in the family unit during year t are asked in interview year $t+1$.

¹² The potential labor market experience is defined as age minus education minus 6. The analysis excludes observations having negative potential experience from the sample.

Workers, Clerical and Kindred Workers, Craftsman and Kindred Workers, Operatives, Laborers (except Farm), Farmers and Farm Managers, and Service Workers. State refers to the respondent's state of residence and year refers to the calendar year 1975-2010.

4.1.3 Summary Statistics of the PSID Sample

4.1.3.1 Summary Statistics of the 1975-2010 PSID Full Sample

Restricting the sample to observations that have incentive pay in the job, the employment status of spouse, the number of children, the ages of children, the presence of alternative family income sources and control variables leaves a total sample of 125,117 observations for 16,426 workers from 1975 through 2010. The variable definitions and summary statistics of the variables for the 1975-2010 PSID full sample used in the analysis are presented in Table 4-1.

Table 4-1 shows that 9% of the sample reported information of receiving incentive pay including bonuses, commissions, tips, and/or working overtime in their jobs. Among the 11,253 observations (*i.e.*, 5,490 workers), who received non-zero incentive compensation, the average of real values of the amount of incentive pay is \$4,572 per year. The descriptive statistics of the dependent variables—the presence of incentive pay and the amount of the incentive received in the job—provide evidence that there is variation in terms of workers' job choices based on incentives and effort supply.

The summary statistics also show that there is variation among family characteristics and control variables in the PSID sample. Nearly 25% of the sample is

female.¹³ About 60% of the sample is White and 35% is Black or African-American. Approximately 40% of workers don't have a spouse, and about 36% of them have a working spouse. The average number of children in the family unit is 1.10 with a standard deviation of 1.29. About 31% of all observations in the sample have a child aged between zero and five, 29% of them have a child between the ages of six and eleven, and over 25% of the sample has a child aged between twelve and seventeen living in the family unit. The mean of the highest completed education level is about grade 13. Approximately 16% of the sample observations are union members. The average potential labor market experience is about 21 years. In the sample, 20.7% of the observations are not working for money. In terms of occupation, 14%, 13.4%, 13.1%, 10.9%, 10.2%, 7.5%, 4.4%, 3.9%, and 1.9% of the sample are in the categories of Craftsman and Kindred Workers, Professional or Technical or Kindred Workers, Operatives, Managers and Administrators (except Farm), Service Workers, Clerical and Kindred Workers, Laborers (except Farm), Sales Workers, and Farmers and Farm Managers, respectively. In terms of industry, Professional and Related Services, Manufacturing, Wholesale and Retail Trade, Transportation or Communications or Other Public Utilities, and Construction are the top 5 industries, which have highest percentage of sample observations.

¹³ This small proportion of female observations in the 1975-2010 PSID sample is consistent with the fact that the sample of female heads is relatively small in the PSID. When the PSID began, the husband was arbitrarily designated the head if the family contained a husband-wife pair. The same is true if the female has a boyfriend with whom she has been living for at least one year.

Table 4-1: Variable Definitions and Summary Statistics for the 1975-2010 Panel Study of Income Dynamics Sample
(N=125,117)

Variable	Definition	Mean	Std. Dev.
The presence of incentive pay	Indicator of the worker's job choice based on the presence of incentive pay, which equals one if respondent reported having income from bonuses, commissions, tips, and/or working overtime in previous calendar year.	0.091	0.288
The nominal value of the amount of incentive pay	The reported annual amount of incentive pay for the respondent who received non-zero income from bonuses, commissions, tips, and/or working overtime in previous calendar year. Measured in dollars.	5901.882	27486.539
The real value of the amount of incentive pay	The real value of the amount of non-zero incentive pay for the respondent received deflated from the nominal value of the amount of incentive pay in dollars.	4571.951	18061.958
Log of amount of incentive pay	Log of real value of the amount of non-zero incentive pay the respondent received.	6.794	1.784
Spouse employment status: no spouse	Indicator variable of spouse employment status, which equals one if the respondent didn't have a spouse.	0.404	0.491
Spouse employment status: working spouse	Indicator variable of spouse employment status, which equals one if the respondent had a working spouse.	0.359	0.480
Spouse employment status: not working spouse	Indicator variable of spouse employment status, which equals one if the respondent had a not working spouse.	0.209	0.406
Number of children	The number of children living in the family unit under 18 years of age.	1.096	1.289
The presence of child age 0-5	Indicator variable of the presence of child's age, which equals one if there is child between ages of zero and five living in the family unit.	0.309	0.462
The presence of child age 6-11	Indicator variable of the presence of child's age, which equals one if there is child between ages of six and eleven living in the family unit.	0.285	0.452

Table 4-1 (Continued)

Variable	Definition	Mean	Std. Dev.
The presence of child age 12-17	Indicator variable of the presence of child's age, which equals one if there is child between twelve and seventeen living in the family unit.	0.254	0.435
The presence of child age >=18	Indicator variable of the presence of child's age, which equals one if there is child aged eighteen and above living in the family unit.	0.384	0.486
The presence of alternative family income sources	Indicator variable of the presence of alternative family income sources, which equals one if there is other income receive in the family unit.	0.245	0.430
Female	Indicator variable of gender, which equals one if the respondent was female.	0.253	0.435
Potential labor market experience	Potential labor market experience in years.	20.503	12.646
Education	The highest completed education level in grades.	12.660	2.974
Union member	Indicator variable of union member status, which equals one if respondent belonged to a labor union in the job.	0.160	0.367
White	Indicator variable of race, which equals one if respondent is white.	0.599	0.490
Black	Indicator variable of race, which equals one if respondent is black or African-American.	0.352	0.478
American Indian or Alaska Native	Indicator variable of race, which equals one if respondent is American Indian or Alaska Native (native American).	0.022	0.146
Asian or Native Hawaiian or Pacific Islander	Indicator variable of race, which equals one if respondent is Asian or Native Hawaiian or Pacific Islander.	0.003	0.055
Latino	Indicator variable of race, which equals one if respondent is Latino.	0.009	0.094
Race other than Black or White	Indicator variable of race, which equals one if respondent is race other than black or white.	0.001	0.034
Other	Indicator variable of race, which equals one if respondent is another race.	0.008	0.087
Two or more races mentioned	Indicator variable of race, which equals one if respondent is mentioned with two or more races.	0.011	0.106

Table 4-1 (Continued)

Variable	Definition	Mean	Std. Dev.
Occupation: not working	Indicator variable of occupation, which equals one if respondent is not working for money.	0.207	0.405
Occupation: Professional, Technical or Kindred Workers	Indicator variable of occupation, which equals one if respondent's occupation is Professional, Technical, and Kindred Workers.	0.134	0.340
Occupation: Managers and Administrators (except Farm)	Indicator variable of occupation, which equals one if respondent's occupation is Managers and Administrators, except Farm.	0.109	0.312
Occupation: Sales Workers	Indicator variable of occupation, which equals one if respondent's occupation is Sales Workers.	0.039	0.193
Occupation: Clerical and Kindred Workers	Indicator variable of occupation, which equals one if respondent's occupation is Clerical and Kindred Workers.	0.075	0.263
Occupation: Craftsman and Kindred Workers	Indicator variable of occupation, which equals one if respondent's occupation is Craftsman and Kindred Workers.	0.140	0.347
Occupation: Operatives	Indicator variable of occupation, which equals one if respondent's occupation is Operatives.	0.131	0.338
Occupation: Laborers (except Farm)	Indicator variable of occupation, which equals one if respondent's occupation is Laborers, except Farm.	0.044	0.205
Occupation: Farmers and Farm Managers	Indicator variable of occupation, which equals one if respondent's occupation is Farmers and Farm Managers.	0.019	0.136
Occupation: Service Workers	Indicator variable of occupation, which equals one if respondent's occupation is Service Workers.	0.102	0.302
Industry: not working	Indicator variable of industry, which equals one if respondent is not working for money.	0.207	0.405
Industry: Agriculture, Forestry, or Fisheries	Indicator variable of industry, which equals one if respondent's industry is Agriculture, Forestry, and Fisheries.	0.027	0.163
Industry: Mining	Indicator variable of industry, which equals one if respondent's industry is Mining.	0.007	0.081

Table 4-1 (Continued)

Variable	Definition	Mean	Std. Dev.
Industry: Construction	Indicator variable of industry, which equals one if respondent's industry is Construction.	0.070	0.255
Industry: Manufacturing	Indicator variable of industry, which equals one if respondent's industry is Manufacturing.	0.181	0.385
Industry: Transportation, Communications, and Other Public Utilities	Indicator variable of industry, which equals one if respondent's industry is Transportation, Communications, and Other Public Utilities.	0.071	0.257
Industry: Wholesale and Retail Trade	Indicator variable of industry, which equals one if respondent's industry is Wholesale and Retail Trade.	0.122	0.328
Industry: Finance, Insurance, and Real Estate	Indicator variable of industry, which equals one if respondent's industry is Finance, Insurance, and Real Estate.	0.036	0.186
Industry: Business and Repair Services	Indicator variable of industry, which equals one if respondent's industry is Business and Repair Services.	0.038	0.192
Industry: Personal Services	Indicator variable of industry, which equals one if respondent's industry is Personal Services.	0.028	0.166
Industry: Entertainment and Recreation Services	Indicator variable of industry, which equals one if respondent's industry is Entertainment and Recreation Services.	0.007	0.084
Industry: Professional and Related Services	Indicator variable of industry, which equals one if respondent's industry is Professional and Related Services.	0.200	0.400
Industry: Public Administration	Indicator variable of industry, which equals one if respondent's industry is Public Administration.	0.061	0.240

4.1.3.2 Summary Statistics of the 1992-2010 PSID Sub-Samples

It would be ideal to differentiate different types of incentives such as bonuses, commissions and tips and to use them separately in the analysis. But those separate questions about the amounts earned in bonuses, commissions and tips for the previous calendar year are not available until the interview year 1993 in the PSID. Thus, the

analysis has four sub-samples in terms of non-zero annual amount of bonuses, tips, commissions, and overtime pay the respondent received in the job from 1992 to 2010 to test workers' reactions to different types of incentives, but it is not the main analysis of this dissertation. This section presents summary statistics of key variables for these four sub-samples in Table 4-2, 4-3, 4-4, and 4-5.¹⁴

First, as presented in Table 4-2, restricting the 1992-2010 PSID sample to individual with positive annual dollar amounts of bonuses the respondent received in previous calendar year leaves a total sample of 2,794 observations for 1,826 workers. Table 4-2 shows that the average of real values of the amount of bonuses is \$4,798 per year with a very large standard deviation, among the people who received non-zero bonuses. In this sub-sample, nearly 23% is female, which is similar to the proportion of the 1975-2010 PSID full sample. Approximately 37% of workers don't have a spouse, and about 39% of them have a working spouse. The average number of children in the family unit is 0.97 with a standard deviation of 1.15. About 25% of the 2,794 observations in the sub-sample have a child aged between zero and five, 28% of them have a child between the ages of six and eleven, and over 26% of the sample has a child aged between twelve and seventeen living in the family unit. The mean of the highest grade completed is 14. Approximately 7.8% of the sub-sample observations are union members, which are fewer than that of the 1975-2010 full sample. The average potential labor market experience is about 20 years.

¹⁴ The variables of race, industry, and occupation are presented in Appendix Tables 2, 3, 4, and 5.

**Table 4-2: Summary Statistics for the 1992-2010 PSID Sub-sample with Non-zero
Income from Bonuses**
(N=2,794)

Variable	Mean	Std. Dev.
The nominal value of the amount of bonuses	8098.987	40650.638
The real value of the amount of bonuses	4798.283	23565.171
Log of amount of bonuses	6.626	1.777
Spouse employment status: no spouse	0.370	0.483
Spouse employment status: working spouse	0.385	0.487
Spouse employment status: not working spouse	0.149	0.356
Number of children	0.967	1.148
The presence of child age 0-5	0.254	0.435
The presence of child age 6-11	0.281	0.450
The presence of child age 7-12	0.266	0.442
The presence of child age >=18	0.417	0.493
The presence of alternative family income sources	0.231	0.422
Female	0.228	0.420
Potential labor market experience	19.730	10.412
Education	13.738	2.634
Union member	0.078	0.268

Second, as presented in Table 4-3, restricting the 1992-2010 PSID sample to individuals with positive annual dollar amounts of non-zero commissions the respondent received in previous calendar year leaves a total sample of 270 observations for 220 workers. Table 4-3 shows that the average of real values of the amount of commissions is \$19,139 per year with a very large standard deviation, among the people who received non-zero commissions. In this sub-sample, nearly 14% is female, which is smaller than the proportion of the 1975-2010 PSID full sample. Approximately 33% of workers don't have a spouse, and about 40% of them have a working spouse. The average number of children in the family unit is 1.10 with a standard deviation of 1.29. About 28% of the 270 observations in the sub-sample have a child aged between zero and five, 25% of them have a child between the ages of six and eleven, and over 20% of the sample has a child aged between twelve and seventeen living in the family unit. The mean of the

highest grade completed is 14. Approximately 2.2% of the sub-sample observations are union members, which are fewer than that of the full sample. The average potential labor market experience is about 21 years.

Table 4-3: Summary Statistics for the 1992-2010 PSID Sub-sample with Non-zero Income from Commissions
(N=270)

Variable	Mean	Std. Dev.
The nominal value of the amount of bonuses	30443.752	81171.054
The real value of the amount of bonuses	19138.956	547.259
Log of amount of bonuses	8.435	2.084
Spouse employment status: no spouse	0.330	0.471
Spouse employment status: working spouse	0.404	0.492
Spouse employment status: not working spouse	0.159	0.367
Number of children	1.096	1.289
The presence of child age 0-5	0.278	0.449
The presence of child age 6-11	0.248	0.433
The presence of child age 7-12	0.196	0.398
The presence of child age >=18	0.493	0.501
The presence of alternative family income sources	0.274	0.447
Female	0.141	0.348
Potential labor market experience	21.163	11.146
Education	14.126	2.150
Union member	0.022	0.148

Third, as presented in Table 4-4, restricting the 1992-2010 PSID sample to individuals with positive annual dollar amounts of non-zero tips the respondent received in previous calendar year leaves a total sample of 237 observations for 186 workers. Table 4-4 shows that the average of real values of the amount of tips is \$4,855 per year among the people who received non-zero tips. In this sub-sample, nearly 46% is female, which is larger than the proportion of the 1975-2010 PSID full sample. Approximately 72% of workers don't have a spouse, and about 16% of them have a working spouse. The average number of children in the family unit is 0.81 with a standard deviation of 1.12.

About 31% of the 237 observations in the sub-sample have a child aged between zero and five, 25% of them have a child between the ages of six and eleven, and over 23% of the sample has a child aged between twelve and seventeen living in the family unit. The mean of the highest completed education level is grade 13. Approximately 6.8% of the sub-sample observations are union members, which are fewer than that of the 1975-2010 PSID full sample. The average potential labor market experience is about 13 years, which is fewer than that of the full sample.

Table 4-4: Summary Statistics for the 1992-2010 PSID Sub-sample with Non-zero Income from Tips
(N=237)

Variable	Mean	Std. Dev.
The nominal value of the amount of bonuses	7370.350	64955.391
The real value of the amount of bonuses	4854.960	43821.549
Log of amount of bonuses	6.365	1.907
Spouse employment status: no spouse	0.717	0.451
Spouse employment status: working spouse	0.160	0.368
Spouse employment status: not working spouse	0.072	0.259
Number of children	0.810	1.117
The presence of child age 0-5	0.312	0.464
The presence of child age 6-11	0.245	0.431
The presence of child age 7-12	0.232	0.423
The presence of child age >=18	0.439	0.497
The presence of alternative family income sources	0.177	0.383
Female	0.456	0.499
Potential labor market experience	13.380	9.243
Education	12.578	1.792
Union member	0.068	0.251

Fourth, as presented in Table 4-5, restricting the 1992-2010 PSID sample to individuals with positive annual dollar amounts of non-zero overtime pay the respondent received in previous calendar year leaves a total sample of 1,121 observations for 915 workers. Table 4-5 shows that the average of real values of the amount of overtime pay is

\$1,987 per year with a very large standard deviation, among the people who received non-zero overtime pay. In this sub-sample, nearly 28% is female. Approximately 46% of workers don't have a spouse, and about 33% of them have a working spouse. The average number of children in the family unit is 1.03 with a standard deviation of 1.20. About 28% of the 1,121 observations in the sub-sample have a child aged between zero and five, 31% of them have a child between the ages of six and eleven, and over 26% of the sample has a child aged between twelve and seventeen living in the family unit. The mean of the highest grade completed is 13. Approximately 28.9% of the sub-sample observations are union members. The average potential labor market experience is about 18 years.

Table 4-5: Summary Statistics for the 1992-2010 PSID Sub-sample with Non-zero Income from Overtime Pay
(N=1,121)

Variable	Mean	Std. Dev.
The nominal value of the amount of bonuses	3220.358	5427.844
The real value of the amount of bonuses	1987.294	3246.092
Log of amount of bonuses	6.612	1.571
Spouse employment status: no spouse	0.459	0.498
Spouse employment status: working spouse	0.331	0.471
Spouse employment status: not working spouse	0.133	0.340
Number of children	1.029	1.201
The presence of child age 0-5	0.275	0.447
The presence of child age 6-11	0.309	0.462
The presence of child age 7-12	0.256	0.437
The presence of child age >=18	0.395	0.489
The presence of alternative family income sources	0.222	0.416
Female	0.276	0.447
Potential labor market experience	18.047	10.354
Education	12.919	2.210
Union member	0.289	0.454

4.2 The American Time Use Survey (2003-2012)

4.2.1 Brief Introduction to the ATUS

The American Time Use Survey (ATUS) is an ongoing survey on time use to measure how people spend their time among activities and the study began in 2003 in the U.S. The individuals in the ATUS are randomly selected from households that are completing their participation in the Current Population Survey (CPS).¹⁵ The ATUS interviews are conducted between two and five months after the last CPS interview for the ATUS household.¹⁶ The ATUS interviews are administered using computer-assisted telephone, either in English or in Spanish (see Hamermesh *et al.* 2005 for a description the ATUS study and interview process). The ATUS respondents provide detailed information on how, where, and with whom they spend their time during a designated 24-hour period from 4 a.m. on the designated day to 4 a.m. on the following day (the interview day). This unique feature of the ATUS data provides the opportunity to explore the effects of the time constraints on work in this dissertation. Since the ATUS uses the CPS as a sampling frame, The ATUS also includes the usual labor market and demographic information as the CPS.

In 2003, the ATUS started collecting 20,720 usable time diaries, or over 1,700 diaries per month (Hamermesh *et al.* 2005). But beginning in January 2004, the sample

¹⁵ Households that have completed their final (8th) month of the CPS are eligible for the ATUS. One person aged 15 or over is randomly chosen from each household, which is selected from the eligible group to represent a range of demographic characteristics, to answer questions about his or her time use. All adults within a household have the same probability of being selected. This person is interviewed for the ATUS 2-5 months after his or her household's final CPS interview. Source: <http://www.bls.gov/tus/atusfaqs.htm#4>.

¹⁶ Source: <https://www.atusdata.org/atus/whatisatus.shtml>.

size was reduced to about 14,000 or about 1,150 diaries per month, and it has remained near that level since 2004.¹⁷ Thus, the data has been collected from over 136,000 interviews conducted from 2003 to 2012. For this analysis, the sample only consists of respondents aged from 18 to 65 for the years 2003 through 2012.

4.2.2 Measurement of Variables using the ATUS

The key variables including the dependent variables and family characteristics from the ATUS are constructed as follows:

Identifying Worker's Reactions to Compensation Incentives: The Presence of Incentive Pay and The Amount of Incentive Pay.

First, similar to using the PSID data, the presence of incentive pay in the ATUS is also constructed as an incentive pay indicator variable. The incentive pay indicator variable is created by looking at whether the individual receives commissions, tips, or overtime in the job. This variable is determined from the question “Do you usually receive overtime pay, tips, or commissions [at your main job]?” The two categories of responses, Yes or No, are used to identify the presence of incentive pay in the job. This question was asked for employed ATUS respondents, excluding those who were self-employed or working without pay. Note that one key difference between the incentive pay in the ATUS and the one in the PSID is that bonuses are not included as part of incentive pay in the ATUS, due to the wording of the questionnaire in the ATUS.

¹⁷ Source: https://www.atusdata.org/atus/linked_docs/atususersguide.pdf.

Second, also similar to the PSID data, the worker's effort supply is measured as the amount of incentive pay including overtime pay, tips, and commissions workers received in their job from 2003 to 2010. The variable is assessed from the question "How much do you usually receive JUST in overtime pay, tips or commissions, before taxes or other deductions?" This question was asked for employed ATUS respondents who report hourly earnings and who report usually receiving overtime pay, tips, or commissions. The response is measured in weekly dollar amount top-coded at \$2,884.61. The analysis deflates nominal values of the amount of incentive pay to real values for each year by dividing nominal values by the CPI for that same year. Then the analysis uses the logarithm of real value of the amount of weekly incentive pay received in the job, which excludes the individuals who reported zero amount of incentive in the analysis on the effects of worker's effort supply. But these individuals are still included in the analysis of worker's job choices based on incentives.

Measurements of Family characteristics. In the ATUS, family characteristics include spouse employment status, the number of children and the ages of children. Note that one difference from using the PSID data is that the presence of alternative family income sources is not available in the ATUS sample.

Specifically, the employment status of spouse is determined from the responses of whether the respondent's spouse or unmarried partner is employed. The workers are categorized into three groups as: no spouse if the response is "Not in universe", having an employed spouse if the response is employed, and having a not-employed spouse if the

response is not employed.¹⁸ The number of children is measured as the number of the respondent's own children under the age of 18 who live in the household.¹⁹ Individuals who have own children under 18 but not living in the household are excluded from the sample. For the ages of children, six indicators are created to represent the presence of an individual's own child under the age of one, between the ages of one and two, between the ages of three and five, between the ages of six and twelve, between the ages of thirteen and seventeen, and no own child under the age of 18 living in the household, separately.

Measuring Time Constraints on Work. Using detailed information of time spent on individual's activities in ATUS, this analysis uses two ways to measure the time constraints on work. The underlying assumption is that the more time the individual spends on non-work activities, the more time constraints on work she or he has. The time spent on each activity is measured in minutes in the ATUS. This analysis rescales these time variables by dividing the original amount of time by 100.

The first way is to generate an aggregate time constraints on work variable to capture the total time influences of other non-work activities. The variable is created as the aggregate time spent on activities of household, caring for and helping household and non-household members, socializing, relaxing, and leisure, and sports, exercise, and recreation in the 24-hour period starting at 4 a.m. the preceding day.

¹⁸ "Universe" here is defined as ATUS respondents with a spouse or unmarried partner in the household.

¹⁹ In the ATUS, own children refer to the respondent's own children, whether they live in the respondent's household or in another household. Stepchildren and adopted children are considered own children, although foster children are not. Source: <http://www.bls.gov/tus/atususersguide.pdf>.

The second way is to construct separate time constraints on work variables in order to explore the time influences of different types of activities. This analysis constructs three separate time constraints variables by adding each group of similar activities together: time spent on household activities, aggregate time spent on caring for and helping household and non-household members, and aggregate time spent on socializing, relaxing, leisure, sports, exercise, and recreation activities.

Control Variables. The analysis controls for gender, education measured as completed education years, potential labor market experience²⁰ and its square, union member status, metropolitan area, race, industry, occupation, current state, and year in the regressions. Specifically, union member status indicates whether or not the individual belonged to a union. The metropolitan area variable indicates whether a household locates in a metropolitan area or not. Race is categorized into five groups: White only, Black only, American Indian or Alaskan Native, Asian only or Hawaiian Pacific Islander only, and Two or more races. Industry includes twenty one categories: not working, Agriculture or Forestry or Fishing or Hunting, Mining, Construction, Manufacturing, Wholesale Trade, Retail Trade, Transportation and Warehousing, Utilities, Information, Finance and Insurance, Real Estate and Rental and Leasing, Professional or Scientific or Technical Services, Management or Administrative or Waste Management Services, Educational Services, Health Care and Social Services, Arts or Entertainment or Recreation, Accommodation and Food Services, Other Services, and Public Administration. Occupation includes ten categories: not working, Management or

²⁰ As in the PSID, the analysis excludes observations had negative potential experience from the ATUS sample.

Business or Financial occupations, Professional and Related occupations, Service occupations, Sales and Related occupations, Office and Administrative Support occupations, Farming or Fishing or Forestry occupations, Construction and Extraction occupations, Installation or Maintenance or Repair occupations, Production occupations, and Transportation and Material Moving occupations. Current state refers to the household's state of residence and year refers to the calendar year from 2003 to 2012.

4.2.3 Summary Statistics of the ATUS Sample

The restricted sample with the presence of incentive pay, the employment status of spouse, the number of children, the age of child, and control variables has 54,612 observations. In order to present the nature of the ATUS sample used in the analysis, the unweighted summary statistics and variable definitions for the 2003-2012 ATUS sample are shown in Table 4-6. All regression estimates using the ATUS data reported in the next section of the paper are weighted using the ATUS sample weights.

Table 4-6 shows that in the ATUS sample, 17.7% of the observations reported they usually received overtime pay, tips, or commissions at their job. Among 3,524 observations who received non-zero amount of compensation incentives in their job, the average of real values of the weekly incentive pay is \$91. The descriptive statistics of the dependent variables—the presence of incentive pay and the amount of the incentive received in the job—consistently provide evidence that there are a lot of variation in terms of workers' job choices based on incentives and effort supply.

The summary statistics also show that there is variation among family characteristics and control variables in the sample. Compared with the PSID sample, the ATUS sample has relative more female observations. About 53% of the ATUS sample is female. About 83% of the sample is White and 12% is Black. Approximately 48% of the sample has a working spouse and nearly 38% of the workers don't have a spouse. The mean value of the number of own children under age 18 living in the household is 0.91. About 4% of all observations in the sample have children under the age of one, 9% of them have children aged between one and two, 14% of them have children aged between three and five, nearly 28% of the sample has children between the ages of six and twelve, and 18% of them have children aged between thirteen and seventeen. The average completed education years is nearly 14 years and the average potential labor market experience is 21 years. 14% of the workers belong to unions and about 83% of the sample lives in a metropolitan area. In terms of occupation, Professional and Related occupations, Management or Business or Financial occupations, Office and Administrative Support occupations, Service occupations, and Sales and Related occupations are the top 5 occupations that have highest percentage of the sample. In terms of industry, Health Care and Social Services, Manufacturing, Education Services, Retail Trade, Professional or Scientific or Technical Services and Public Administration are the top 6 industries that have highest percentage of sample observations.

In terms of time spent on different activities, individuals spent about 407 minutes on average on household, caring for other people, socializing, and sports activities in the 24-hour period. Individuals daily spent about 109 minutes, 44 minutes, and 253 minutes

on average on household activities, on caring for and helping household and non-household members activities, and on both socializing and sports activities, respectively.

Table 4-6: Variable Definitions and Unweighted Summary Statistics for the 2003-2012 American Time Use Survey Sample
(N=54,612)

Variable	Definition	Mean	Std. Dev.
The presence of incentive pay	Indicator of the worker's job choice based on the presence of incentive pay, which equals one if respondent receives overtime pay, tips, or commissions at the main job.	0.177	0.382
The nominal value of the amount of incentive pay	The reported weekly amount of incentive pay for the respondent who received non-zero income from overtime pay, tips, or commissions at the main job. Measured in dollars.	181.623	206.288
The real value of the amount of incentive pay	The real value of the weekly amount of non-zero incentive pay in dollars.	90.605	102.695
Log of amount of incentive pay	Log of real value of the weekly amount of non-zero incentive pay the respondent received.	3.979	1.157
Spouse employment status: no spouse	Indicator variable of spouse employment status, which equals one if the respondent didn't have a spouse.	0.381	0.486
Spouse employment status: working spouse	Indicator variable of spouse employment status, which equals one if the respondent had an employed spouse.	0.478	0.500
Spouse employment status: not working spouse	Indicator variable of spouse employment status, which equals one if the respondent had a not employed spouse.	0.141	0.348
Number of own children	The number of own children under the age of 18 living in the household.	0.908	1.097
The presence of own child age <1	Indicator variable of the presence of own child's age, which equals one if there is own child aged under one living in the household.	0.041	0.198
The presence of own child age 1-2	Indicator variable of the presence of own child's age, which equals one if there is own child aged between one and two living in the household.	0.093	0.290

Table 4-6 (Continued)

Variable	Definition	Mean	Std. Dev.
The presence of own child age 3-5	Indicator variable of the presence of own child's age, which equals one if there is own child aged between three and five living in the household.	0.139	0.346
The presence of own child age 6-12	Indicator variable of the presence of own child's age, which equals one if there is own child aged between six and twelve living in the household.	0.278	0.448
The presence of own child age 13-17	Indicator variable of the presence of own child's age, which equals one if there is own child aged between thirteen and seventeen living in the household.	0.181	0.385
The presence of no own child age <18	Indicator variable of the presence of own child's age, which equals one if there is no own child under age of 18 living in the household.	0.500	0.500
Aggregate time constraints on work	Time spent on household, caring for household and non-household members, socializing, relaxing, leisure, sports, exercise, and recreation activities in minutes.	407.163	224.361
Time spent on household activities	Time spent on household activities in minutes.	109.443	132.284
Aggregate time spent on caring for people	Time spent on caring for household and non-household members activities in minutes.	44.900	88.657
Aggregate time spent on social activities	Time spent on socializing, relaxing, leisure, sports, exercise, and recreation activities in minutes.	252.820	182.478
Female	Indicator variable of gender, which equals one if the respondent was female.	0.530	0.499
Potential labor market experience	Potential labor market experience in years.	21.284	11.481
Education	Completed education in years.	14.191	2.899
Union member	Indicator variable of union member status, which equals one if the respondent belonged to a union.	0.140	0.347
Metropolitan	Indicator variable which equals one if a household was located in a metropolitan area.	0.832	0.373
White	Indicator variable of race, which equals one if respondent is White.	0.827	0.378
Black	Indicator variable of race, which equals one if respondent is Black.	0.118	0.323

Table 4-6 (Continued)

Variable	Definition	Mean	Std. Dev.
American Indian or Alaska Native	Indicator variable of race, which equals one if respondent is American Indian or Alaska Native.	0.006	0.080
Asian or Pacific Islander	Indicator variable of race, which equals one if respondent is Asian or Pacific Islander.	0.036	0.187
Two or more races	Indicator variable of race, which equals one if respondent is reported with two or more races.	0.012	0.110
Occupation: not working	Indicator variable of occupation, which equals one if respondent is not working.	0.000	0.000
Occupation: Management, Business, or Financial occupations	Indicator variable of occupation, which equals one if respondent's occupation is Management or Business or Financial occupations.	0.164	0.370
Occupation: Professional and Related occupations	Indicator variable of occupation, which equals one if respondent's occupation is Professional and Related occupations.	0.262	0.440
Occupation: Service occupations	Indicator variable of occupation, which equals one if respondent's occupation is Service occupations.	0.136	0.343
Occupation: Sales and Related occupations	Indicator variable of occupation, which equals one if respondent's occupation is Sales and Related occupations.	0.093	0.290
Occupation: Office and Administrative Support	Indicator variable of occupation, which equals one if respondent's occupation is Office and Administrative Support occupations.	0.149	0.357
Occupation: Farming, Fishing, or Forestry occupations	Indicator variable of occupation, which equals one if respondent's occupation is Farming or Fishing or Forestry occupations.	0.006	0.078
Occupation: Construction and Extraction occupations	Indicator variable of occupation, which equals one if respondent's occupation is Construction and Extraction occupations.	0.039	0.194
Occupation: Installation, Maintenance, or Repair occupations	Indicator variable of occupation, which equals one if respondent's occupation is Installation or Maintenance or Repair occupations.	0.035	0.183
Occupation: Production	Indicator variable of occupation, which equals one if respondent's occupation is Production occupations.	0.066	0.248

Table 4-6 (Continued)

Variable	Definition	Mean	Std. Dev.
Occupation: Transportation and Material Moving occupations	Indicator variable of occupation, which equals one if respondent's occupation is Transportation and Material Moving occupations.	0.050	0.218
Industry: not working	Indicator variable of industry, which equals one if respondent is not working.	0.000	0.000
Industry: Agriculture, Forestry, Fishing, or Hunting	Indicator variable of industry, which equals one if respondent's industry is Agriculture or Forestry or Fishing or Hunting.	0.008	0.088
Industry: Mining	Indicator variable of industry, which equals one if respondent's industry is Mining.	0.004	0.063
Industry: Construction	Indicator variable of industry, which equals one if respondent's industry is Construction.	0.050	0.218
Industry: Manufacturing	Indicator variable of industry, which equals one if respondent's industry is Manufacturing.	0.131	0.337
Industry: Wholesale Trade	Indicator variable of industry, which equals one if respondent's industry is Wholesale Trade.	0.031	0.173
Industry: Retail Trade	Indicator variable of industry, which equals one if respondent's industry is Retail Trade.	0.098	0.297
Industry: Transportation and Warehousing	Indicator variable of industry, which equals one if respondent's industry is Transportation and Warehousing.	0.040	0.197
Industry: Utilities	Indicator variable of industry, which equals one if respondent's industry is Utilities.	0.011	0.106
Industry: Information	Indicator variable of industry, which equals one if respondent's industry is Information.	0.029	0.168
Industry: Finance and Insurance	Indicator variable of industry, which equals one if respondent's industry is Finance and Insurance.	0.061	0.239
Industry: Real Estate and Rental and Leasing	Indicator variable of industry, which equals one if respondent's industry is Real Estate and Rental and Leasing.	0.017	0.129
Industry: Professional, Scientific, or Technical Services	Indicator variable of industry, which equals one if respondent's industry is Professional or Scientific or Technical Services.	0.063	0.242

Table 4-6 (Continued)

Variable	Definition	Mean	Std. Dev.
Industry: Management, Administrative and Waste Management Services	Indicator variable of industry, which equals one if respondent's industry is Management or Administrative or Waste Management Services.	0.032	0.175
Industry: Educational Services	Indicator variable of industry, which equals one if respondent's industry is Educational Services.	0.117	0.322
Industry: Health Care and Social Services	Indicator variable of industry, which equals one if respondent's industry is Health Care and Social Services.	0.144	0.351
Industry: Arts, Entertainment, and Recreation	Indicator variable of industry, which equals one if respondent's industry is Arts or Entertainment or Recreation.	0.015	0.121
Industry: Accommodation and Food Services	Indicator variable of industry, which equals one if respondent's industry is Accommodation and Food Services.	0.046	0.209
Industry: Other Services	Indicator variable of industry, which equals one if respondent's industry is Other Services.	0.041	0.199
Industry: Public Administration	Indicator variable of industry, which equals one if respondent's industry is Public Administration.	0.063	0.244

4.3 Limitations of the Two Datasets

The PSID and the ATUS datasets have several common limitations. First, both datasets don't directly observe worker's effort. Thus, this dissertation needs to use proxy for effort supply in the analysis. Second, the incentive pay in both datasets includes overtime pay as part of the incentives. But overtime pay could be highly associated with overtime working hours (*i.e.*, labor supply) and sometimes the workers are forced to work overtime by the companies. In this case, the overtime pay is not an incentive. So this analysis uses selected years of PSID data to have separate measures of different types of incentives for several years in order to have more accurate measures of incentive pay.

Third, the variables of the number of (own) children only measure those under the age of 18 living in the family unit or household. But the number of children above the age of 18 might have impacts on the worker's reactions to incentives. Both datasets don't provide sufficient information for the analysis to measure the number of children above 18 in the household. Fourth, both datasets don't observe an individual's target income or loss aversion so that this dissertation couldn't explore these two possible theoretical mechanisms in the analysis.

In addition to these common limitations, the PSID data has too few female observations in the sample due to the nature of the PSID study's respondents. Because there might be differences between men and women in terms of reacting to compensation incentives, there could be some biases to use this male-dominated sample. Another limitation of the PSID data is the industry and occupation categories are general and broad, which is not as detailed categories as in the ATUS. Different industries especially different occupations usually have different types of incentives so that it might influence workers' choices based on incentives. Thus, it might be necessary to control more detailed categories of job industry and occupation in the analysis.

Moreover, the ATUS dataset has several other limitations as well. First, as mentioned earlier in section 4.2.1, the incentive pay measure in the ATUS doesn't include bonuses due to the ATUS's original questionnaire. But bonuses are one of the most important compensation incentives the companies use, so there might be biases not having bonuses as part of the incentive pay measure. Second, due to the limited information, the child-related variables from the ATUS focus on the respondent's own

child under the age of 18 living in the household, ignoring the own child not living in the household or other children living in the household. Actually, the other types of children might also influence the individual's reactions to incentives. Moreover, the indicators of the presence of own children at various ages in the household can't differentiate people who don't have a child and people who have an own child at the age of 18 or above living in the household due to the ATUS's original questions. But those two groups of people might react differently to incentives.

Chapter 5 The Effects of Family Characteristics on Job Choices

This chapter presents the empirical analysis and results estimating the effects of family characteristics on workers' job choices based on incentives in the job using both the PSID and the AUTS samples. First, this chapter describes the empirical method—multivariate Probit regressions—used to examine the reduced-form relationships between family characteristics and the presence of incentive pay in the job in section 5.1. Second, section 5.2 presents and discusses the regression results using the data from the 1975-2010 PSID sample. Third, section 5.3 first reports and discusses the regression results of the reduced-form relationships between family characteristics and the presence of incentive pay using data from the 2003-2012 ATUS full sample. Moreover, this section presents the empirical analysis adding time constraints on work from the ATUS full sample into the regressions to explore some underlying mechanisms by which the reduced-form relationships between family characteristics and worker's job choices based on incentives occur. Furthermore, this section shows the regression results using the ATUS sub-samples by sex to explore the gender differences in workers' job choices based on the presence of incentive pay in the job and the possible mechanism—time constraints on work—for women and men separately. Lastly, this chapter compares the estimation results using the same variables with both the 1975-2010 PSID sample and the 2003-2012 ATUS sample in section 5.4.

5.1 Empirical Method

The impact of family characteristics on a worker's job choices based on incentives is estimated using multivariate Probit regression models.²¹ The baseline regression model is of the following form:

$$\textit{The presence of incentive pay} = \beta_0 + \beta_1 \textit{Family Characteristics} + \varepsilon$$

Where the dependent variable—the presence of incentive pay—is a binary variable (*i.e.*, equaling “1” when the worker chooses a job with incentive pay; and equaling “0” when the worker chooses a job without incentive pay). “Family characteristics” refers to the family characteristics independent variables used in the estimation which include: 1) Two indicator variables of the spouse's employment status: the worker having a working spouse and the worker having a not working spouse. The third indicator—the worker who is not having a spouse—is used as the reference group and not included in the regressions. 2) The number of children under the age of 18 using the PSID sample and the number of own child under the age of 18 using the ATUS sample. 3) Indicator variables of the presence of children at various ages living in the family unit/household. Using the PSID sample, three indicators are included: the presence of child aged between 0 and 5, the presence of child aged between 6 and 11, and the presence of child aged between 12 and 17; The fourth indicator variable: the presence of child aged 18 and

²¹ Note for the ATUS data, both the weighted Probit regressions and weighted OLS regressions are used in the empirical analysis for the binary dependent variable, which is the presence of incentive pay received in the job in these regressions. But the weighted Probit regressions had some issues in terms of convergence especially for analyzing the whole ATUS sample. The estimated coefficients are similar comparing the weighted Probit regressions and the weighted OLS regressions for partial sample. Thus, due to the computational convenience and accuracy, this dissertation reports the weighted OLS estimates using the ATUS sample.

above is used as the reference group and not included in the regressions. Using the ATUS sample, five indicators are included: the presence of own child aged under 1, the presence of own child aged between 1 and 2, the presence of own child aged between 3 and 5, the presence of own child aged between 6 and 12, and the presence of child aged between 13 and 17. The sixth indicator: no own child under the age of 18 living in the household is used as the reference group and not included in the regressions. 4) Using the PSID sample, the indicator variable of the presence of alternative family income sources is included in the regressions as one of the family characteristics. The analysis also has year fixed effects when using the PSID sample.

Adding control variables into the baseline regressions, the regressions models become as the following form:

$$\textit{The presence of incentive pay} = \beta_0 + \beta_1 \textit{Family Characteristics} + \beta_2 \textit{Controls} + \varepsilon$$

Where the control variables include indicator variable of gender, potential labor market experience and its square, completed education, indicator variable of union member status, race, occupation, industry, state and year for using both the PSID and ATUS samples. In addition, the indicator variable of living in a metropolitan area is controlled in the regressions using the ATUS sample.

Furthermore, to test how one possible theoretical mechanism—time constraints on work—plays the role in the relationships between family characteristics and worker’s job choices based incentives, the analysis first adds the aggregate time constraints on work using the ATUS sample into the regression as:

$$\begin{aligned} \textit{The presence of incentive pay} = & \beta_0 + \beta_1 \textit{Family Characteristics} + \beta_2 \textit{Controls} \\ & + \beta_3 \textit{Aggregate time constraints on work} + \varepsilon \end{aligned}$$

Where the *Controls* are the same control variables using the ATUS sample as aforementioned. Moreover, the analysis adds three separate time constraints on work variables—time spent on household activities, time spent on caring for other people, and time spent on socializing and sports —into the regression as:

$$\begin{aligned} \textit{The presence of incentive pay} = & \beta_0 + \beta_1 \textit{ Family Characteristics} + \beta_2 \textit{ Controls} \\ & + \beta_4 \textit{ Time spent on household} \\ & + \beta_5 \textit{ Aggregate time spent on caring for people} \\ & + \beta_6 \textit{ Aggregate time spent on social activities} + \varepsilon \end{aligned}$$

5.2 Regression Results on the Relationships between Family Characteristics and Job Choices using the PSID

This section presents the regression results of the reduce-form relationships between family characteristics and workers’ decisions on sorting themselves into different jobs on the basis of incentives present in the job using the data from the 1975-2010 PSID sample and discusses the implications of these results. The empirical estimates are presented in Table 5-1. The marginal effects of the Probit coefficients are reported in both columns.

First, column (1) presents the results from a baseline model that only includes the family characteristics—the employment status of spouse, the number of children, the presence of child at different ages, and the presence of alternative family income sources—as the independent variables. As can be seen from column (1), the estimates demonstrate that family characteristics have significant relationships with the dependent variable—worker’s job choice based on the presence of incentives. Second, column (2)

adds the control variables including gender, potential labor market experience and its square, education as the highest grade level completed, union member status, race, occupation, industry, and state into the baseline model. The analysis controls for year fixed effects in both regressions.

The results in both columns of Table 5-1 consistently show that having a not-working spouse and the number of children have significant relationships with the presence of incentive pay in the job. Specifically, a worker who has a not-working spouse is more likely (*i.e.*, with a 15.6 percent higher probability) to have a job with incentives relative to the worker who does not have a spouse.²² One explanation could be that having a not-working spouse gives the worker more financial pressure so that the worker has a higher target income and also exhibits higher degree of loss aversion, especially relative to a worker who does not have a spouse. Thus, the worker would be more likely to choose jobs with incentive pay and then she or he could earn more income from incentives by putting more effort when she or he gets the job. Another possible explanation is that having a not-working spouse provides the worker more resources for work, such as time, related to the “wife/spouse as a resource” theory, so that the worker could work harder in the job. In this case, the worker is more willing to choose jobs with incentives so that she or he could earn more with the available resources for work.

The results in both columns of Table 5-1 also show that the number of children has significant and negative relationship with choosing an incentive pay job. According

²² $0.156 = \frac{0.014}{0.09}$, where 0.014 is the coefficient of spouse employment status: not working in column (2) of Table 5-1 and 0.09 is the base rate of the respondents reporting the presence of incentive pay in the 1975-2010 PSID sample.

to the estimate in column (2), one additional child reduces the probability of choosing a job with incentive pay by 0.3 percentage points, holding all other independent variables constant. It implies that workers with more children are less likely to choose jobs with compensation incentives. One possible reason could be that having more children places more time and energy constraints on work so that the worker would exert less effort in the job. Thus, the workers having more children are less willing to choose jobs with incentives because they know they have less time and energy to put into work.

In addition to these family characteristics, the results in columns (2) show that there are significant gender differences in terms of workers sorting into different jobs based on the presence of incentive pay.²³ Women are less likely (*i.e.*, with a 7.8 percent lower probability) to choose jobs with incentive pay relative to men, controlling for other observables.²⁴ Note that there is a small number of female observations in the PSID sample and women as household heads in the PSID sample are single or “the husband or boyfriend is incapacitated and unable to fulfill the functions of Head”.²⁵ So the next section presents more evidence on gender differences using the ATUS sample and discusses possible explanations of the differences between men and women. Another significant result is that union member status has significant relationships with the

²³ This dissertation doesn't estimate the PSID sample by sex to further investigate the gender differences in the analysis. The reason is that the sample of female heads is relatively small and the female heads are much less likely to be married in the PSID sample.

²⁴ $0.078 = \frac{0.007}{0.09}$, where 0.007 is the absolute value of the coefficient of spouse employment status: not working spouse in column (2) of Table 5-1 and 0.09 is the base rate of the respondents reporting the presence of incentive pay in the 1975-2010 PSID sample.

²⁵ Source: <https://psidonline.isr.umich.edu/Guide/FAQ.aspx?Type=ALL#130>.

presence of incentive pay in the job: workers belonging to unions are less likely to be in jobs with incentives relative to non-union workers.

Table 5-1: Worker’s Job Choice Based on the Presence of Incentive Pay and Family Characteristics—the PSID 1975-2010 Sample

	Dependent Variable:	
	The presence of incentive pay	
	(1)	(2)
Spouse employment status: working	0.014*** (0.003)	0.004 (0.003)
Spouse employment status: not working	0.013*** (0.003)	0.014*** (0.003)
Number of children	-0.006*** (0.001)	-0.003** (0.001)
The presence of child age 0-5	0.014*** (0.003)	-0.001 (0.003)
The presence of child age 6-11	0.007** (0.003)	-0.000 (0.002)
The presence of child age 12-17	-0.003 (0.003)	0.001 (0.003)
The presence of alternative family income sources	-0.000 (0.002)	0.007** (0.002)
Female		-0.007* (0.003)
Potential labor market experience		-0.002*** (0.000)
Potential labor market experience-square		-0.000 (0.000)
Education		0.001** (0.000)
Union member		-0.012*** (0.003)
Race dummies	N	Y
Occupation dummies	N	Y
Industry dummies	N	Y
State dummies	N	Y
Year dummies	Y	Y
Observations	125117	125114

Notes: The marginal effects of the Probit coefficients are reported; standard errors in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%.

5.3 Regression Results on the Relationships between Family Characteristics and Job Choices using the ATUS

This section presents and discusses the regression results on the reduced-form relationships between family characteristics, time constraints on work, and worker's job choices based on the presence of incentive pay in the job using the 1975-2010 ATUS full sample and using the ATUS sub-samples by sex separately.

5.3.1 Results on the Relationships between Family Characteristics and Job Choices using the 1975-2010 ATUS Full Sample

Using the data from the ATUS, this dissertation first does the similar analysis for the effects of family characteristics on worker's job choices based on incentives as using the PSID sample and presents and discusses the regression results. The weighted OLS estimates of the relationships between family characteristics and the presence of incentive pay are reported in the columns (1) and (2) of Table 5-2.²⁶ The baseline model is shown in column (1) with the independent variables only including the family characteristics as the employment status of spouse, the number of own children and the indicators of the own child at various ages living in the household. Column (2) adds other control variables including gender, potential labor market experience and its square, education as

²⁶ As explained earlier, in the analysis of using ATUS sample, the dependent variable is the binary variable of the presence of incentive pay received in the job. Both the weighted Probit regressions and OLS regressions are used in the analysis and the estimated coefficients are similar comparing the weighted Probit regressions and the weighted OLS regressions for partial sample. But this dissertation reports the weighted OLS estimates due to the computational convenience and accuracy for the ATUS full sample.

the years completed, union member status, whether living in the metropolitan area, race, occupation, industry, and state into the baseline regression.

As can be seen from column (1), Table 5-2 demonstrates that some family characteristics, such as having an employed spouse and having own child at different ages present in the household, have significant relationships with workers' job choices based on the presence of incentives. After adding control variables, the results in column (2) show that all the indicator variables for the presence of own child at different ages under 18 living in the household have significant and negative relationships with the presence of incentive pay in the job. This implies that workers who have own children under 18 living in the household are less likely to choose jobs with incentives compared to workers who do not have own children under 18 in the household. One possible explanation could be that having children under 18 demands more resources in terms of child care activities and education related activities, so that the workers have fewer resources put into work. Thus, the worker would be more likely to choose jobs without incentives since the worker knows that she or he doesn't have sufficient time or energy.

In addition, the results of column (2) in Table 5-2 also show that gender has significant relationships with the presence of incentive pay, just as in the PSID sample: women are less likely to choose jobs with incentive pay relative to men. Unlike using the PSID sample, union members tend to sort themselves into jobs with incentives in the ATUS sample.

Table 5-2: Worker's Job Choice Based on the Presence of Incentive Pay, Time Constraints and Family Characteristics—the ATUS 2003-2012 Full Sample

	Dependent Variable: The presence of incentive pay			
	(1)	(2)	(3)	(4)
Spouse employment status: working	-0.012*	0.007	0.007	0.007
	(0.006)	(0.006)	(0.006)	(0.006)
Spouse employment status: not working	-0.001	-0.001	-0.001	-0.001
	(0.007)	(0.008)	(0.008)	(0.008)
Number of own children	0.010	0.007	0.008	0.008
	(0.005)	(0.005)	(0.005)	(0.005)
The presence of own child age<1	-0.019	-0.028*	-0.025*	-0.023
	(0.012)	(0.012)	(0.012)	(0.012)
The presence of own child age 1-2	-0.014	-0.024**	-0.023*	-0.021*
	(0.009)	(0.009)	(0.009)	(0.009)
The presence of own child age 3-5	-0.012	-0.020*	-0.019*	-0.019*
	(0.009)	(0.009)	(0.009)	(0.009)
The presence of own child age 6-12	-0.021*	-0.024**	-0.024**	-0.024**
	(0.009)	(0.009)	(0.009)	(0.009)
The presence of own child age 13-17	-0.030***	-0.029***	-0.030***	-0.030***
	(0.008)	(0.008)	(0.008)	(0.008)
Aggregate time constraints on work			-0.005***	
			(0.001)	
Time spent on household activities				-0.001
				(0.002)
Aggregate time spent on caring for people				-0.008**
				(0.002)
Aggregate time spent on social activities				-0.006***
				(0.001)
Female		-0.045***	-0.044***	-0.045***
		(0.005)	(0.005)	(0.005)
Potential labor market experience		0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)
Potential labor market experience-square		-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)
Education		0.002	0.002	0.002
		(0.001)	(0.001)	(0.001)
Union member		0.074***	0.075***	0.075***
		(0.007)	(0.007)	(0.007)
Metropolitan		0.008	0.008	0.008
		(0.006)	(0.006)	(0.006)
Race dummies	N	Y	Y	Y
Occupation dummies	N	Y	Y	Y
Industry dummies	N	Y	Y	Y
State dummies	N	Y	Y	Y
Year dummies	Y	Y	Y	Y
Constant	0.213***	-0.010	0.001	0.004
	(0.006)	(0.055)	(0.055)	(0.055)

Table 5-2 (Continued)

	(1)	(2)	(3)	(4)
R-squared	0.002	0.066	0.067	0.067
Observations	54612	54612	54612	54612

Notes: The weighted OLS estimates are reported; weighted standard errors in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%.

5.3.2 Results on the Relationships between Family Characteristics, Time Constraints on Work and Job Choices using the 2003-2012 ATUS Full Sample

On the basis of examining the reduced-form relationships between family characteristics and worker’s job choices based on the presence of incentive pay, this dissertation explores one possible underlying mechanism—time constraints on work—through which the relationships occur by using the detailed time information from the ATUS. The analysis adds the aggregate time constraints on work variable and three separate time constraints on work variables into the regression in column (2) of Table 5-2. The results reported in the columns (3) and (4) of Table 5-2 are discussed in details in the rest of this section.

5.3.2.1 Results on the Relationships between Family Characteristics, Aggregate Time Constraints on Work Variable, and Job Choices using the ATUS Full Sample

Column (3) in Table 5-2 presents the estimates on the effects of family characteristics on the presence of incentive pay through the aggregate time spent on household, caring for household and non-household members, socializing, and sports activities. The results show that the aggregate time constraints on work significantly negatively associates with the presence of incentive pay. Specifically, one minute

increases in the daily aggregate time spent on these non-work activities reduces the probability of choosing a job with incentive pay by 0.5 percentage points, holding other independent variables constant.

Moreover, the indicator variables of the presence of own child aged under one, between one and two, between six and twelve, and between thirteen and seventeen living in the household still have significant and negative relationships with the dependent variable after adding the aggregate amount of daily time constraints on work variable in the regression. This implies that the impact of child's age related variables on a worker's job choice is a separate effect, which may not be only through the aggregate time constraints on work. So the future research needs to explore other possible underlying mechanisms including a worker's target income and loss aversion, through which the effects of the presence of own child at various ages on the presence of incentive pay might happen. This is also consistent with the prediction that having children under 18 demands more resources so that the workers have less time to put on work. Therefore, the worker would choose jobs without incentives. It also implies that the effects of time constraints from having child under 18 are stronger than those of the financial needs from having children in the household. Otherwise, the coefficients of the presence of child at different ages wouldn't be significant or even not be negative after adding the aggregate time constraints variable.

Additionally, the results still show the coefficients of gender and union member status are significant after adding the time constraints on work into regression. Specifically, women are less likely to choose jobs with incentive pay relative to men, and

workers who are covered by unions are more likely to choose jobs with incentives relative to the workers who are not covered by unions.

5.3.2.2 Results on the Relationships between Family Characteristics, Separate Time Constraints on Work Variables, and Job Choices using the ATUS Full Sample

Furthermore, in order to explore how the theoretical linkage might work and differentiate the effects of different activities on workers' job choices, the analysis adds three separate time constraints on work variables at the same time into the regression. The results in column (4) of Table 5-2 show that the daily amount of time spent on caring for household and non-household members activities and the daily time spent on both socializing and sports activities have significant and negative relationships with the presence of incentive pay in the job. Specifically, controlling for other variables, one minute increases in the daily time spent on caring for other people reduces the probability that the worker chooses a job offering incentives by 0.8 percentage points; and one minute increases in the daily time spent on both socializing and sports activities would decrease the chance of choosing a job with incentive pay by 0.6 percentage points. But the coefficient of time spent on household activities is not significant. These results imply that the activities of caring for household and non-household members and the activities of socializing, relaxing, leisure, sports, exercise, and recreation might have stronger time influences on work than the activities of household.

Moreover, all indicators for the presence of own child at different ages under 18 living in the household are still significantly and negatively associate with the presence of incentive pay in the job. This is consistent with the results in column (3), which implies

that the impact of the presence of own child at different ages on a worker's job choice is a separate effect not only through time constraints on work variables. In addition, the results still show the coefficients of gender and union member status are significant after adding the time constraints on work into regression.

5.3.3 Results on the Relationships between Family Characteristics and Job Choices using the ATUS Sub-Samples by Sex

To further explore the gender differences in workers' job choices based on incentives shown in column (2) of Table 5-2, the analysis next tests the effects of family characteristics on the presence of incentive pay for women and men separately using the ATUS sample. Columns (1) and (2) of Table 5-3 report the weighted OLS estimates of the relationships between family characteristics and workers' job choices by sex. A chow test for all the coefficients across female and male sub-samples yields an F -statistic of 5.943 (p -value <0.001), which rejects the null hypothesis of equality of all of the coefficients across the two sex sub-samples at a significance level of 5%.²⁷

As shown in column (1) of Table 5-3, female workers having own child aged under one, between one and two, between six and twelve, and between thirteen and seventeen are less likely to choose jobs with incentives relative to female workers not

²⁷ The sum of squared residuals from estimating the unweighted OLS model of full sample: $The\ presence\ of\ incentive\ pay = \beta_0 + \beta_1\ Family\ Characteristics + \beta_2\ Controls\ (without\ "Gender") + \varepsilon$ is 7487.073, the sum of squared residuals from estimating the unweighted OLS model of female sub-sample is 3281.813, and the sum of squared residuals from estimating the unweighted OLS model of male sub-sample is 4122.7643. Then the Chow test statistic is $F = \frac{(7487.073 - 3281.813 - 4122.763)/102}{(3281.813 + 4122.763)/(28922 + 25690 - 2*102)} = 5.943$ with 102 and 54410 degrees of freedom.

having own child under the age of 18 present in the household. While for male workers, according to the estimates shown in column (2), only the presence of own child aged between thirteen and seventeen has significantly negative relationship with job choices bases on incentives. Thus, the empirical results show that there are differences in the effects of family characteristics on the presence of incentive pay by sex. But a t -test for testing the two coefficients of the presence of own child between ages of thirteen and seventeen across female and male sub-samples yields a t -statistic of 0.128 (p -value >0.05), which fails to reject the null hypothesis of the equality of these two coefficients across the two sex sub-samples at a significance level of 5%.²⁸ This indicates that the magnitudes of the coefficients of the presence of own child between ages of thirteen and seventeen are not statistically significantly different across two sub-samples, controlling for all other independent variables. And for both women and men, they are more likely to choose jobs with incentive pay if they belong to unions.

²⁸ The t statistic of testing the equality of the two coefficients of the presence of own child between ages of thirteen and seventeen across female and male sub-samples is $t = \frac{(\beta_1 - \beta_2) - (b_1 - b_2)}{S_{b_1 - b_2}}$, where $b_1 - b_2 = 0$. Assuming the two sub-samples by sex are independent, the standard error of the difference between the two coefficients is $S_{b_1 - b_2} = \sqrt{S_{b_1}^2 + S_{b_2}^2}$, where S_{b_1} and S_{b_2} are weighted standard errors of the two coefficients. Then the t -statistics are $t = \frac{(\beta_1 - \beta_2) - (b_1 - b_2)}{S_{b_1 - b_2}} = \frac{(\beta_1 - \beta_2) - (b_1 - b_2)}{\sqrt{S_{b_1}^2 + S_{b_2}^2}} = \frac{(-0.026) - (-0.028) - 0}{\sqrt{0.010^2 + 0.012^2}} = 0.128$ with 54410 degrees of freedom.

Table 5-3: Gender Differences in The Presence of Incentive Pay, Time Constraints, and Family Characteristics—the ATUS 2003-2012 Sub-Samples by Sex

	Dependent Variable: The presence of incentive pay					
	Women	Men	Women	Men	Women	Men
	(1)	(2)	(3)	(4)	(5)	(6)
Spouse employment status: working	-0.001 (0.006)	0.012 (0.009)	-0.001 (0.006)	0.012 (0.009)	-0.001 (0.006)	0.011 (0.009)
Spouse employment status: not working	-0.011 (0.010)	0.003 (0.011)	-0.010 (0.010)	0.003 (0.011)	-0.010 (0.010)	0.002 (0.011)
Number of own children	0.006 (0.006)	0.008 (0.008)	0.006 (0.006)	0.008 (0.008)	0.008 (0.006)	0.007 (0.008)
The presence of own child age<1	-0.034* (0.015)	-0.024 (0.018)	-0.030* (0.015)	-0.022 (0.018)	-0.022 (0.015)	-0.023 (0.018)
The presence of own child age 1-2	-0.030** (0.011)	-0.020 (0.014)	-0.028** (0.011)	-0.019 (0.013)	-0.024* (0.011)	-0.020 (0.013)
The presence of own child age 3-5	-0.021* (0.010)	-0.019 (0.013)	-0.021* (0.010)	-0.019 (0.013)	-0.019 (0.010)	-0.019 (0.013)
The presence of own child age 6-12	-0.030** (0.010)	-0.019 (0.013)	-0.030** (0.010)	-0.018 (0.013)	-0.029** (0.010)	-0.019 (0.013)
The presence of own child age 13-17	-0.026** (0.010)	-0.028* (0.012)	-0.027** (0.010)	-0.029* (0.012)	-0.027** (0.010)	-0.028* (0.012)
Aggregate time constraints on work			-0.004** (0.001)	-0.006*** (0.001)		
Time spent on household activities					-0.003 (0.002)	0.001 (0.003)
Aggregate time spent on caring for people					-0.010*** (0.003)	-0.004 (0.004)
Aggregate time spent on social activities					-0.003* (0.002)	-0.009*** (0.002)
Potential labor market experience	0.000 (0.001)	0.002 (0.001)	0.000 (0.001)	0.002 (0.001)	0.000 (0.001)	0.002 (0.001)

Table 5-3 (Continued)

	Women	Men	Women	Men	Women	Men
	(1)	(2)	(3)	(4)	(5)	(6)
Potential labor market experience-square	-0.000 (0.000)	-0.000** (0.000)	-0.000 (0.000)	-0.000** (0.000)	-0.000 (0.000)	-0.000** (0.000)
Education	0.003* (0.001)	0.001 (0.001)	0.003* (0.001)	0.001 (0.001)	0.003* (0.001)	0.001 (0.001)
Union member	0.030*** (0.009)	0.103*** (0.010)	0.030*** (0.009)	0.104*** (0.010)	0.029*** (0.009)	0.103*** (0.010)
Metropolitan	0.010 (0.007)	0.005 (0.010)	0.010 (0.007)	0.005 (0.010)	0.010 (0.007)	0.006 (0.010)
Race dummies	Y	Y	Y	Y	Y	Y
Occupation dummies	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y
State dummies	Y	Y	Y	Y	Y	Y
Year dummies	Y	Y	Y	Y	Y	Y
Constant	-0.048 (0.067)	-0.004 (0.078)	-0.038 (0.066)	0.009 (0.078)	-0.040 (0.066)	0.017 (0.079)
R-squared	0.055	0.067	0.056	0.068	0.056	0.069
Observations	28922	25690	28922	25690	28922	25690

Notes: The weighted OLS estimates are reported; weighted standard errors in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%.

5.3.4 Results on the Relationships between Family Characteristics, Time Constraints on Work, and Job Choices using the ATUS Sub-Samples by Sex

In addition to examining gender differences in the direct relationships between family characteristics and workers' job choices, the analysis also investigates the gender differences in the relationships between family characteristics, time constraints and the presence of incentive pay using the ATUS sample. In Table 5-3, columns (3) and (4) report the regression results of adding aggregate time constraints on work variable for men and women, separately; while columns (5) and (6) present the results of adding separate time constraints on work variables by sex.

5.3.4.1 Results on the Relationships between Family Characteristics, Aggregate Time Constraints on Work Variable, and Job Choices using the ATUS Sub-Samples by Sex

A chow test for all the coefficients of the relationships between family characteristics, aggregate time constraints on work, and the presence of incentive pay across female and male sub-samples yields an F -statistic of 5.857 (p -value <0.001), which rejects the null hypothesis of equality of all of the coefficients across the two sex sub-samples at a significance level of 5%.²⁹ The weighted OLS estimates in columns (3)

²⁹ The sum of squared residuals from estimating the unweighted OLS model of full sample: $The\ presence\ of\ incentive\ pay = \beta_0 + \beta_1\ Family\ Characteristics + \beta_2\ Controls\ (without\ "Gender") + \beta_3\ Aggregate\ time\ constraints\ on\ work + \varepsilon$ is 7481.408, the sum of squared residuals from estimating the unweighted OLS model of female sub-sample is 3280.099, and the sum of squared residuals from estimating the unweighted OLS model of male sub-sample is 4119.266. Then the Chow test statistic is $F = \frac{(7481.408 - 3280.099 - 4119.266)/103}{(3280.099 + 4119.266)/(28922 + 25690 - 2 * 103)} = 5.857$ with 103 and 54406 degrees of freedom.

and (4) of Table 5-3 show that for both women and men, the daily aggregate time spent on household, caring for household and non-household members, socializing, and sports activities negatively influences their job choices based on the presence of incentive pay. Specifically, for women, one minute increases in the daily aggregate time spent on other non-work activities reduces the probability that the female worker chooses a job with incentives by 0.4 percentage points, controlling for other independent variables. For men, one minute increases in the daily aggregate time spent on other non-work activities reduces the probability that the male worker chooses a job offering incentives by 0.6 percentage points, controlling for other independent variables. But a *t*-test for testing the two coefficients of aggregate time constraints on work across female and male sub-samples yields a *t*-statistic of 1.414 (*p*-value>0.05), which fails to reject the null hypothesis of the equality of these two coefficients across the two sex sub-samples at a significance level of 5%.³⁰ This indicates that the magnitudes of the two coefficients of aggregate time constraints on work across female and male sub-samples are not statistically significantly different, controlling for other independent variables.

At the same time, the estimates in column (3) of Table 5-3 show that for women, the presence of own child at all different ages under 18 living in the household all have significantly negative relationships with receiving the incentive pay in the job after adding the aggregate time constraints variable. While column (4) shows that for men,

³⁰ The *t* statistic of testing the equality of the two coefficients of aggregate time constraints on work across female and male sub-samples is $t = \frac{(\beta_1 - \beta_2) - (b_1 - b_2)}{S_{b_1 - b_2}} = \frac{(\beta_1 - \beta_2) - (b_1 - b_2)}{\sqrt{S_{b_1}^2 + S_{b_2}^2}} = \frac{(-0.004) - (-0.006) - 0}{\sqrt{0.001^2 + 0.001^2}} = 1.414$ with 54406 degrees of freedom, assuming the two sub-samples by sex are independent.

only having own child between the ages of thirteen and seventeen in the household significantly affects the presence of incentive pay controlling for the time constraints and other variables. These results are consistent with previous results in Table 5-2 that the impact of the presence of own child at various ages on a worker's job choice is a separate effect might not only through time constraints on work.

5.3.4.2 Results on the Relationships between Family Characteristics, Separate Time Constraints on Work Variables, and Job Choices using the ATUS Sub-Samples by Sex

To further explore the different time influences of different activities on worker's job choices based on incentives, the analysis adds three separate time constraints on work variables using the ATUS sub-samples by sex and presents the results in columns (5) and (6) of Table 5-3 for women and men. A chow test for all the coefficients of testing the relationships between family characteristics, three separate time constraints on work variables, and the presence of incentive pay across female and male sub-samples yields an *F*-statistic of 5.889 (*p*-value <0.001), which rejects the null hypothesis of equality of all of the coefficients across the two sex sub-samples at a significance level of 5%.³¹

³¹ The unweighted OLS regression model is *The presence of incentive pay* = $\beta_0 + \beta_1$ Family Characteristics + β_2 Controls (without "Gender") + β_4 Time spent on household + β_5 Aggregate time spent on caring for people + β_6 Aggregate time spent on social activities + ε . The sum of squared residuals from estimating the full sample is 7480.494, the sum of squared residuals from estimating the female sub-sample is 3279.629, and the sum of squared residuals from estimating the male sub-sample is 4116.801. Then the Chow test statistic is $F = \frac{(7480.494 - 3279.629 - 4116.801)/105}{(3279.629 + 4116.801)/(28922 + 25690 - 2 * 105)} = 5.889$ with 105 and 54402 degrees of freedom.

The estimates in column (5) show that both time spent on caring for other people and time spent on socializing and sports activities have significant and negative relationships with female workers' decisions on choosing jobs based on the presence of incentive pay. Specifically, one minute increases in the daily aggregate time spent on caring for household and non-household member activities reduces the probability that the female worker chooses a job with incentives by 1.0 percentage points, controlling for other independent variables; and one minute increases in the daily aggregate time spent on socializing and sports reduces the probability that the female worker chooses a job with incentives by 0.3 percentage points, controlling for other independent variables. While column (6) shows that for male workers, only the time spent on socializing and sports significantly influences the presence of incentive pay in the job. One minute increases in the daily aggregate time spent on socializing and sports reduces the probability that the male worker chooses a job providing incentive pay by 0.9 percentage points, controlling for other independent variables. Moreover, a *t*-test for testing the two coefficients of aggregate time spent on social activities across female and male sub-samples yields a *t*-statistic of 2.121 (*p*-value<0.05), which rejects the null hypothesis of the equality of these two coefficients across two sub-samples at a significance level of 5%.³² This indicates that time spent on the activities of socializing and sports seems to have stronger effects on male workers' job choices on the presence of incentive pay

³² The *t* statistic of testing the equality of the two coefficients of aggregate time spent on social activities across female and male sub-samples is $t = \frac{(\beta_1 - \beta_2) - (b_1 - b_2)}{S_{b_1 - b_2}} = \frac{(\beta_1 - \beta_2) - (b_1 - b_2)}{\sqrt{S_{b_1}^2 + S_{b_2}^2}} = \frac{(-0.003) - (-0.009) - 0}{\sqrt{0.002^2 + 0.002^2}} = 2.121$ with 54402 degrees of freedom, assuming the two sub-samples by sex are independent.

relative to female workers' job choices, based on the magnitudes of the two coefficients of time spent on social activities. This is also consistent with the gender norms that men tend to spend more time on social activities than women.

At the same time, the estimates in column (5) show that for women, the presence of own child aged between one and two, between six and twelve, and between thirteen and seventeen living in the household have significantly negative relationships with receiving the incentive pay in the job after adding the time constraints variables; While column (6) shows that for men, only having own child between the ages of thirteen and seventeen in the household significantly affects the presence of incentive pay controlling for the time constraints and other variables. This evidence supports that the impact of the presence of own child at various ages on a worker's job choice is a separate effect not only through time constraints on work variables.

5.4 Comparison of Regression Results on the Relationships between Family Characteristics and Job Choices using the PSID and the ATUS Samples

The PSID sample and the ATUS sample have different compositions in terms of the presence of incentive pay in the job, family characteristics and other demographics. Therefore, it's useful to compare the estimation results between these two samples. In order to fully compare the estimates on the effects of family characteristics on workers' job choices based on incentives, the analysis uses the same family characteristics including the employment status of spouse and the number of children living in the

family during the same time period from 2003 to 2010.³³ The analysis also controls for gender, potential labor market experience and its square, completed education, union member status, race, occupation, industry, state, and year for both samples. Table 5-4 reports the marginal effects of Probit coefficients on comparison between the results of the reduced-form relationships between the presence of incentive pay and family characteristics using the PSID sample and the ATUS sample from 2003 to 2010.³⁴

According to the results, the number of children has significant and negative relationship with the presence of incentive pay only using the AUTS sample, but not using the PSID sample. It implies that the more children the worker has, the more likely she or he to choose jobs without incentives in the ATUS sample. But another set of family characteristics—the employment status of spouse—doesn't show significantly relationships with workers' job choices based on the presence of incentive pay in both the PSID sample and the ATUS sample.

In terms of gender differences, only estimate from ATUS sample shows that women are less likely to choose jobs with incentive pay relative to men. The coefficient of female is not significant using the PSID sample. The union member status significantly positively associates with the presence of incentive pay in the ATUS sample, but doesn't show significant effect in the PSID sample.

³³ To compare with the PSID sample, the analysis here uses “the number of children under the age of 18 who live in the household” to measure the number of children for the 2003-2010 ATUS sample.

³⁴ To fully compare with the PSID sample, the analysis here uses unweighted Probit regression for analyzing the 2003-2010 ATUS sample. The regression results using weighted OLS regression are presented in column (1) of Appendix Table 6.

Table 5-4: Comparison between the PSID and the ATUS (2003-2010): Worker's Job Choices based On the Presence of Incentive Pay and Family Characteristics

	Dependent Variable: The presence of incentive pay	
	PSID	ATUS
	(1)	(2)
Spouse employment status: working	0.009 (0.009)	-0.002 (0.004)
Spouse employment status: not working	0.019 (0.012)	-0.008 (0.005)
Number of own children	-0.000 (0.003)	-0.010*** (0.002)
Female	0.011 (0.010)	-0.045*** (0.004)
Potential labor market experience	-0.003** (0.001)	0.001 (0.001)
Potential labor market experience-square	0.000 (0.000)	-0.000*** (0.000)
Education	0.001 (0.001)	0.000 (0.001)
Union member	-0.003 (0.009)	0.060*** (0.005)
Race dummies	Y	Y
Occupation dummies	Y	Y
Industry dummies	Y	Y
State dummies	Y	Y
Year dummies	Y	Y
Observations	8769	54900

Notes: The marginal effects of Probit coefficients are reported; standard errors in parentheses.
 *** significant at 1%; ** significant at 5%; * significant at 10%.

Chapter 6 The Effects of Family Characteristics on Effort Supply

This chapter presents the empirical analysis and results estimating the effects of family characteristics on workers' effort supply, which is measured as the amount of incentive pay workers received in their job, using both the PSID and the ATUS samples. First, the chapter describes the empirical method—multivariate OLS regression models—to examine the reduced-form relationships between family characteristics and worker's effort supply. Second, section 6.2 presents and discusses the regression results of the relationships between family characteristics and the aggregate amount of incentive pay using the data from the 1975-2010 PSID full sample. Moreover, the section also reports the effects of family characteristics on workers' reactions to different types of compensation incentives including bonuses, commissions and tips using the 1992-2010 PSID sub-samples. Third, section 6.3 first presents and discusses the regression results of the reduced-form relationships between family characteristics and the amount of incentive pay received in the job using data from the full 2003-2012 ATUS sample. Furthermore, this section shows the empirical analysis using the ATUS sub-samples by sex to explore the gender differences in workers' effort supply. Lastly, this chapter compares the estimation results using the same variables with both the PSID and the ATUS samples in section 6.4.

6.1 Empirical Method

The impact of family characteristics on the worker's effort supply is estimated using the multivariate OLS regression models. The baseline regression model is of the following form:

$$\text{LOG}(\text{Amount of incentive pay}) = \beta_0 + \beta_1 \text{Family Characteristics} + \varepsilon$$

Where the dependent variable is the logarithm of real value of the amount of incentive pay the worker received in the job, which is the proxy of worker's effort supply in the analysis. The family characteristics independent variables used in the estimation are the same as in the regression models in Section 5.1. Specifically, the family characteristics include: 1) Two indicator variables of the spouse's employment status: the worker having a working spouse and the worker having a not working spouse; and the worker not having a spouse is used as the reference group and not included in the regressions. 2) The number of children under the age of 18 using the PSID sample and the number of own child under the age of 18 using the ATUS sample. 3) Indicator variables of the presence of children at various ages living in the FU/household. Different indicators are used for the PSID sample and the ATUS sample. 4) Using the PSID sample, the presence of alternative family income sources is included.

Adding control variables into the baseline regressions, the regressions models have the following form:

$$\text{LOG}(\text{Amount of incentive pay}) = \beta_0 + \beta_1 \text{Family Characteristics} + \beta_2 \text{Controls} + \varepsilon$$

Where the control variables are the same as the regressions in Section 5.1. Specifically, the regressions control for gender, potential labor market experience and its square,

completed education, union member status, race, occupation, industry, state, and year for both the PSID and ATUS samples. In addition, the indicator variable of living in a metropolitan area is included using the ATUS sample.

Furthermore, to test the effects of family characteristics on workers' reactions to different compensation incentives using the 1992-2010 PSID sub-samples, the analysis uses four separate regression models with the dependent variables as the logarithm of real values of the amount of bonuses, commission, tips, and overtime pay received in the job. The formats of the regression models are as same as used for testing the effects on the log of aggregate amount of incentive pay. The same family characteristics and control variables are included in the regressions as used for the log of aggregate amount of incentive pay.

6.2 Regression Results on the Relationships between Family Characteristics and Effort Supply using PSID

This section first presents the regression results on the relationships between family characteristics and workers' effort supply using the 1975-2010 PSID full sample and discusses the implications of these results. Then this section reports the estimates on the effects of family characteristics on workers' responses to four different types of incentives using the 1992-2010 PSID sub-samples separately.

6.2.1 Results on the Relationships between Family Characteristics and Effort Supply using the 1975-2010 PSID full sample

Using data from the 1975-2010 PSID full sample, the empirical estimates of the effects of family characteristics on the worker's effort supply measured as the amount of incentive pay the worker received in the job are reported in Table 6-1. Only the individuals who reported non-zero amount of incentive pay such as bonuses, commissions, tips and overtime pay in the PSID sample are included in this part of analysis on testing the effects on workers' effort supply. This is the reason why the sample size in Table 6-1 is smaller than that in Table 5-1 when analyzing workers' job choices. The OLS estimation with robust standard errors clustered at the individual level are reported in both columns. The analysis controls for year fixed effects in both regressions.

First, column (1) presents the results from a baseline model that only includes the family characteristics—the employment status of spouse, the number of children, the presence of child at various ages, and the presence of alternative family income sources—as the independent variables. The results in column (1) demonstrate that some family characteristics such as the employment status of spouse significantly associate with the log aggregate amount of incentive pay the worker received in the job.

Second, after adding control variables into the baseline regression, the results in column (2) show that only the indicator for having a not-working spouse has a significantly positive relationship with the amount of incentive pay the worker received in the job. It indicates that the worker who has a not-working spouse would put more effort (*i.e.*, earn 25.8 percent more income from the incentive pay) than the worker

without a spouse, controlling for other independent variables. This is consistent with the result that a worker with a not-working spouse is more likely to choose jobs with incentive pay compared with the worker not having a spouse shown in Table 5-1. One possible reason could be that workers who have a not-working spouse usually have higher target incomes and stronger loss aversion, so that the workers would put more effort to earn more from incentive pay in order to meet the target income. Another reason could be that workers with a not-working spouse might have more resources for work due to the non-working spouse taking some responsibilities of household, so that the workers could work harder on the basis of these resources and earn more from incentive pay.

In addition to these family characteristics, the results in columns (2) of Table 5-1 show that there are significant gender differences in terms of workers earning the amount of incentive pay in the job.³⁵ On average, women receive lower incentive pay in their jobs relative to men, controlling for other independent variables. As previously mentioned, the female household heads in the PSID sample are special because they are single or their husbands or boyfriends are incapacitated and unable to fulfill the functions of Head. The empirical analysis exploring gender differences using the ATUS sample is described later in this chapter. Moreover, union member status has a significant and positive relationship with the amount of incentive pay in the job: union members earn larger amounts of incentive pay than non-union members among workers receiving non-zero compensation incentives, on average.

³⁵ As explained in section 5.2, this dissertation doesn't estimate the PSID sample by sex to further investigate the gender differences, because the sample of female heads is relatively small and the female heads are much less likely to be married.

Table 6-1: The Worker's Effort Supply as Log of Amount of Incentive Pay and Family Characteristics—the PSID 1975-2010 Sample

	Dependent Variable: Log of amount of incentive pay	
	(1)	(2)
Spouse employment status: working	0.759*** (0.051)	0.066 (0.055)
Spouse employment status: not working	0.982*** (0.072)	0.258*** (0.065)
Number of children	-0.034 (0.026)	-0.003 (0.023)
The presence of child age 0-5	-0.256*** (0.058)	0.017 (0.049)
The presence of child age 6-11	0.014 (0.053)	0.084 (0.047)
The presence of child age 12-17	0.007 (0.056)	-0.020 (0.050)
The presence of alternative family income sources	0.124* (0.050)	0.048 (0.042)
Female		-0.534*** (0.065)
Potential labor market experience		0.045*** (0.007)
Potential labor market experience-square		-0.001*** (0.000)
Education		0.135*** (0.010)
Union member		0.215*** (0.052)
Race dummies	N	Y
Occupation dummies	N	Y
Industry dummies	N	Y
State dummies	N	Y
Year dummies	Y	Y
Constant	6.499*** (0.109)	4.296*** (0.672)
R-squared	0.056	0.273
Observations	11253	11253
N_clust	5490	5490

Notes: The OLS estimates are reported; robust standard errors clustered at individual level. *** significant at 1%; ** significant at 5%; * significant at 10%.

6.2.2 Results on the Relationships between Family Characteristics and Reactions to Different Types of Incentives using the 1992-2010 PSID Sub-Samples

Furthermore, the analysis explores how workers with different family characteristics react to different types of incentives using the 1992-2010 PSID sub-samples. Table 5-2 reports the regression results of the effects of family characteristics on the amount of bonuses, commissions, tips, and overtime pay workers received in their job separately. The OLS estimation with robust standard errors clustered at the individual level are reported in all columns.

In column (1), the results of workers' reactions to bonuses show that only the indicator for the employment status of spouse: having a not-working spouse has significant and positive relationship with log of amount of bonuses, holding other independent variables constant. It implies that the worker who has a not-working spouse earns more bonuses compared with the worker without a spouse, among the workers who reported non-zero amount of bonuses received in their job in the previous calendar year.

In column (2) and (3), the dependent variables are log of amount of commissions and log of amount of tips the worker received in the job. But the reported estimates in both columns don't show any significant relationships between the family characteristics and workers' reactions (*i.e.*, effort supply) to commission or tips, after adding all the control variables in the regressions.

The results reported in column (4) show that several indicators for having child at different ages under 18 living in the family unit have significant relationships with log of amount of overtime pay, controlling for other independent variables. Specifically, a worker who has a child between the ages of zero and five earns more overtime pay

compared to a worker who has a child at 18 or above; and a worker who has a child between the ages of twelve and seventeen earns more overtime pay relative to a worker who has a child at 18 or above. Moreover, the presence of alternative family income sources significantly correlates to the log of amount of overtime pay. It implies that the worker who has other income receiver in the family unit would earn more from the overtime pay than the worker who is the single income receiver in the family unit, holding other variables constant.

In addition, there are significant gender differences in reactions to all four types of incentives for women and men. The results indicate that female workers, who are single or their husbands or boyfriends are unable to fulfill the function as household heads in the PSID sample, significantly earn lower income from incentives such as bonuses and commissions (*i.e.*, work less hard) than male workers, controlling other things the same.

Table 6-2: Workers' Reactions to Different Types of Incentives as Log of Amount of Bonuses, Commissions, Tips, and Overtime Pay and Family Characteristics—the PSID 1992-2010 Sub-Samples

	Dependent Variable			
	LOG(Bonuses)	LOG(Commissions)	LOG(Tips)	LOG(Overtime pay)
	(1)	(2)	(3)	(4)
Spouse employment status: working	0.110 (0.090)	-0.190 (0.400)	-0.103 (0.551)	-0.084 (0.138)
Spouse employment status: not working	0.483*** (0.124)	0.153 (0.488)	-0.736 (0.725)	-0.073 (0.190)
Number of children	0.015 (0.047)	0.273 (0.213)	-0.146 (0.202)	-0.103 (0.059)
The presence of child age 0-5	0.126 (0.091)	-0.544 (0.486)	-0.244 (0.354)	0.296* (0.142)
The presence of child age 6-11	0.110 (0.086)	-0.119 (0.386)	0.627 (0.538)	-0.085 (0.129)
The presence of child age 12-17	-0.115 (0.089)	-0.236 (0.403)	0.020 (0.481)	0.341* (0.136)
The presence of alternative family income sources	0.037 (0.074)	-0.491 (0.324)	0.133 (0.464)	0.239* (0.118)
Female	-0.451*** (0.102)	-1.173* (0.507)	-0.202 (0.510)	-0.421** (0.157)
Potential labor market experience	0.035** (0.013)	0.113* (0.057)	0.021 (0.063)	0.034 (0.020)
Potential labor market experience-square	-0.000 (0.000)	-0.002 (0.001)	-0.001 (0.002)	-0.001 (0.000)
Education	0.181*** (0.019)	0.048 (0.071)	0.101 (0.092)	0.048 (0.027)
Union member	0.092 (0.108)	-2.426*** (0.691)	1.229* (0.554)	0.119 (0.123)
Race dummies	Y	Y	Y	Y
Occupation dummies	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y

Table 6-2 (Continued)

	LOG(Bonuses)	LOG(Commissions)	LOG(Tips)	LOG(Overtime pay)
	(1)	(2)	(3)	(4)
State dummies	Y	Y	Y	Y
Year dummies	Y	Y	Y	Y
Constant	2.208*** (0.628)	7.514*** (1.807)	5.393* (2.223)	4.364*** (0.478)
R-squared	0.398	0.473	0.469	0.197
Observations	2794	270	237	1121
N_clust	1826	220	186	915

Notes: The OLS estimates are reported; robust standard errors in parentheses clustered at individual level. *** significant at 1%; ** significant at 5%; * significant at 10%.

6.3 Regression Results on the Relationships between Family Characteristics and Effort Supply using ATUS

This section presents and discusses the regression results on the reduced-form relationships between family characteristics, time constraints on work, and worker's effort supply measured as the aggregated amount of incentive pay received in the job using the 2003-2012 ATUS full sample and using the ATUS sub-samples by sex.

6.3.1 Results on the Relationships between Family Characteristics and Effort Supply using the 2003-2012 ATUS Full Sample

Using the data from the 2003-2012 ATUS full sample, this dissertation first does the similar analysis on the effects of family characteristics on worker's effort supply measured as the amount of incentive pay including commissions, tips, and overtime pay received in the job as using the PSID sample. The weighted OLS estimates of the relationships between family characteristics and the aggregate amount of incentive pay are reported in the columns (1) and (2) of Table 6-3. The sample in Table 6-3 is not the same as that of columns (1) and (2) in Table 5-2. Only respondents who reported non-zero amount of incentive pay are included in this part of the analysis on testing the effects on worker's effort supply.

The baseline model is shown in column (1) with only these family characteristics—the employment status of spouse, the number of own children and the indicators of the own child at various ages living in the household—as the independent variables. The estimates in column (1) demonstrate that some family characteristics, such as having a not-working spouse and having a child between the ages of thirteen and

seventeen living in the household, have significant relationships with the amount of incentive pay, which is the proxy for worker's effort in this analysis.

Column (2) adds other control variables to the baseline regression. As can be seen from column (2), few family characteristics, such as the indicators of having own children under age of one and between ages of thirteen and seventeen living in the household, show significant relationships with the amount of incentive pay the worker received in the job, after controlling other independent variables. It indicates that workers who have own child under one and between ages of thirteen and seventeen earn more from incentives compared with workers who do not have own children under 18 living in the household. One possible explanation could be that having very young children under one might demand more financial costs for child-care activities and having children aged between thirteen and seventeen demands more financial costs for education and related activities, so that the workers with children at these two stages have higher target incomes. And also these workers might have stronger loss aversion compared with workers who do not have children under 18. Thus, these workers who are having younger children under the age of one and between the ages of one and two would work harder to earn more from incentive pay to meet the target income when they have incentives in the job.

In addition, the results of column (2) in Table 6-3 also show that gender has significant relationships with the amount of incentive pay as same as using the PSID sample: women receive less incentive pay in their jobs relative to men. As well, same as

using the PSID sample, union members receive more incentive pay in the jobs compared with workers not belonging to unions.

Table 6-3: Worker's Effort Supply as Log of Amount of Incentive Pay, Time Constraints and Family Characteristics—the ATUS 2003-2012 Full Sample

	Dependent Variable: Log of amount of incentive pay			
	(1)	(2)	(3)	(4)
Spouse employment status: working	0.058 (0.054)	-0.024 (0.055)	-0.025 (0.055)	-0.030 (0.055)
Spouse employment status: not working	0.243** (0.092)	0.070 (0.094)	0.067 (0.094)	0.060 (0.093)
Number of own children	-0.070 (0.053)	-0.040 (0.055)	-0.039 (0.055)	-0.040 (0.054)
The presence of own child age<1	0.230 (0.130)	0.300* (0.136)	0.302* (0.136)	0.290* (0.136)
The presence of own child age 1-2	0.090 (0.096)	0.131 (0.099)	0.133 (0.099)	0.123 (0.100)
The presence of own child age 3-5	0.094 (0.094)	0.039 (0.091)	0.041 (0.091)	0.035 (0.092)
The presence of own child age 6-12	0.095 (0.087)	-0.022 (0.090)	-0.021 (0.090)	-0.026 (0.089)
The presence of own child age 13-17	0.329*** (0.083)	0.188* (0.088)	0.187* (0.089)	0.190* (0.088)
Aggregate time constraints on work			-0.007 (0.010)	
Time spent on household activities				0.027 (0.019)
Aggregate time spent on caring for people				-0.001 (0.027)
Aggregate time spent on social activities				-0.023 (0.014)
Female		-0.234*** (0.056)	-0.234*** (0.056)	-0.251*** (0.057)
Potential labor market experience		0.024** (0.008)	0.024** (0.008)	0.023** (0.008)

Table 6-3 (Continued)

	(1)	(2)	(3)	(4)
Potential labor market experience-square		-0.001** (0.000)	-0.001** (0.000)	-0.001** (0.000)
Education		0.025* (0.012)	0.025* (0.012)	0.023 (0.012)
Union member		0.333*** (0.062)	0.335*** (0.062)	0.335*** (0.062)
Metropolitan		0.120* (0.057)	0.121* (0.057)	0.123* (0.057)
Race dummies	N	Y	Y	Y
Occupation dummies	N	Y	Y	Y
Industry dummies	N	Y	Y	Y
State dummies	N	Y	Y	Y
Year dummies	Y	Y	Y	Y
Constant	3.865*** (0.059)	3.444*** (0.431)	3.469*** (0.431)	3.549*** (0.427)
R-squared	0.019	0.134	0.134	0.136
Observations	3524	3524	3524	3524

Notes: The weighted OLS estimates are reported; weighted standard errors in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%.

6.3.2 Results on the Relationships between Family Characteristics, Time Constraints on Work, and Effort Supply using the 2003-2012 ATUS Full Sample

As in section 5.3.2, on the basis of examining the direct relationships between family characteristics and worker's effort supply, the analysis uses the detailed time information in the ATUS to explore one possible underlying mechanism—time constraints on work—through which the direct relationships could occur. The analysis adds the aggregate time constraints on work variable and the three separate time constraints on work variables into the regression in column (2) of Table 6-3 separately. The results are reported in the columns (3) and (4) in Table 6-3.

Column (3) of Table 6-3 presents the estimates on the effects of family characteristics on the amount of incentive pay through the aggregate time spent on household, caring for household and non-household members, socializing, and sports activities. The results show that the aggregate time constraints on work doesn't have a significant relationship with the amount of incentive pay, though the coefficient of the aggregate time constraints on work variable is negative and the coefficients of the presence of own child age under 1 and the presence of own child age between thirteen and seventeen are significant.

Then as shown in column (4), the analysis adds three separate time constraints variables—time spent on household activities, aggregate time spent on caring for other people, and aggregate time spent on socializing and sports—at the same time in the regression to further explore how the theoretical linkage might work. But similar to the estimates in column (3), column (4) presents no significant relationships between these time constraints on work variables and the amount of incentive pay, though the

coefficients of the presence of own child age under 1 and the presence of own child age between thirteen and seventeen are significant.

6.3.3 Results on the Relationships between Family Characteristics and Effort Supply using the ATUS Sub-Samples by Sex

Column (2) of Table 6-3 shows that there are significant gender differences in the effects of family characteristics on workers' effort supply. The analysis tests the reduced-form relationships between family characteristics and the amount of incentive pay for women and men, separately using the ATUS sub-samples. Table 6-4 reports the weighted OLS estimates by sex from the ATUS to further explore the gender differences. A chow test for all the coefficients across female and male sub-samples yields an F -statistic of 1.390 (p -value < 0.01), which rejects the null hypothesis of equality of all of the coefficients across the two sex sub-samples at a significance level of 5%.³⁶

As shown in column (1) of Table 6-4, for women no family characteristics show significant relationships with log of amount of incentive pay. While for men, only the presence of own child age between thirteen and seventeen have significantly positive relationships with the amount of incentive pay, controlling for other independent variables. This implies that male workers who have own child between ages of thirteen

³⁶ The sum of squared residuals from estimating the unweighted OLS model of full sample: $LOG(\text{Amount of incentive pay}) = \beta_0 + \beta_1 \text{Family Characteristics} + \beta_2 \text{Controls (without "Gender")} + \varepsilon$ is 4140.272, the sum of squared residuals from estimating the unweighted OLS model of female sub-sample is 1654.184, and the sum of squared residuals from estimating the unweighted OLS model of male sub-sample is 2316.570. Then the Chow test statistic is $F = \frac{(4140.272 - 1654.184 - 2316.570)/102}{(1654.184 + 2316.570)/(1499 + 2025 - 2 \cdot 102)} = 1.390$ with 102 and 3320 degrees of freedom.

and seventeen earn more from the incentive pay relative to male workers who do not have own child under the age of 18 living in the household. Thus, the empirical results on the effects of family characteristics on workers' effort supply between women and men are different.

Table 6-4: Gender Differences in Log of Amount of Incentive Pay and Family Characteristics—the ATUS 2003-2012 Sub-Samples by Sex

	Dependent Variable: Log of amount of incentive pay	
	Women	Men
	(1)	(2)
Spouse employment status: working	0.029 (0.076)	-0.070 (0.078)
Spouse employment status: not working	0.059 (0.141)	0.063 (0.120)
Number of own children	0.052 (0.092)	-0.044 (0.069)
The presence of own child age<1	0.190 (0.202)	0.311 (0.170)
The presence of own child age 1-2	0.077 (0.176)	0.116 (0.127)
The presence of own child age 3-5	-0.178 (0.131)	0.097 (0.115)
The presence of own child age 6-12	-0.154 (0.140)	-0.027 (0.120)
The presence of own child age 13-17	0.017 (0.125)	0.241* (0.117)
Potential labor market experience	0.031** (0.012)	0.021* (0.011)
Potential labor market experience-square	-0.001* (0.000)	-0.001* (0.000)
Education	0.060** (0.020)	0.010 (0.015)
Union member	0.136 (0.112)	0.387*** (0.072)
Metropolitan	0.068 (0.079)	0.165 (0.086)
Race dummies	Y	Y
Occupation dummies	Y	Y
Industry dummies	Y	Y
State dummies	Y	Y
Year dummies	Y	Y

Table 6-4 (Continued)

Constant	2.291*** (0.648)	3.848*** (0.605)
R-squared	0.140	0.154
Observations	1499	2025

Notes: The weighted OLS estimates are reported; weighted standard errors in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%.

6.4 Comparison of Results on the Relationships between Family Characteristics and Effort Supply using the PSID and the ATUS Samples

As in section 5.4, the analysis also compares the estimates on the effects of family characteristics on workers' effort supply measured as the amount of incentive pay received in the job. In order to fully compare the estimates, the analysis uses the same family characteristics including the employment status of spouse and the number of children living in the family, and the same control variables for both samples during the same years from 2003 to 2010. Table 6-5 reports the OLS estimates for the comparison between the results of the reduced-form relationships between log amount of incentive pay and family characteristics using the PSID sample and the ATUS sample from 2003 to 2010.³⁷

The results show that the indicator for having a not-working spouse has significant and positive relationship with log of amount of incentive pay only using the ATUS sample, but not using the PSID sample. It implies that a worker who has a not-working spouse earns more from incentives compared with a worker without a spouse in the ATUS sample. But the results show no significant relationships between other family

³⁷ To fully compare with the PSID sample, the analysis here uses unweighted OLS regression for analyzing the 2003-2010 ATUS sample. The regression results using weighted OLS are presented in column (2) of Appendix Table 6.

characteristics and the amount of incentive pay. These are consistent with the reported estimates in terms of the amount of incentive pay in Table 5-1, 5-2, 5-3, and 5-4, in which most family characteristics don't show significant relationships with the amount of incentive pay the worker received in the job using both samples.

One possible reason of the weak results between family characteristics and worker's effort supply is that this dissertation has not been able to disentangle offsetting positive and negative effects of these family characteristics, so that they are canceling each other out. For example, the number of children in the family could have opposite effects on the amount of incentive pay earned in the job. On the one side, workers with more children would have more financial pressure so that they will work harder and earn more from incentives in order to meet the higher target income. On the other side, more children demand more non-work time so the workers would work less hard due to the increased time constraints on work. In this case, the workers with more children receive less incentive pay. Therefore, the opposite effects with uncertain magnitudes could cancel each other so that the coefficients of the number of children are not significant in the analysis.

An alternative explanation of the results could be that the measures of workers' effort supply in the analysis are weak. This dissertation measures workers' effort supply as the amount of incentive pay workers received in their job. The aggregate incentive pay includes overtime pay in both the PSID and the ATUS samples. However, in the literature, usually the amount of money workers received from working overtime is not treated as the component of incentives. A variable pay component often includes bonus,

commission, and tips. Also, the analysis doesn't know the fraction of any workers' pay package that is devoted to incentives. Some might have a big piece of incentive pay; while others might have a smaller one. Thus, in order to differentiate different types of incentives, this dissertation measures workers' effort supply as the amount of each type of incentive pay separately using the 1992-2010 PSID sub-samples. The empirical results only show the significant effect of the spouse employment status on the amount of bonuses workers received. There are no significant relationships between family characteristics and the amount of commissions or tips. And the sample sizes of individuals reporting non-zero amount of commission and tips are very small. It would be better to have a larger sample to test the effects on these types of incentives. But this dissertation could not measure workers' reactions to separate incentives in the ATUS sample because the survey does not ask workers to report separate types of incentive pay. Also, the incentive pay in the ATUS includes only commissions, tips, and overtime pay but not bonuses. Thus, the measure in this dissertation—the amount of incentive pay—might not represent workers' effort supply accurately. Future work needs to measure workers' effort supply more precisely in a large sample.

Additionally, based on the results in Table 6-5, gender differences are still significant for both samples. Female workers earned less incentive pay than men in their jobs. Potential labor market experience and completed education both significantly positively associate with the amount of incentive pay workers received in their job in both the PSID and ATUS samples; while union member status has significant and positive relationship with the amount of incentive pay only in the ATUS sample.

Table 6-5: Comparison between the PSID and the ATUS (2003-2010): Worker's Effort Supply as Log of Amount of Incentive Pay and Family Characteristics

	Dependent Variable: Log of amount of incentive pay	
	PSID	ATUS
	(1)	(2)
Spouse employment status: working	0.193 (0.167)	0.038 (0.044)
Spouse employment status: not working	0.230 (0.221)	0.141* (0.063)
Number of own children	0.058 (0.058)	-0.013 (0.019)
Female	-0.388* (0.181)	-0.232*** (0.047)
Potential labor market experience	0.041* (0.019)	0.021*** (0.006)
Potential labor market experience-square	-0.001 (0.000)	-0.000*** (0.000)
Education	0.165*** (0.031)	0.036*** (0.010)
Union member	0.140 (0.167)	0.299*** (0.055)
Race dummies	Y	Y
Occupation dummies	Y	Y
Industry dummies	Y	Y
State dummies	Y	Y
Year dummies	Y	Y
Constant	1.402 (1.067)	3.826*** (0.494)
R-squared	0.372	0.125
Observations	965	3558
N_Clust	826	

Notes: The OLS estimates are reported; robust standard errors in parentheses clustered at individual level. *** significant at 1%; ** significant at 5%; * significant at 10%.

Chapter 7 Conclusion

To conclude, this dissertation investigates influences on workers' reactions to compensation incentives. The investigation in this study focuses on the impact of family characteristics including the employment status of spouse, the number of child, the age of child, and the alternative family income sources on workers' decisions on making job choices based on the presence of incentives and determining effort supply in the job. Both the theoretical and empirical analysis is conducted to examine the impacts of these characteristics.

The theoretical analysis develops a model to present how the underlying mechanisms link family characteristics and workers' effort supply on the basis of the standard effort maximization problem. Three potential theoretical mechanisms—target income, loss aversion, and time and energy constraints—are incorporated in this illustrative model. The model predicts that the employment status of spouse, child characteristics, and the alternative family income sources might have positive and negative effects on workers' effort through those theoretical channels. Drawing from the extended model of effort supply and the theory of equalization differences, it also implies that workers associated with different family characteristics would sort themselves into different jobs based on the presence of incentive pay. Thus, this theoretical model illustrates some of the possible relationships between family characteristics and workers' reactions to incentives.

The reduced-form relationships between family characteristics and workers' job choices based on incentives, and workers' effort supply are examined empirically using

two large nationally representative data sets—the Panel Study of Income Dynamics (PSID) and the American Time Use Survey (ATUS). Using both the 1975-2010 PSID sample and the 2003-2012 ATUS sample, two analyses are conducted: first, the multivariate Probit analysis³⁸ examines the impact of the employment status of spouse, the number of children, the age of child, and the alternative family income sources³⁹ on the presence of incentive pay in the job as the measure of worker’s job choices based on incentives; second, the multivariate OLS analysis focuses on the impact of these family characteristics on the amount of incentive pay the worker received in the job which is the proxy of worker’s effort supply in the study. Moreover, using the 1992-2010 PSID subsamples, the Probit analysis tests how workers with different family characteristics react to different types of incentives including bonuses, commissions, tips, and overtime pay. Furthermore, the analysis explores one underlying mechanism—time constraints on work—through which the reduced-form relationships between family characteristics and workers’ reactions to incentives occur, using the ATUS sample.

The empirical results from analyzing the PSID and ATUS data find that family characteristics, namely the employment status of spouse, the number of children, and the age of child, significantly associate with workers’ job choices on the basis of receiving incentive pay in the job. This supports the theoretical predictions that family characteristics have significant effects on workers’ sorting themselves into different jobs based on the presence of incentive pay. Moreover, the regression results are weakly

³⁸ The weight OLS analysis is reported using the ATUS sample in this dissertation.

³⁹ The indicator of the alternative family income sources is not included using the ATUS sample.

supportive of the importance of family characteristics on workers' effort supply. The results from both samples show few family characteristics such as the employment status of spouse have significant relationships with the amount of incentive pay workers received in their job. This dissertation also evaluates the effects on reactions to different types of incentives such as bonuses, commissions, and tips separately. The estimation results are different and not strong for each type of incentive. The weak results on the amount of incentive pay could be due to the weakness of the measures discussed in the former section. The weak results also indicate that maybe the traditional effort supply model is correct and it's not necessary to incorporate family characteristics into the effort supply function. Furthermore, this dissertation unveils the possible role of some underlying mechanisms using the detailed time information from the ATUS by adding time constraints on work to the regressions testing the relationships between family characteristics and workers' reactions to incentives. Time constraints on work are measured as time spent on several activities including household, caring for other people, socializing and sports. The results demonstrate that time constraints on work significantly negatively relate to workers' job choices based on the presence of incentive pay. It implies that the more time a worker spends on non-work activities, the less likely she or he chooses an incentive pay job. Moreover, some family characteristics such as the ages of children still have significant relationships with the presence of incentive pay after adding time constraints on work variables. This implies that the impact of the child's age related variables on a worker's job choice is a separate effect, which may not be only through time constraints on work. So the future research needs to explore other possible

mechanisms including a worker's target income and loss aversion. Additionally, there are significant gender differences in terms of the impacts of family characteristics and reactions to incentives. The results using both datasets show that women are less likely to choose jobs with incentives and receive less incentive pay in the job relative to men. Moreover, the analysis also shows that there are significant gender differences between the presence of incentive pay, time constraints on work, and family characteristics. The results show that time spent on other non-work activities, especially the activities of socializing and sports, has stronger effects on male workers' job choices based on the presence of incentive pay relative to female workers' job choices.

Furthermore, the empirical results in this dissertation have implications for labor supply research. As previously mentioned, one main reason of focusing on the role of family characteristics in determining workers' reactions to incentives in this dissertation is that family characteristics matter to workers' labor supply. According to the empirical results in the labor supply literature and in this dissertation, some family characteristics have significant relationships with both workers' labor supply decisions and workers' decisions on making job choices based on incentives and how much effort to put into work. For example, previous research shows that child-related variables, such as the presence of a child and the number of children, have significant effects on workers' labor force participation and hours of work; while this dissertation also presents that the presence of children at various ages under 18 and the number of children significantly associate with workers' job choices based on the presence of incentive pay in the job. Moreover, there are significant gender differences in the relationships between family

characteristics and workers' labor supply and reactions to compensation incentives. This implies that the determinations of workers' labor supply and job choices based on incentives and effort supply might be influenced by some common factors including family characteristics and gender. In addition, the empirical results in this dissertation show that some family characteristics such as the presence of young child (*e.g.*, the presence of own child under one using the ATUS sample), which are used as typical exclusion restriction in the classical Heckman selection approach, have significant relationships with both workers' job choices based on the presence of incentive pay and effort supply. It implies that some variables used as exclusion restriction in the Heckman selection model might have significant relationships with the dependent variable, such as the amount of earnings, in the second stage of the selection model. These results, therefore, suggest that some re-thinking of the validity of this exclusive restriction is warranted.

So in conclusion, the contribution of this dissertation to the literature is adding a novel perspective to heterogeneous responses to compensation incentives by workers, by shedding light on the previously unexplored roles that family characteristics can play. Given the limited analyses on this topic, these results using both the PSID and the ATUS data sets in this dissertation are important, but future research efforts should use stronger measures of workers' effort supply to better understand the relationships between family characteristics and workers' reactions to incentives. This could include measuring the separate incentive pay in a larger sample or collecting income data from incentive components in an incentive-pay dominated occupation such as sales. Future studies

should also explicitly analyze the possible underlying mechanisms, such as a worker's target income and the degree of a worker's loss aversion. This could include a field study using an employee survey in an organization to collect data that includes subjective measures of workers' target income and degree of loss aversion combined with archival data from human resources records. There is still much to be learned about the role of family characteristics in determining workers' reactions to compensation incentives using a variety of data sources and methodologies.

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Appendix Tables

**Appendix Table 1: Consumer Price Index Data from 1975 to 2012
All Urban Consumers -- CPI-U**

Year	Annual Average	Annual Percent Change
1975	53.8	9.10%
1976	56.9	5.70%
1977	60.6	6.50%
1978	65.2	7.60%
1979	72.6	11.30%
1980	82.4	13.50%
1981	90.9	10.30%
1982	96.5	6.10%
1983	99.6	3.20%
1984	103.9	4.30%
1985	107.6	3.50%
1986	109.6	1.90%
1987	113.6	3.70%
1988	118.3	4.10%
1989	124	4.80%
1990	130.7	5.40%
1991	136.2	4.20%
1992	140.3	3.00%
1993	144.5	3.00%
1994	148.2	2.60%
1995	152.4	2.80%
1996	156.9	2.90%
1997	160.5	2.30%
1998	163	1.60%
1999	166.6	2.20%
2000	172.2	3.40%
2001	177.1	2.80%
2002	179.9	1.60%
2003	184	2.30%
2004	188.9	2.70%
2005	195.3	3.40%
2006	201.6	3.20%
2007	207.3	2.90%
2008	215.3	3.80%
2009	214.5	-0.40%
2010	218.1	1.60%
2011	224.9	3.20%
2012	229.6	2.10%

Note: Base year is chained; 1982-1984=100.

Source: <https://www.minneapolisfed.org/community/teaching-aids/cpi-calculator-information/consumer-price-index-and-inflation-rates-1913>.

**Appendix Table 2: Summary Statistics of Race, Occupation, and Industry for the
1992-2010 PSID Sub-sample with Non-zero Income from Bonuses
(N=2,794)**

Variable	Mean	Std. Dev.
White	0.690	0.463
Black	0.258	0.438
American Indian or Alaska Native	0.010	0.101
Asian or Native Hawaiian or Pacific Islander	0.010	0.101
Latino	0.013	0.114
Race other than black or white	0.001	0.033
Other	0.015	0.120
Two or more races mentioned	0.021	0.143
Occupation: not working	0.018	0.133
Occupation: Professional, technical or kindred workers	0.219	0.414
Occupation: Managers and administrators (except farm)	0.224	0.417
Occupation: Sales workers	0.060	0.238
Occupation: Clerical and kindred workers	0.094	0.292
Occupation: Craftsman and kindred workers	0.107	0.309
Occupation: Operatives	0.130	0.336
Occupation: Laborers (except farm)	0.045	0.208
Occupation: Farmers and farm managers	0.018	0.134
Occupation: Service workers	0.084	0.278
Industry: not working	0.018	0.134
Industry: Agriculture, forestry, or fisheries	0.030	0.171
Industry: Mining	0.010	0.101
Industry: Construction	0.076	0.265
Industry: Manufacturing	0.213	0.409
Industry: Transportation, communications, and other public utilities	0.101	0.301
Industry: Wholesale and retail trade	0.162	0.369
Industry: Finance, insurance, and real estate	0.086	0.280
Industry: Business and repair services	0.050	0.219
Industry: Personal services	0.021	0.145
Industry: Entertainment and recreation services	0.011	0.105
Industry: Professional and related services	0.379	0.485
Industry: Public administration	0.042	0.200

**Appendix Table 3: Summary Statistics of Race, Occupation, and Industry for the
1992-2010 PSID Sub-sample with Non-zero Income from Commissions
(N=270)**

Variable	Mean	Std. Dev.
White	0.796	0.403
Black	0.181	0.386
American Indian or Alaska Native	0.004	0.061
Asian or Native Hawaiian or Pacific Islander	0.011	0.105
Latino	0.000	0.000
Race other than black or white	0.000	0.000
Other	0.007	0.086
Two or more races mentioned	0.011	0.105
Occupation: not working	0.019	0.135
Occupation: Professional, technical or kindred workers	0.074	0.262
Occupation: Managers and administrators (except farm)	0.252	0.435
Occupation: Sales workers	0.500	0.501
Occupation: Clerical and kindred workers	0.033	0.180
Occupation: Craftsman and kindred workers	0.059	0.237
Occupation: Operatives	0.041	0.198
Occupation: Laborers (except farm)	0.015	0.121
Occupation: Farmers and farm managers	0.000	0.000
Occupation: Service workers	0.007	0.086
Industry: not working	0.019	0.135
Industry: Agriculture, forestry, or fisheries	0.015	0.121
Industry: Mining	0.000	0.000
Industry: Construction	0.026	0.159
Industry: Manufacturing	0.093	0.290
Industry: Transportation, communications, and other public utilities	0.085	0.280
Industry: Wholesale and retail trade	0.344	0.476
Industry: Finance, insurance, and real estate	0.259	0.439
Industry: Business and repair services	0.067	0.250
Industry: Personal services	0.015	0.121
Industry: Entertainment and recreation services	0.022	0.148
Industry: Professional and related services	0.274	0.447
Industry: Public administration	0.000	0.000

**Appendix Table 4: Summary Statistics of Race, Occupation, and Industry for the
1992-2010 PSID Sub-sample with Non-zero Income from Tips
(N=237)**

Variable	Mean	Std. Dev.
White	0.624	0.485
Black	0.333	0.472
American Indian or Alaska Native	0.008	0.092
Asian or Native Hawaiian or Pacific Islander	0.004	0.065
Latino	0.013	0.112
Race other than black or white	0.000	0.000
Other	0.008	0.092
Two or more races mentioned	0.008	0.092
Occupation: not working	0.084	0.279
Occupation: Professional, technical or kindred workers	0.042	0.201
Occupation: Managers and administrators (except farm)	0.059	0.236
Occupation: Sales workers	0.030	0.170
Occupation: Clerical and kindred workers	0.046	0.211
Occupation: Craftsman and kindred workers	0.059	0.236
Occupation: Operatives	0.160	0.368
Occupation: Laborers (except farm)	0.046	0.211
Occupation: Farmers and farm managers	0.000	0.000
Occupation: Service workers	0.473	0.500
Industry: not working	0.084	0.279
Industry: Agriculture, forestry, or fisheries	0.013	0.112
Industry: Mining	0.000	0.000
Industry: Construction	0.046	0.211
Industry: Manufacturing	0.034	0.181
Industry: Transportation, communications, and other public utilities	0.080	0.272
Industry: Wholesale and retail trade	0.295	0.457
Industry: Finance, insurance, and real estate	0.013	0.112
Industry: Business and repair services	0.034	0.181
Industry: Personal services	0.245	0.431
Industry: Entertainment and recreation services	0.038	0.192
Industry: Professional and related services	0.270	0.445
Industry: Public administration	0.017	0.129

**Appendix Table 5: Summary Statistics of Race, Occupation, and Industry for the
1992-2010 PSID Sub-sample with Non-zero Income from Overtime Pay
(N=1,121)**

Variable	Mean	Std. Dev.
White	0.544	0.498
Black	0.412	0.492
American Indian or Alaska Native	0.005	0.073
Asian or Native Hawaiian or Pacific Islander	0.009	0.094
Latino	0.012	0.107
Race other than black or white	0.001	0.030
Other	0.015	0.122
Two or more races mentioned	0.017	0.129
Occupation: not working	0.034	0.181
Occupation: Professional, technical or kindred workers	0.140	0.347
Occupation: Managers and administrators (except farm)	0.053	0.223
Occupation: Sales workers	0.028	0.164
Occupation: Clerical and kindred workers	0.161	0.368
Occupation: Craftsman and kindred workers	0.173	0.378
Occupation: Operatives	0.187	0.390
Occupation: Laborers (except farm)	0.055	0.229
Occupation: Farmers and farm managers	0.000	0.000
Occupation: Service workers	0.169	0.375
Industry: not working	0.034	0.181
Industry: Agriculture, forestry, or fisheries	0.005	0.073
Industry: Mining	0.008	0.089
Industry: Construction	0.067	0.250
Industry: Manufacturing	0.219	0.414
Industry: Transportation, communications, and other public utilities	0.117	0.321
Industry: Wholesale and retail trade	0.126	0.332
Industry: Finance, insurance, and real estate	0.041	0.198
Industry: Business and repair services	0.029	0.167
Industry: Personal services	0.024	0.153
Industry: Entertainment and recreation services	0.009	0.094
Industry: Professional and related services	0.344	0.475
Industry: Public administration	0.114	0.318

Appendix Table 6: Weighted OLS Results using ATUS (2003-2010): Worker's Job Choices, Effort Supply and Family Characteristics

	Dependent Variable	
	The presence of incentive pay	Log of amount of incentive pay
	(1)	(2)
Spouse employment status: working	0.006 (0.005)	-0.000 (0.053)
Spouse employment status: not working	-0.001 (0.007)	0.116 (0.094)
Number of own children	-0.013*** (0.002)	-0.009 (0.020)
Female	-0.045*** (0.005)	-0.226*** (0.049)
Potential labor market experience	0.001 (0.001)	0.024** (0.009)
Potential labor market experience-square	-0.000*** (0.000)	-0.001** (0.000)
Education	0.002 (0.001)	0.022 (0.013)
Union member	0.074*** (0.007)	0.311*** (0.065)
Race dummies	Y	Y
Occupation dummies	Y	Y
Industry dummies	Y	Y
State dummies	Y	Y
Year dummies	Y	Y
Constant	0.001 (0.055)	3.700*** (0.449)
R-squared	0.066	0.125
Observations	54900	3558

Notes: The weighted OLS estimates are reported; weighted standard errors in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%.