

Essays on Taxation, Marriage, and Labor Supply

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(ABSTRACT)

My dissertation consists of three essays on labor supply responses, along the extensive margin (participation into the labor force) and along the intensive margin (intensity of work on the job). The first two essays focus on the labor supply responsiveness of single women with children to taxation and welfare programs. The third essay investigates the effects of marriage, the wage rate, and the associated tax rate on men's labor supply.

In the first essay, to avoid bias from the fact that labor supply outcomes are being driven by self-selection, I build a dynamic stochastic discrete choice model to investigate the long run effects of the earned income tax credit and welfare policies on single mothers' labor supply. Simulated method of moments is used to estimate parameters of this dynamic model, based on March CPS data files from 1964 to 2013. I compare the performance of the dynamic stochastic discrete choice model, a static model, and a reduced-form model. My analysis concludes that the dynamic stochastic discrete choice model captures the simultaneous impact of the state variables on the predicted employment decision. My study provides evidence of the long-run positive effect of public policy on low income families in a life-cycle setting. This essay also emphasizes the importance of education in increasing single mothers' labor supply.

The second essay is designed to identify factors that help single mothers leave TANF within a short span of time. I find strong evidence for the importance of child support assistance to single mothers' success in exiting TANF with a job. I uncover evidence that work-related activities do not induce TANF participants to leave within a short span of time. My analysis also suggests that

health issues significantly limit the ability of single mothers to exit TANF.

In the third essay, the main research question is how marital status affects the elasticity of the labor supply of males with respect to wages and taxes, in a life-cycle setting. A dynamic panel data model, which extends the literature on dynamic labor supply, indicates that the elasticity of men's labor supply with respect to wages and taxes is affected by marital status. The empirical results using the Panel Study of Income Dynamics (PSID) data show that men who are continuously married to the same wife have a lower average Frisch elasticity than others.

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Chapter 1

Introduction

My dissertation consists of three essays on topics in labor and public economics. I observe labor supply responses along the extensive margin (participation in the labor force) in the first two essays, while in the third essay I examine the labor supply response along the intensive margin (intensity of work on the job). I conduct estimations by both the structural method and the reduced form method in my dissertation. The first two essays focus on public policy's effect on employment of single women with children, while the third essay investigates the effect of marital stability on the elasticity of the labor supply of men with respect to wages and taxes, in a life cycle setting.

Since the late 1980's, to induce single mothers to increase their labor supply, welfare and tax policies have been reformed. The largest change in welfare and tax policy with respect to the poor during the past 25 years was the personal responsibility and work opportunity act (PRWORA) of 1996, which replaced Aid to Families with Dependent Children (AFDC) with temporary assistance for needy families (TANF), reducing welfare benefits while expanding the Earned Income Tax Credit (EITC). In the first essay, I construct and estimate a dynamic stochastic discrete choice

model, to explore the long-run effect of these policy changes on single mothers' labor supply decisions. The model allows each woman to choose to work or not, at each period, based on her education, work experience, number of children, ages of children, the welfare program, and the tax system. The parameters of this dynamic model are estimated by the simulated method of moments. The synthetic cohorts are constructed based on March CPS data files from 1964 to 2013. In the first essay, to validate the performance of the dynamic model, I explore long run labor participation behavior using both a static model and a probit model. The comparison of three models indicates that the dynamic model provides a better fit, with smaller differences between predicted and actual participation rates. The results of simulation based on the dynamic model suggest that public assistance programs and education cause a large portion of the increase in work by single mothers.

In the case of EITC where single women with children could benefit from the program by increase their labor supply, while in the case of TANF where these women could make themselves eligible for benefits through remaining in the program. My second essay investigates factors influencing low income families to leave TANF. In 2012-2013 sample, within four months, 79 percent of TANF recipients leave TANF. I conduct a multinomial logistic regression based on 2008 panels of the Survey of Income and Program Participation (SIPP) Data to explore the associated factors.

The second essay reports that child support payments by fathers appear to encourage single mothers to leave TANF and work. I also provide evidence that decreases in TANF cash transfers induce women with children leave TANF. Some studies have shown that sanctions for failure to meet TANF work requirements have a significant impact on the rate at which recipients move off TANF. My empirical results indicate that disability prevents single mothers from leaving TANF, so that the usual presumption that every TANF receiver has the same labor skills and should be able to leave TANF within the same specified time limit may not have the validity that would be needed to support existing sanctions. Meanwhile, I find no evidence that work related activities improve

the ability of recipients to leave TANF.

The third essay introduces marital stability to estimation of the response of the labor supply to fluctuations over time in wages. I define a man to be maritally stable if he has had only one marriage and it is intact when data are gathered. My study is the first study to investigate the effect of marital stability on the Frisch elasticity. Frisch elasticity is the intertemporal elasticity of substitution of the labor supply. It predicts the response of the labor supply to temporary wage rate and tax changes over time. I find clear evidence that the elasticity of labor supply with respect to wages and taxes is affected by marital status. The empirical results show that males who are continuously married to the same wife have a lower average Frisch elasticity than others. This can be explained either by the higher opportunity cost of the husband's time, due to the loss in household production when the husband's labor supply changes in response to wage and tax changes, or by the possibility that maritally unstable men are characterized by greater responsiveness to changes in their opportunities.

In my third essay, I analyze both a conventional-individual model and a married-individual model, which includes household production. The labor supply functions from the two models are different. The Frisch elasticity of the labor supply in the married-individual model is less than the Frisch elasticity in the conventional-individual model. Therefore, I predict that the Frisch elasticity of maritally stable men is less than the elasticity of others.

My exercise takes two approaches to estimating the Frisch elasticity. The first approach is the First-Differenced Labor Supply Equation approach, and the second approach is Using Consumption as A Proxy for the Marginal Utility of Wealth. In the first estimation approach, I use two instrument sets to estimate the parameters, considering the endogeneity of wage growth and measurement error. The first instrument is the reported hourly wage as the instrument for the wage rate. The second is a Macurdy-type instrument. My second estimation approach uses consumption

as a proxy of marginal utility of wealth. In principle, the marginal utility of wealth parameter captures all wages and wealth information, and it determines the consumption choice in each period. Therefore, I estimated parameters by using consumption as a proxy for the marginal utility of wealth.

Chapter 2

A Dynamic Model of the Labor Supply of Single Mothers

(ABSTRACT)

To induce single mothers' to increase their labor supply, tax and welfare policy changed in the 1990s. I construct a dynamic stochastic discrete choice model to investigate the long-run effects of the earned income tax credit (EITC) and welfare policies on single mothers' labor supply. I estimate parameters of this dynamic model by simulated method of moments, based on March CPS data files from 1964 to 2013. My study finds that a dynamic stochastic discrete choice model captures the simultaneous impact of the state variables on the predicted employment decision. The study concludes that the principal causes of the increase in single mothers' labor supply were the increase in EITC payments and the increase in single mothers' educational attainments.

2.1 Introduction

Single mothers are the focus of many public assistant programs including the welfare program and the Earned Income Tax Credit (EITC). To help these women and their children avoid poverty, many transfer programs are implemented. However, in view of the maxim, "give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime," it is more valuable to induce single mothers to increase their labor supply. The increase in single mothers' labor force participation rate increases their current income and future income. Data show that for the past 50 years, the single mothers' labor force participation rate has been increasing. Since early 1990's, the rapid increase in the single mothers' participation rate has been inspiring (Eissa and Liebman, 1996; Meyer and Rosenbaum, 2000; Meyer and Rosenbaum, 2001; Moffitt 2002; Eissa, Kleven, and Kreiner, 2005). Literature has suggested that welfare policies and tax credit programs are important reasons for the increase in the single mothers' labor force participation in past 20 years (Eissa and Liebman, 1996; Meyer and Rosenbaum, 2000; Meyer and Rosenbaum, 2001; Moffitt 2002; Chan 2013).

There is a large amount of research investigating the effect of EITC on labor supply behavior in the Public Finance literature. One strand of labor supply research focuses on single mothers' labor supply behavior in response to EITC. Eissa and Liebman (1996) used a "natural experiment"-the Tax Reform Act of 1986, to identify the effect of the expansion of EITC on single mothers' labor supply. They examined EITC's effect on both the extensive margin (participation into the labor force) and the intensive margin (intensity of work on the job). They found that EITC and related provisions of the Tax Reform Act 1986 can explain up to a 2.8 percentage increase in the labor force participation of single women with children relative to that of single women without children. Meyer and Rosenbaum (2001) presented a simple structural model and a more detailed

examination of the effect of EITC and other tax changes (welfare benefit cuts, welfare waivers, training programs and child care programs) on the labor supply of single mothers. They concluded that these tax changes successfully encouraged single mothers to work more. Eissa, Kleven, and Kreiner (2005) constructed a computable general equilibrium model and applied this model to measure the labor supply and expansion from EITC for single mothers in the United States. Their simulation results again indicated a substantial response of the labor supply of single mothers to the expansion of EITC. These studies consistently show that women were more responsive along extensive margin than that along intensive margin. Chetty and Saez (2013) used a randomized experiment to test whether a lack of EITC information could result in small responses of hours worked.

Another strand of inquiry into labor supply responsiveness to EITC focuses on married women and men. Eissa (1995) used the difference-in-difference methodology to identify the effect of the tax reform act of 1986 on high-income married women's labor supply responsiveness. She found that the labor supply of high-income married women increased due to the tax cut of the Tax Reform Act of 1986. Eissa and Hoynes (2004) used a reduced-form model to examine the labor force participation response of married couples to EITC expansions between 1984 and 1996. Their study indicated that the total family labor supply of married couples declined due to EITC expansions, because the decrease in labor force participation by married women was more than the increase in labor force participation by married men. Heim (2009) used a more complicated model to examine the family labor supply response to taxes. His methodology allowed for continuous hours choices, measurement error in hours, heterogeneity in tastes, and accounts for fixed costs of working and a nonlinear tax schedule. His simulation results suggested weak responsiveness of labor supply of married couple to tax changes. Kumar and Liang (2015) estimated the trend of labor supply elasticities with respect to wages and to income, for married women, from 1980 to 2006. They reported a long-term decline in married women's labor supply elasticities on the

participation margin.

Another strand of labor supply research is devoted to explaining the labor supply of women, especially the rise in their labor supply, as surveyed by Keane (2011). Eckstein and Wolpin (1989) developed a dynamic model of married women's labor force participation and fertility. Their model was estimated using the National Longitudinal Survey's mature women's data. The conclusion from their model was that work experience had a negative impact on utility and a positive impact on wages. Overall, work experience had positive impact on married women's labor force participation. Their study also suggested that schooling, fertility, and husband's income significantly affected women's labor force participation. Eckstein and Lifshitz (2011) extended Eckstein and Wolpin (1989) and explained the increase in married women's labor supply by education and higher wages. In Eckstein and Lifshitz (2011), the model also included the fertility and marriage decisions, and their study reported a small share of the contribution of fertility and marriage to women's labor force participation. These two studies and other studies (Fernandez 2013, Ge 2011) focus on the relationship between individual factors such as schooling, marriage, fertility and labor supply. Keane and Wolpin (2007), Keane and Wolpin (2010), and Chan (2013) included a welfare factor in a dynamic women's labor supply model. In their studies, they emphasized more the effects of AFDC and TANF on women's labor supply, and the welfare gained. Keane and Wolpin (2010) mentioned EITC, but their interest was in minority-majority differences in women's behavior.

Studies using natural experiments or other exogenous sources of variation in the data may be biased by the fact that labor supply outcomes are being driven by self-selection. Also, the long run contribution of EITC and welfare programs to single mothers' labor supply is an open question. This paper uses a dynamic stochastic discrete choice (DSDC) model to account for the contribution of education and public assistance programs to the increase in single mothers' labor supply.

This paper contributes to the literature on the effect of EITC and welfare on single mothers'

labor supply, using a dynamic stochastic discrete choice (DSDC) model and a single mothers' sample from March CPS data files from 1964 to 2013. It uses the simulated method of moments (SMM) to estimate this structural model. Comparing the performance of the DSDC model against standard Heckman reduced-form estimation, this study finds that the DSDC model captures the simultaneous impact of the state variables on the predicted employment decision. The dynamics of the model reflect the effect of the state variables on the change in predicted employment and their impact on future employment. It addresses the long-run effect of public policy on low income families in a life-cycle setting.

March CPS data files from 1964 to 2013 indicate that the single mothers' participation rate has increased in the past 50 years. With a newer data set and a dynamic structural model, the simulation exercise suggests that a rise in education levels accounts for a significant part of increase in single mothers' labor supply. Also, changes in public assistance programs induced an important part of the increase in single mothers' labor supply.

The study is organized as follows. Section 2.2 introduces the policy background. Section 2.3 provides the model. Section 2.4 describes the data set and estimation approaches. Section 2.5 report estimation results. Section 2.6 and section 2.7 report the model fitness and simulation results. The last section provides concluding remarks.

2.2 Policy Background

The two main programs that provide assistance to single mothers are welfare and EITC. Welfare consists mainly of temporary assistance for needy families (TANF), Medicaid and food stamp pro-

grams. The federal and state governments support low-income single-parent families with dependent children through TANF. In addition, the federal government provides public health insurance for the poor through Medicaid. For low-income families, the refundable tax credit EITC serves as a wage subsidy, which reduces the income tax of qualified households and sometimes makes the income tax negative. The amount of the EITC depends on the amount of earned income and the number of dependent children.

Since the late 1980's, to induce single mothers to increase their labor supply, welfare and tax policies have been reformed. The largest change in welfare and tax policy with respect to the poor during the past 25 years was the personal responsibility and work opportunity act (PRWORA) of 1996, which replaced AFDC with TANF, reducing welfare benefits while expanding EITC. The rest of the study constructs and estimates a model, showing the effect of these policy changes on single mothers' labor supply decisions.

2.3 Model

This study models the dynamic labor-force-participation behavior of low-income single mothers. Following Eckstein and Lifshitz (2011), a representative single mother is modeled as solving the following maximization problem

$$\max E_t \sum_{t=0}^T \delta_t U(P_t, x_t, K_{t-1}, N_{t,j} (j = 1, \dots, J), S, \nu_t) \quad (2.1)$$

where P_t is the choice of working or not in period t . The model sets one year as one period and the working period starting at age 22. Following Eckstein and Wolpin (1989) and Eckstein and

Lifshitz (2011), I set the starting age as 22 years old, because the education level does not change much and labor supply starts for most women at 22 years old. If the woman chooses to work in period t , $P_t = 1$; otherwise, $P_t = 0$.

The only endogenous variable is the labor supply decision. x_t is the consumption in period t . K_{t-1} is the accumulated work experience at time t . $N_{t,j}$ represents the number of children of type j at time t , which is assumed to be exogenous. This study considers two types of children, $j = 1, 2$. Children belong to the first group if they are under six years old, and others belong to the second group. Years of schooling that a mother has received is represented by S . ν_t is a stochastic error term. δ is the discount factor. When δ is zero, the model is reduced to a static model. I assume single mothers retire at period T .

A single mother's budget constraint is affected by welfare programs and the tax system. The budget constraint is

$$y_t P_t + TC_t + Wel_t = x_t + \sum_{j=1}^J c_j N_{tj} + b P_t \quad (2.2)$$

$$TC_t = 0.2 y_t P_t \sum_{j=1}^J N_{tj} \quad (2.3)$$

$$Wel_t = Y_A \sum_{j=1}^J N_{tj} \quad (2.4)$$

where y_t denotes the labor income if the single mother chooses to work. EITC is denoted by TC_t , and a welfare payment is denoted by Wel_t . Tax credits and welfare programs generate extra income, which allows extra consumption. c_j is the cost of raising a child. If the woman chooses to work, there is a cost of home production which is denoted by b . Y_A is cash transfer or food stamp for a child.

Single mothers choose whether or not to work, based on education, previous work experience,

number of children, age of children, the welfare program and the tax system. For simplicity, in this study I assume that all eligible single mothers accept welfare programs and all report their tax credit.

This study assumes that at age 22, the education level is not going to change, so that S is given at the starting period. At each period, the state variable includes work experience, education level, last period's participation history, and number of children by type. In this study, I assume the state variables are exogenously given. Fertility is assumed to follow a simple state-dependent discrete dynamic process.

$$P_r(N_t = N_{t-1} + 1) = \Phi(\lambda_0 + \lambda_1 AGE_t + \lambda_2 AGE_t^2 + \lambda_3 S + \lambda_4 P_{t-1} + \lambda_5 N_{t-1} + \lambda_6 N_{t-1}^2) \quad (2.5)$$

The number of children aged under 5 years old and 5-18 years old evolves as follows

$$N_{tj} = N_{t-1,j} + n_{tj} - d_{tj} \quad (2.6)$$

I adopt the classical Mincer wage function.

$$\ln y_t = \beta_0 + \beta_1 K_{t-1} + \beta_2 K_{t-1}^2 + \beta_3 S + \beta_4 t + \epsilon_t \quad (2.7)$$

The goal of this model is to capture the labor supply behavior of single mothers and account for the increase in the single mothers' labor force participation rate. At period t , the utility function of a single mother is

$$U_t = (\alpha_1 + \nu_t) P_t + x_t + \alpha_2 P_t x_t + \alpha_3 P_t K_{t-1} + \sum_{j=1}^J \alpha_{4j} N_{tj} P_t + \alpha_5 P_t S + f(N_{tj}) \quad (2.8)$$

where α_1 denotes the disutility of work. This model allows for nonseparability between leisure and consumption using $P_t x_t$ and for intertemporal nonseparability, using $P_t K_{t-1}$. Following the literature, I leave the form in which children enter the utility function unspecified.

A single mother makes the labor supply decisions that maximize her expected present value of utility. The value function of this dynamic programming procedure is standard. It is defined as

$$V_t(K_{t-1}, \epsilon_t, \Omega_t) = \max[V_t^1(K_{t-1}, \epsilon_t, \Omega_t), V_t^0(K_{t-1}, \Omega_t)] \quad (2.9)$$

When a single mother chooses to work, the expected value function is $V_t^1(K_{t-1}, \epsilon_t, \Omega_t)$. If the single mother does not work, the expected value function is $V_t^0(K_{t-1}, \Omega_t)$. The functions are specified as follows,

$$V_t^1(\Omega_t, \epsilon_t, \nu_t, t) = U_t^1(K_{t-1}, \Omega_t, \epsilon_t, \nu_t) + \delta E(V_{t+1}(K_t, \Omega_{t+1}, \epsilon_{t+1}, \nu_{t+1} | \Omega_t, P_t = 1)) \quad (2.10)$$

$$V_t^0(\Omega_t, t) = U_t^0(K_{t-1}, \Omega_t) + \delta E(V_{t+1}(K_t, \Omega_{t+1}, \epsilon_{t+1}, \nu_{t+1} | \Omega_t, P_t = 0)) \quad (2.11)$$

If the single mother works, plugging the budget constraints into the utility function at period t yields the following utility function

$$U_t^1(K_{t-1}, \Omega_t, \epsilon_t, \nu_t) = \alpha_1 + \nu_t + \alpha_3 K_{t-1} + \sum_{j=1}^J \alpha_{4j} N_{tj} + \alpha_5 S + f(N_{tj}) + (1 + \alpha_2) [y_t + 0.2y_t \sum_{j=1}^J N_{tj} + Y_A \sum_{j=1}^J N_{tj} - \sum_{j=1}^J c_j N_{tj} - b] \quad (2.12)$$

Otherwise, the utility at period t is

$$U_t^0(\Omega_t) = Y_A \sum_{j=1}^J N_{tj} - \sum_{j=1}^J c_{tj} N_{tj} + f(N_{tj}) \quad (2.13)$$

If $\delta = 0$, the result is the static model. The single mother chooses to work if

$$U_t^1(K_{t-1}, \Omega_t, \epsilon_t, \nu_t) > U_t^0(K_{t-1}, \Omega_t) \quad (2.14)$$

At each period, a single mother may receive a job offer which is from a logistic distribution as follows:

$$P_{rt} = \frac{\exp(\rho_0 + \rho_1 S + \rho_2 K_{t-1} + \rho_3 K_{t-1}^2 + \rho_4 P_{t-1})}{1 + \exp(\rho_0 + \rho_1 S + \rho_2 K_{t-1} + \rho_3 K_{t-1}^2 + \rho_4 P_{t-1})} \quad (2.15)$$

The model is solved by standard backward recursion. At the final period T , a single mother may receive a job offer. She makes the labor supply decision by comparing the alternative rewards after receiving the job offers. The rewards are mainly determined by wage, tax credit, welfare receipt, number of children and work experiences. The alternative with the largest realized reward is chosen. In the preceding periods, the state space determines the probability of new child arriving. The alternative with the largest realized reward is chosen.

2.4 Data and Estimation

This study employs data from the March CPS to estimate a dynamic model. For simplicity, I define the cohort of women born in the years 1965-1975 as the young generation who make the labor supply decision in a new public policy environment. For the status quo ante exercise, I use data on women who were born during the period 1945-1955. For the young generation, there are

tax credit data since they finish education. Data for the 1965-1975 cohort serves for estimating the benchmark model.

To have more welfare and tax credit data and increase sample size, the estimation is not undertaken using panel methods. Instead, repeated cross-section CPS data are used. The estimation method is simulated method of moments (SMM).

The SMM estimator, $\hat{\theta}$, minimizes the objective function $J(\theta) = g(\theta)'Wg(\theta)$, where $g(\theta)' = [m_1^A - m_1^S(\theta), \dots, m_j^A - m_j^S(\theta), \dots, m_j^A - m_j^S(\theta)]'$, which is the difference between actual moments and simulated moments, and W is the weighting matrix, which is a diagonal matrix consisting of the inverse of the estimated variance of each moment.

Actual moments are from the observed data and simulated moments are from the model simulation with the parameter vector θ .

Following Pencavel (1998) and Eckstein and Lifshitz (2011), the single mothers are divided into five groups by their education. Education groups are high school dropout (HSD), high school graduate (HSG), some college (SC), college graduate (CG) and post college group (PS). This study calculates moments for nine variables for each group at each period. Therefore the total number of moments is $5 * T * 9$. The nine variables are participation rate, hourly wage rate, and dummy variables for 0 children under 5, 1 child under 5, 2 children under 5, 0 children aged 5-18, 1 child aged 5-18, 2 children aged 5-18, and more than 3 children aged 5-18.

To obtain the simulated moments, the model is numerically solved and randomly simulated. Starting from the first period, when women are aged 22, the model can simulate each woman's labor supply choice for each period. The simulations are conducted with a wage shock, a utility shock, arrival of a job offer and an arrival of a child. The simulated moments include participation rate, hourly wage rate, and distribution of number of children by age (no child who is under 5 years

old, 1 child who is under 5 years old, 2 children who are under 5 years old, no children who is aged 5-18 years old, 1 child who is aged 5-18, 2 children who are aged 5-18 and more than 2 children who are aged 5-18) for each education group of women at each period.

When the discount factor is equal to zero, the dynamic model is reduced to a static model.

2.5 Results

To fully investigate the labor supply choice of single mothers, this study undertook three models estimations. The first one is the classical probit regression of single mothers' labor force participation. I estimated the probit equation

$$P(lfp = 1) = \Phi(\alpha_1 + \alpha_{51}HSD + \alpha_{52}HSG + \alpha_{53}SC + \alpha_{54}CG + \alpha_{55}PC + \alpha_2Wel + \alpha_3K + \alpha_{41}Child5 + \alpha_{42}Child518) \quad (2.16)$$

The results are reported in column 4 of table 2.1. The probit regression results show that a decrease in welfare benefits significantly increases the probability of participating in the labor force.

Estimation results for dynamic models and static models are reported in column 2 and column 3 of table 2.1 and 2.2 respectively. The parameters are consistent with results in the literature. The estimation results imply that a dynamic model can explain more of the changes than a static model.

Table 2.1: Utility Equation Estimation Results

Parameter	Dynamic	Static	Probit
$\alpha_1 + \alpha_{52}$	-15393.3	-14529.8	.9353
α_2	-0.0403	-0.0329	-.9151
α_3	-46.5734	-40.6204	.0320
α_{41}	-2531.4738	-2415.5263	-.2442
α_{42}	-494.7348	-530.1453	-.0262
α_{51}	-1939.4381	-1817.7486	.4902
α_{53}	1458.3945	2119.4043	1.0795
α_{54}	2946.5040	2977.0678	1.3360
α_{55}	1924.8415	2453.2083	1.4476

Table 2.2: Wage Equation Estimation Results

Parameter	Dynamic	Static	Heckman
β_1	0.0427	0.0340	0.0431
β_2	-0.0004	-0.0004	-0.0868
β_{31}	2.0144	2.0553	1.9632
β_{32}	2.4540	2.4751	2.1413
β_{33}	2.4214	2.4267	2.3345
β_{34}	2.7070	2.6286	2.6332
β_{35}	2.9133	3.0043	2.8851
β_4	0.0095	0.0097	

Table 2.3: Job Offer Probability Equation Estimation Results

Parameter	Dynamic	Static
ρ_{11}	-0.0218	-0.0218
ρ_{12}	-0.0213	-0.0235
ρ_{13}	-0.0158	-0.0200
ρ_{14}	-0.0152	-0.0189
ρ_{15}	-0.0233	-0.0182
ρ_2	0.0758	0.1001
ρ_3	1.2406	1.05
ρ_4	-0.0010	-0.0009

Table 2.4: Children Arrival Equation Estimation

Parameter	Dynamic	Static
λ_0	-2.6560	-2.7521
λ_1	0.1107	0.1145
λ_2	-0.0133	-0.0141
λ_3	-0.0099	-0.0101
λ_4	-0.3702	-0.2955
λ_5	0.0850	0.0874
λ_6	-0.4513	-0.5829

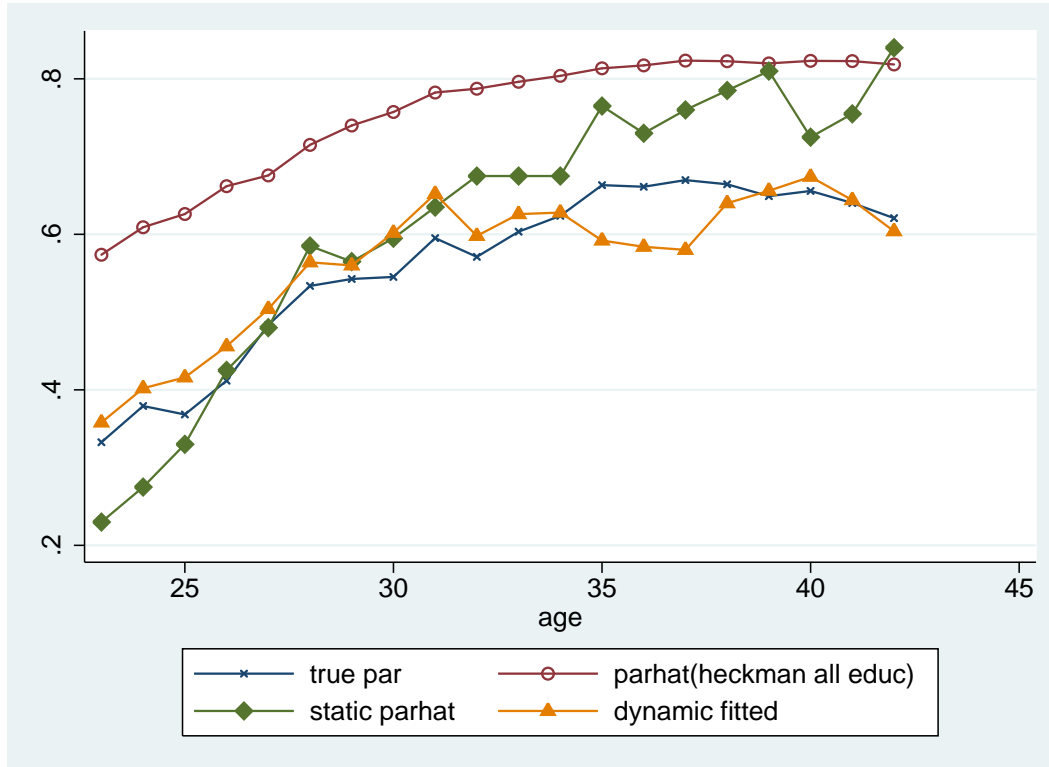
2.6 Quality of Fit

In this study, I use the difference between predicted and actual participation rates for all three modes to measure the quality of the model's fit of the data. Given the estimated parameters of the models, I simulated participation rates for the 1970 cohort of single mothers.

The above figure shows the goodness-of-fit of the dynamic, static, and reduced form (Heckman) models. The line marked by triangles shows the relationship between actual single mothers' labor supply and age. The line marked by circles describes the life-cycle relationship between predicted labor supply using a Heckman reduced-form model and age. The line marked by dots provides the life-cycle relationship between predicted labor supply using dynamic model and age. The line marked by "x"es shows the life-cycle relationship between predicted labor supply using static model and age. The humped shape of the employment rate by age for the 1970 cohort is best captured by the dynamic model, although the static model also provides a good fit, while the reduced form Heckman model provides a poor fit.

The employment of the single mothers aged 28-43 for the 1970 cohort is accurately predicted

Figure 2.1: Actual and Predicted Participation Rates: 1970 Cohort



by the dynamic model. The static model over predicts employment for the single mothers aged 40-43, although it captures the employment rate for younger single mothers. The actual participation rate reaches a peak when they are 35 years old, then gradually decreases. The pattern of the true participation rate is well captured by the dynamic model. The Heckman model predicts an inverse U-shaped employment profile that over predicts the participation rate of all age's single mothers. Overall, the dynamic model provides a much better fit with a lower difference between predicted and actual participation rates.

2.7 Accounting for the Increase in the Single Mothers' Participation Rate

In order to explain single mothers' labor supply behavior, simulation exercises are performed using the dynamic model. This study, as mentioned, uses two cohorts, a 1970 cohort who were born between 1965 and 1975? and a 1950 cohort who were born between 1945 and 1955. The 1970 cohort serves as the base cohort who makes participation decisions in the new policy environment. When the 1970 cohort women do not work, the welfare benefits from the welfare system are less than that for the 1950 cohort. In addition, if they choose to work, they receive more tax credit than the 1950 cohort receives.

Labor supply studies suggest that education is one of the most important determinants of labor supply decisions. This study confirms the importance of education for single mothers' labor supply behavior. The simulation results of education's importance are reported in Table 2.5. By applying 1950 cohort's education distribution to the 1970 cohort's model, I simulated the participation rate for the young cohort women. The simulation results suggest that education alone could explain two-thirds of increase in labor force participation of single mothers, in a dynamic model.

Table 2.5: Education's Contribution in Single Mothers' Participation Rates Changes

Age	(1)	(2)	(3)	(4)	(5)	(6)
23-27	0.5820	0.6304	0.6234	0.0414	-0.007	-16.91
28-32	0.6884	0.7119	0.7680	0.0796	0.0561	70.48
33-37	0.7489	0.7642	0.8079	0.059	0.0437	74.06
38-42	0.7920	0.7863	0.8191	0.0271	0.0328	121.03

- (1): True Participation Rate of 1950 Cohort;
(2): Fitted Participation Rate;
(3): True Participation Rate of 1970 Cohort;
(4): Participation Rates Difference between Two Cohorts;
(5): Difference Contribution of Education;
(6): Share of Change in Participation Rates explained by Education (%).

To determine the contribution of public assistance programs to single mothers' participation rates, I assume the young generation's education, wage, fertility choice are not changed and the only changes are in the welfare program and the tax credit. Then I re-estimate the model and obtain new estimators and new fitted participation rates. The results are reported in Table 2.6.

Table 2.6: Public Assistance Programs' Contribution in Single Mothers' Participation Rates Changes

Age	(1)	(2)	(3)	(4)	(5)	(6)
23-27	0.5820	0.3446	0.6234	0.0414	0.2788	673.44
28-32	0.6884	0.5573	0.7680	0.0796	0.2107	264.69
33-37	0.7489	0.7024	0.8079	0.059	0.1055	178.81
38-42	0.7920	0.7683	0.8191	0.0271	0.0508	187.45

- (1): True Participation Rate of 1950 Cohort; (2): Fitted Participation Rate;
(3): True Participation Rate of 1970 Cohort;
(4): Participation Rates Difference between Two Cohorts;
(5): Difference Contribution of Assistance Programs;
(6): Share of Change in Participation Rates explained by Public Assistance Programs (%).

Column 2 and column 4 of Table 2.6 report the true participation rates of the 1950 cohort single

mothers and the 1970 cohort single mothers respectively. For each 1970 cohort single mother, I simulated her work decisions in the old policy environment using the dynamic model. The fitted participation rates of single mothers are reported in column 3, indicating the effect of the public programs.

The contribution to the increase in participation rates reported in this table is entirely from the policy changes. The fitted numbers in column 2 and the true participation rates in column 4 indicate that in the old policy environment, for the exactly same women, the likelihood of working is consistently lower than the participation rate when single mothers get help from the expansion of EITC and the reformed welfare programs. The trend continues through their life cycles. It implies that the new policies induced a significant increase single mothers' labor supply.

2.8 Conclusions

To investigate the single mothers' labor supply in a life cycle setting, this paper constructed a DSDC model and estimated it using SMM. Comparison among dynamic, static, and Heckman models suggests that structural model can best capture the characteristics of single mothers' labor supply. It shows that the dynamics of the model reflect the effect of the state variables on the changes in predicted employment and their impact on future employment. This study indicates that in the long run, public assistant programs are able to induce many single mothers to enter the labor market. Also, the increase in education levels partially explains the increase in these women's increases in labor supply.

I estimate the DSDC model on a sample of single mothers from March CPS 1964 - 2013 data to

investigate the single mothers' participation rate increase in the past 50 years. With this data sample and a dynamic structural model, a simulation exercise suggests that increases in education explain two-thirds of the increase in single mothers' labor supply in the past 20 years and changes in public assistant programs induced an increase of more than 100% in single mothers' labor supply. However, in this study, I did not include technology changes, culture, and other possible correlates of labor supply. It could be that other factors have a negative impact on single mothers' labor supply. In the future, it will be important to examine the effects of other factors on single mothers' labor supply. Also, more model specification tests and simulation evidence can provide more information on the performance of SMM in policy analysis.

Chapter 3

What Helps TANF Recipients Leave TANF?

(ABSTRACT)

The replacement of Aid to Families with Dependent Children (AFDC) with Temporary Assistance for Needy Families (TANF) led to a dramatic decrease in welfare caseloads since 1996. I examine the data and identify factors that help single mothers leave TANF within a short span of time. I find strong evidence for the importance of child support assistance to single mothers' success in exiting TANF with a job. I uncover evidence that work-related activities do not contribute to leaving TANF within a short span of time. My analysis also suggests that health issues limit the ability of single mothers to exit TANF.

3.1 Introduction

The Temporary Assistance for Needy Families (TANF) program is one of the social safety net programs in the United States. Since the passage of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA), TANF has replaced the Aid to Families with Dependent Children (AFDC) program for providing assistance to low income American families with dependent children. TANF was designed to help low income families to better take care of their children and to help needy parents to make the transition from receiving welfare to working and earning the money for a better life. In addition, TANF was expected to promote marriage, maintain two-parent families, and reduce the incidence of out-of-wedlock pregnancies. This study is undertaken to uncover some facts about TANF in terms of getting people off of assistance and into employment.

Unlike previous welfare programs, TANF was designed to convert welfare into a transitional system. TANF provides assistance to families only for a limited time, normally 60 months in one's whole life. States may set different time limits for their recipients. The federal government set work requirements for needy families in order to qualify benefits. In other words, most recipients¹ have to participate in work-related activities according to the TANF law. Some qualified adults were mandated to engage in 30 hours of work-related activities by FY 2002. The work-related activities include unsubsidized employment, subsidized employment, on-the-job training, job search and job readiness assistance, community service programs, vocational educational training, and other programs. TANF also provides assistance through state earned-income tax credits, child care programs, health related programs, transportation programs and other related programs. In order to reduce caseloads and induce people to work, state governments have the flexibility to decide the

¹There are a few exceptions that depend on families' characteristics.

specific forms of work-related activities, work hours per week, and categories of persons who are exempt from work requirements. The literature reports that since 1996 there have been significant decreases in TANF caseloads and increases in employment among TANF recipients (Black, 2002; Moffitt, 2003; Moffitt and Scholz, 2010; Ziliak, 2015). In 1996, there were about 3,200,000 TANF caseloads in the United States. However, the caseloads declined to about 1,700,000 in 2012 (Ziliak, 2015).

How did economic and policy factors contribute to the dramatic decreases in TANF caseloads and increases in employment? Many studies have already been conducted to answer this question. A literature built on time limits of TANF was developed by Grogger and Michalopoulos (2003), Grogger (2004), Fang and Silverman (2009) and Chan (2013). Grogger and Michalopoulos (2003) constructed a dynamic model with time limits revealing that a rational welfare recipient used time limits to bank or conserve her benefits. The empirical results using data from Florida indeed suggested that time limits caused decreases in welfare use by 19 percent. Grogger (2004) further provided empirical results of the effect of time limits on decline in welfare using Current Population Survey (CPS). Fang and Silverman (2009) and Chan (2013) implemented dynamic structural model of labor supply and welfare program participation for female welfare participants to quantify the effects of time limits on welfare participation and employment. Fang and Silverman (2009) found that a generous welfare policy could lead women with low skill levels to stay in welfare for a longer time. Chan (2013) used a structural model to directly estimate the effects of time limits. He found that five-year time limits for welfare could reduce cumulative years of welfare participation by 40 percent.

Besides time limits, another distinguishing characteristics of TANF is work requirements and sanctions for failure to meet work requirements. Many studies have focused on the effect of work requirement and sanctions on TANF receivers. Besley and Coate (1995), Brett (1998), and Cuff

(2000) pointed out that a work requirement was a screening device when unobservable factors were present. The government uses workfare to induce people with high ability to leave welfare. Therefore, a work requirement can contribute to decreasing TANF caseloads by serving as a screening device, as Fang and Keane (2004) have shown. Associated with a work requirement is sanction policy. Wu, Cancian, and Wallace (2014), examined the effects of financial sanctions on TANF leaver, using longitudinal administrative data for Wisconsin. Their research indicated that sanctions increased the probability of exiting TANF and that this effect increases with the duration of the sanction.

Another strand of the literature is concerned with particular disadvantages that prevent some women from leaving TANF. Using CPS data and a longitudinal administrative data from Maryland, Moffitt and Stevens (2001) reported that there was no strong evidence that particular disadvantages such as health problem or low education levels prevented TANF receivers from leaving TANF, even though the general tendency of welfare reform is to encourage more job-ready recipients to leave TANF. The shortcoming of this analysis is that CPS data is not longitudinal and researchers cannot use cross-section data to track women's transitions on and off TANF and analyze the reasons for TANF exits. A data set from Maryland was one state's data which, was not necessarily nationally representative. Meanwhile, states have flexibility on TANF eligibility and requirements. Irving (2008) showed that geography affects the probability of a TANF exit. She found that female TANF participants in poor southern non-metropolitan areas and large rustbelt cities were less likely to exit TANF with work. Frogner, et al. (2009), using the Three-City Study panel data², reported health problems, disability, and not being married lowered the probability that women would leave TANF. However, the Three-City Study sample is not nationally representative.

One contribution of my study is that I use a more recent and nationally representative longitu-

²The Three-City Study is a longitudinal survey in which people from Boston, Chicago, and San Antonio were interviewed.

dinal data set to examine what helps single mothers exit TANF with a job, within a short span of time. My study finds that women who have health problems are less likely to exit TANF and that the usual presumption that every TANF receiver has the same labor skills and should be able to leave TANF within the same specified time limit may not have the validity that would be needed to support existing sanctions.

Another contribution of my study is that I provide evidence that a work requirement is a screening device when there are unobservable variables. Work-related activities did not appear to serve human capital investments that would help TANF recipients get off TANF.

Using the most recent monthly data, 2008 panels of the Survey of Income and Program Participation (SIPP), and a multinomial logistic regression model, this study reaches the following conclusions: First, child support assistance is important to encourage single women to exit TANF and work. Second, decreases in TANF cash transfers induce single women to exit TANF and work. Third, work-related activities do not increase the rate at which these women leave TANF and work. Finally, this study indicates that health conditions prevent single women from leaving TANF.

This study is organized as follows. Section 3.2 introduces some facts related to TANF. Section 3.3 describes the data and estimation methodology. Section 3.4 reports the empirical results and the test results. Section 3.5 concludes the study.

3.2 Primary Facts

Table 3.1 reports selected characteristics of adult cash TANF recipients in 2012-2013. The rate of participation in work for TANF recipients is much lower than for other people, as shown in row 1

of Table 3.1. Single female TANF recipients are less likely work than other TANF recipients. 74 percent of those who are not-TANF recipients have a job. But the employment/population ratio for TANF receivers is 30 percent. This rises to 34 percent for male or married female TANF recipients. The employment/population ratio for single female TANF recipients is 24 percent. Row 2 shows that the employment/population ratios of TANF leavers are higher than those of TANF recipients.

Table 3.1: Selected Characteristics of TANF Recipients in 2012-2013

	Non-TANF Recipients	Non-Single Female TANF Recipients	Single Female TANF Recipients
Employment/Population Ratio ^a	.74	.34	.24
Employment/population ratio for Those Exiting TANF	n/a	.58	.47
Education Level Shares			
Less than High School	.09	.19	.24
High School Diploma	.27	.47	.33
Some College	.15	.10	.14
Associate's Degree	.10	.08	.09
Bachelor's Degree or More	.29	.05	.02
Unspecified	.10	.11	.18
Average number of children under 18 in the family	0.76	1.2	1.5
Health Problem Rate	.04	.27	.29

^a Monthly Employment status in SIPP is coded as "-1. Not in Universe; 1: With a job entire month, worked all weeks; 2. With a job entire month, absent from work without pay 1+ weeks, absence not due to layoff; 3. With a job entire month, absent from work without pay 1+ weeks, absence due to layoff; 4. With a job at least 1 but not all weeks, no time on layoff; 5. With a job at least 1 but not all weeks, remaining weeks on layoff or looking for work; 6. No job all month, on layoff or looking for work all weeks. 7. No job all month, at least one but not all weeks on layoff or looking for work; 8. No job all month, no time on layoff and no time looking for work." I define employed if the individual was recorded as one of 1-5 categories.

Data from 2012-2013 samples show that within four months, 79 percent of TANF recipients leave TANF³. The after-TANF employment/population ratio for those who are not single women

³I did not find how long the TANF recipients had been in this program. But, after tracking them for five months, I found 79 percent of recipients left the program within four months.

is 58 percent. For the same persons, when receiving TANF, the employment/population ratio is 34 percent. The employment/population ratio for single women increased from 24 percent for those receiving TANF to 47 percent for those who had left TANF within four months.

What factors are associated with leaving TANF and the accompanying increase in the Employment/population ratio? This empirical study shows that increases in child support assistance and decrease in cash transfers through TANF are the main correlates of single women exiting TANF and finding a job. In addition, this study indicates that work-related activities do not encourage single women to leave TANF and work. What's more, bad health conditions frequently prevent single women from leaving TANF⁴.

In the female labor supply literature, the importance of education in the employment and participation of women has been emphasized since Becker (1973). Rows 3-8 in Table 3.1 present the education level composition of the SIPP sample. As row 1 shows, only 24 percent of the single women in TANF have a job. (In this study, TANF recipients are restricted to those who were between 22 years old and 65 years old.) About 57 percent of the single women in TANF are high school drop-outs or high school graduates. Almost 14 percent of them have some college education, while 9 percent of them have an associate's college degree. About 2 percent of them have a bachelor's degree or post college degree. However, 29 percent of Non-TANF recipients have a bachelor's degree, and only 9 percent of these people are high school dropouts.

In the literature, researchers have demonstrated the effect of fertility on women's employment decisions (Gronau 1973, Heckman 1974, Eckstein and Lifshitz, 2011). The average number of children under 18 in the family is given by row 10 in Table 3.1. These numbers show that TANF families have more children than non-TANF families. In male headed or two-parent TANF receiver

⁴The health dummy variable is constructed according to the survey question "Does health or physical or mental condition prevent from working at a job or business?"

families, almost every family has at least 1 child. In single female TANF participants' family, about one half women have 2 children. Thus the need to care for children may hinder these women from exiting TANF.

One reason that TANF receivers cannot exit TANF and find a job is that TANF receivers have a disproportionate rate of health issues that can prevent them from having a job. The last row in Table 3.1 indicates that health problems are severe in TANF receivers. Four percent of Non-TANF receivers have health problem preventing them from working. However, about 27 percent of TANF receivers have health issues. The likelihood of having health problem preventing work is slightly higher among single women who receive TANF than among TANF recipients who are not single women.

3.3 Data and Methodology

3.3.1 Data

This study uses labor supply, welfare and food stamp participation, and demographic data from the 2008 Panels of the Survey of Income and Program Participation (SIPP). Compared to PSID and NLSY, the first advantage of SIPP is that SIPP is designed to answer questions about program participation and benefits, as the name indicates. The second advantage of SIPP is that this data resource contains more samples of women who are household heads. The third advantage is that the interviews in SIPP were conducted at intervals of four months instead of one year, so that one can follow individuals on a short-term basis. The 2008 Panel contain a nationally representative sample of 200,888 observations. Households are interviewed at 4-month intervals, with the interviews conducted over 4 months constituting one wave. The 2008 Panel has 16 waves and covers

2008 to 2013. This study uses 2008 panel waves 13, 14, and 15 to investigate TANF participants' behavior. Wave 13 includes survey data from September 2012 to December 2012. Data from wave 14 include information from January 2013 to April 2013. Wave 15 contains survey data from May 2013 to August 2013.

Since the vast majority of TANF recipients are single-parent families, especially single-female headed families (Ben-Shalom, Moffitt, and Scholz, 2011), the empirical exercise was conducted on single-female headed families that receive TANF benefits. Following Eckstein and Wolpin (1989) and Eckstein and Lifshitz (2011), I selected information on women who were between 22 and 65 years old in wave 13 and wave 14, because the education level does not change much and labor supply starts for most women at the age of 22. This study only keeps single women who are continuously observed in two successive waves. In other words, each single woman was tracked for at least 4 months either from wave 13 to wave 14, or from wave 14 to wave 15. Therefore, we can observe the TANF exit rate after four months. Women who did not receive TANF in the initial wave (wave 13 or wave 14) were excluded from this study. In this study, single means the woman does not have a present husband. She may be never married, or widowed, or divorced, or married with an absent husband.⁵ The final sample contains 1107 observations of single women who were receiving TANF benefits in the first of a pair of interviews.

Table 3.2 describes the variables.

⁵Ben-Shalom, Moffitt, and Scholz, (2011) point out that most of TANF recipients are single women with children and with no father present in the family.

Table 3.2: Variable Descriptions

Variable	Description
TANF Cash Transfer	Amount of means-tested cash transfer in reference month
Education	Years of schooling
Age	Age
Health	1=" Had work-preventing physical/mental/health condition"; 0= None
Race	1=" White alone"; 0= others
Child Support	Amount of child support received
Other Welfare	Amount of food stamp and WIC (Women, Infants and Children Nutrition Program) assistance received
Work History	0="did not work when participating TANF"; 1="worked when participating in TANF"
Agency Subsidy	Amount received by agency for each TANF participant
Metro	1=" Metropolitan area"; 0=" Not a metropolitan area"

Note: Stepwise variable selection method indicates this subset of predictors can explain the data in the simplest way.

Table 3.3 reports the descriptive statistics of variables for the sample.

Table 3.3: Descriptive Statistics

Variable(Units)	Mean	Standard Deviation
Cash Transfer (\$10 /month)	53.0406	39.3722
Education (years)	11.6396	2.5228
Age ^a	38.8130	11.7022
Health	0.3207	0.4670
Race	0.5646	0.4960
Child Support ^b (\$10 /month)	40.7891	43.0669
Other Welfare (\$10 /month)	41.2558	26.8697
Agency Subsidy (\$ /month)	19.7281	76.2798
Work History	0.1978	0.3985
Metro	0.8040	0.3972

Note: sample size is 1107.

^a : In the sample, I did not include 129 observations who are younger than 22 years old.

^b : The statistics on Child Support represent amounts actually received.

3.3.2 Model Specification

Following the multinomial logit model literature (McFadden 1973, McFadden 1974, McFadden 1984, Hausman and McFadden 1984, McFadden 2001), assume the utility equation for woman n experiencing alternative j is:

$$U_{nj} = V_{nj} + \epsilon_{nj} \quad (3.1)$$

where V_{nj} is the systematic component of the woman's utility, and ϵ_{nj} is the stochastic component, $j = 1, \dots, J$. In this study, the alternatives are remaining on TANF, exiting with work, and exiting without work. Moreover, assume

$$V_{nj} = z_n \gamma_j \quad (3.2)$$

so that we have

$$U_{nj} = z_n \gamma_j + \epsilon_{nj} \quad (3.3)$$

where z_n are the individual-specific characteristics and γ_j is a vector of alternative-specific parameters. These parameters relate the characteristics of a respondent (z) to the respondent's utility for the j^{th} choice. Therefore, the probability that individual n chooses alternative j in the multinomial logit model is:

$$P_{nj} = \frac{e^{V_{nj}}}{\sum_h e^{V_{nh}}} = \frac{e^{z_n \gamma_j}}{\sum_h e^{z_n \gamma_h}} \quad (3.4)$$

For continuous individual-specific variable Z_n , the partial effect for this model is

$$\frac{\partial p(y = j|z)}{\partial z_k} = p(y = j|z) \left\{ \gamma_{jk} - \left[\sum_{h=1}^J \gamma_{hk} \exp(z \gamma_h) \right] / g(z, \gamma) \right\} \quad (3.5)$$

where γ_{jk} is the k^{th} element of γ_h and $g(z, \gamma) = 1 + \sum_{h=1}^J \exp(z\gamma_h)$. This equation shows that the partial effect is not determined directly by γ_{hk} .

To better interpret the estimation results, let us look at the odds ratios. The odds of outcome a versus outcome b , where neither a nor b is the baseline category, are:

$$ODDS_{ab} = \frac{P_{na}}{P_{nb}} = \frac{e^{z_n \gamma_a}}{e^{z_n \gamma_b}} = e^{z_n(\gamma_a - \gamma_b)} \quad (3.6)$$

Thus, the log-odds ratio is linear in Z_n :

$$\log[ODDS_{ab}] = \log\left[\frac{P_{na}}{P_{nb}}\right] = z_n(\gamma_a - \gamma_b) \quad (3.7)$$

Assuming $\gamma_1 = 0$, the odds of exiting TANF with work versus the base category remaining in TANF, are

$$ODDS_{a1} = \log\left[\frac{P_{na}}{P_{n1}}\right] = e^{z_n(\gamma_a - \gamma_1)} = e^{z_n \gamma_a} \quad (3.8)$$

Therefore, the log-odds ratio is linear in z_n :

$$\log[ODDS_{a1}] = \log\left[\frac{P_{na}}{P_{n1}}\right] = z_n(\gamma_a - \gamma_1) = z_n(\gamma_a - 0) = z_n \gamma_a \quad (3.9)$$

Following the literature, estimation of the multinomial logit model is carried out by maximum likelihood. For each n , the conditional log likelihood can be written as

$$l_n(\gamma) = \sum_{j=0}^J 1[y_i = j] \log[p_j(z_n, \gamma)] \quad (3.10)$$

Table 3.4 reports the estimation results from a model of TANF Exit choice where

$$\begin{aligned} \log[\text{prob}(TANFExit_{nj}|z_n)] = & \gamma_{j0} + \gamma_{j1}CashTransfer_n + \gamma_{j2}Educ_n + \gamma_{j3}Age_n \\ & + \gamma_{j4}Health_n + \gamma_{j5}Race_n + \gamma_{j6}ChildSupport_n \\ & + \gamma_{j7}OtherWelfare_n + \gamma_{j8}WorkHistory_n \\ & + \gamma_{j9}Agency_n + \gamma_{j10}Metro_n + \varepsilon_{nj} \end{aligned}$$

The outcome $TANFExit_{nj}$ is the individual time $t + 1$ choice among work and welfare following 4 months of TANF receipt. After 4 months assistance from TANF, the single woman may continue to receive TANF, or work without receiving TANF, or be neither working nor receiving TANF. In other words, in this study, choices are remaining in TANF, or exiting with work, or exiting without work. The independent variables are two main categories of individual time t characteristics. The first category of characteristics is assistance from TANF and other government programs. These are the amount of means-tested cash transfer in the reference month, amount of food stamps and WIC (Women, Infants and Children Nutrition Program) received, amount of child support assistance, whether or not the woman participated in work-related programs when receiving TANF in time t , and the amount of subsidy received by the local agency for TANF participants. The second type independent variables are demographic variables, such as age, education, race, health condition in time t , and whether living in a metropolitan area. All these independent variables are measured at time t . But the dependent variable is the time $t + 1$ choice. Thus all independent variables should be individual-specific characteristics. Whether or not the TANF recipient leaves or stays in $t + 1$ is to be explained by the independent variables. But these independent variables will not necessarily be characteristics of the subject in time $t + 1$.

Table 3.4 presents the estimated coefficients, marginal effects of explanatory variables on out-

comes, and odds ratio of welfare and work choices for TANF participants after they received TANF for four months.

Table 3.4: Multinomial Logit Regression Models of Transition from TANF With and Without Work

	dy/dx	Exit With Work		Exit Without Work		
		Odds Ratio	Coefficient (γ)	dy/dx	Odds Ratio	Coefficient (γ)
Cash Transfer	-.0011* (.0004)	0.9911***	-.0089*** (.0025)	.0005 (.00044)	0.9944*	-.0056* (.0024)
Education	-.0045 (.0063)	.9434 ^a	-.0583 (.0385)	.0003 (.0062)	.9531	-.0480 (.0383)
Age	-.0045** (.0015)	.9379***	-.0642*** (.0099)	-.0002 (.0015)	.9464***	-.0550*** (.0099)
Health	-.0520 (.0386)	.3963***	-.9255*** (.2446)	-.0301 (.0382)	.4134***	-.8833*** (.2450)
Race	.0965** (.0323)	1.0780	.0752 (.2098)	-.1075** (.0319)	.6885	-.3733 (.2083)
Child Support	.0041** (.0014)	1.0948*	.0905* (.0360)	.0029* (.0013)	1.0925*	.0885* (.0360)
Other Welfare	.0007 (.0006)	.9986	-.0014 (.0040)	-.0010 (.0006)	.9949	-.0051 (.0041)
Work Program	-.1358** (.0419)	.3427***	-1.0709*** (.2898)	.0534 (.0438)	.5287*	-.6373* (.2864)
Agency	.0002 (.0002)	.9997	-.0003 (.0015)	-.0003 (.0002)	.9985	-.0015 (.0016)
Metro	.0258 (.0415)	1.5812	.4582 (.2494)	.0134 (.0410)	1.5431	.4338 (.2493)

Note: Number of observations is 1107. Log-Likelihood is -1029.0875. Chi-Square for Likelihood ratio test is 162.37.

Standard errors were calculated using Delta-Method.

*Significant at the 5-percent level; ** Significant at the 1-percent level; *** Significant at the 0.1-percent level.

^a Eckstein and Lifshitz (2011) showed that higher education level has no impact on the employment of single women, while higher levels of schooling among women have increased the employment rate of married women. Thus this result is consistent with Eckstein and Lifshitz (2011).

3.4 Results

3.4.1 Empirical Results

This section reports the empirical results from a multinomial logit regression model for transition from TANF to work or from TANF to non-TANF without work. Multinomial logistic regression assumes that a transition probability is a function of many variables (amount of cash transfer received, amount of child support assistance received, education, race, age, etc). As discussed in section 3.3, the value of a coefficient does not indicate marginal effect of independent variables on dependent variable. To better understand the relationship between independent variables and the logit of a dependent variable, in this section this study presents marginal effects, odds ratios, estimated coefficients, and other information.

Table 3.4 shows the *partial effects* (measured at the means of the variables) of independent variables on the probability of exiting TANF with work and without work (first columns of the left-hand and right-hand panels respectively), the relative impact of one-unit increases in independent variables on the *odds* of exiting TANF with work and without work versus remaining on TANF (second columns of the left-hand and right-hand panels respectively), and the corresponding estimated coefficients of the model (third columns of the left-hand and right-hand panels respectively).

The coefficient of -0.0011 for the partial effect of cash transfers on choice in column 1 implies that, at the means of the variables, the estimated probability of exiting TANF and working, for a woman who receives an additional \$10 cash transfer, is lower than that probability for a similar woman who did not receive such a cash transfer, by 0.11 percent. One year of additional age decreases the estimated probability of exiting TANF and work, at the means of the variables,

by 0.45 percent. Having a health issue decreases the estimated probability of exiting TANF and working, at the means of the variables, by 5.20 percent. The estimated probability, at the means of the variables, of exiting TANF and working, for a white female, is 9.65 percent higher than that for a non-white female. The estimated probability, at the means of the variables, of exiting TANF and working, if one receives \$10 more child support assistance, is 0.41 percent higher than that if one does not receive \$10 more child support assistance. The estimated probability, at the means of the variables, of exiting TANF and working, for women who participate in work-related activities when they receive TANF cash assistance is 13.58 percent less than for those who did not participate in work-related activities. Living in a metropolitan area increases the estimated probability of exiting TANF and working.

One can get similar results from the second column of the left-hand panel. This column reports the relative impacts of the independent variables on the odds of exiting TANF with work versus remaining on TANF. Child support assistance is very important to inducing single women to exit TANF and work. Single mothers who received \$10 more child support assistance have 1.09 times greater odds of exiting TANF with work. Also, single mothers who received \$10 more child support assistance have 1.09 times greater odds of exiting TANF without work. Required participation in work-related activities does not encourage single women to get off TANF. The odds of exiting TANF with work for individual who participated work related activities are 34 percent of what they are for others. This may be explained by difficulty of finding jobs. Rather than exiting and have nothing, these women continue to receive TANF. This suggests that the work requirement may not increase human capital for these women. Bad health conditions frequently prevent single women from leaving TANF. The odds of exiting TANF with work for an individual with a health issue are 39 percent of those of a healthy individual. The empirical results indicate that transfers impair incentives to exit TANF. This is not surprising since both the income effect and the substitution effect discourage work when people are provided cash assistance. Encouraging people exit

TANF through agency subsidies does not have a statistically significant effect. It is more difficult for older people to exit TANF. Higher education levels do not increase the rate at which women exit TANF. In this sample, more than 70 percent of single women in TANF do not have a college degree. 24 percent are high school dropouts and 33 percent are only high school graduates. Statistically, education level is not a significant factor in the rates at which they exit TANF with jobs. White women are more likely to exit TANF and work. Living in a metropolitan area significantly increasing the odds of exiting TANF.

From the statistically significant negative sign of the partial effect of cash transfers and the statistically significant positive sign of the partial effect of child support in column 2, it follows that the average probability of exiting TANF and work would be increased if the government decreased cash transfers to low income families, or if the government could require fathers to pay more child support. These results make economic sense because women who receive smaller cash transfers while in TANF have a greater incentive to find work, and women who receive more child support have less of a need to receive TANF support.

Participation in work related activities in time t (Work program) is associated with a reduced rate of leaving TANF and working. This is consistent with the screening device function of workfare (Besley and Coate (1995), Brett (1998), and Cuff (2000)). Also, this could be because TANF treats these activities as equivalent to working for pay, in terms of turning participants into productive citizens, so that those who participate in these activities do not face the same pressure to find work.

The following figures report the predicted probabilities of work and welfare status according to different explanatory variable, holding other explanatory variables fixed at their means. One can have the similar conclusions as Table 3.4 suggests by looking at these figures.

Figure 3.1: Predicted Probabilities of Outcome Depending on Schooling

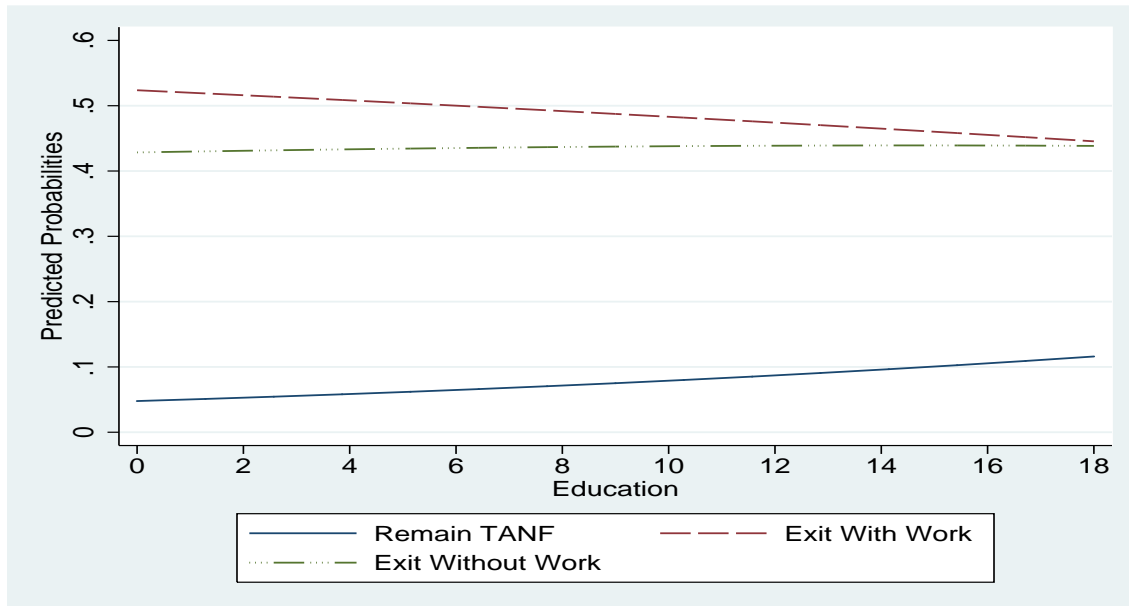


Figure 3.2: Predicted Probabilities of Outcome Depending on Age

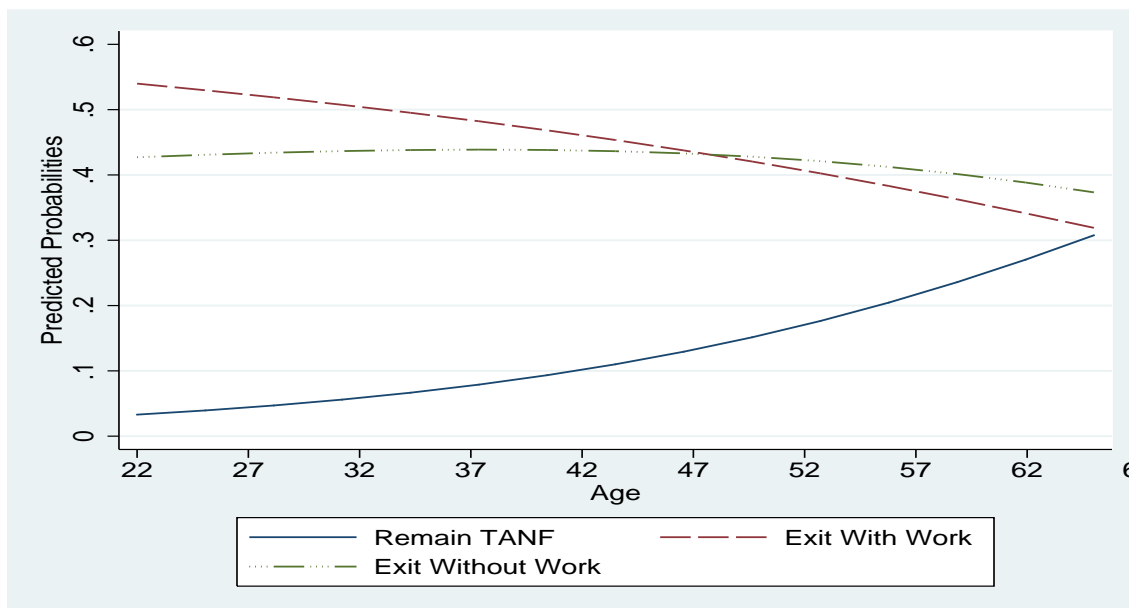


Figure 3.3: Predicted Probabilities of Outcome Depending on Cash Transfer

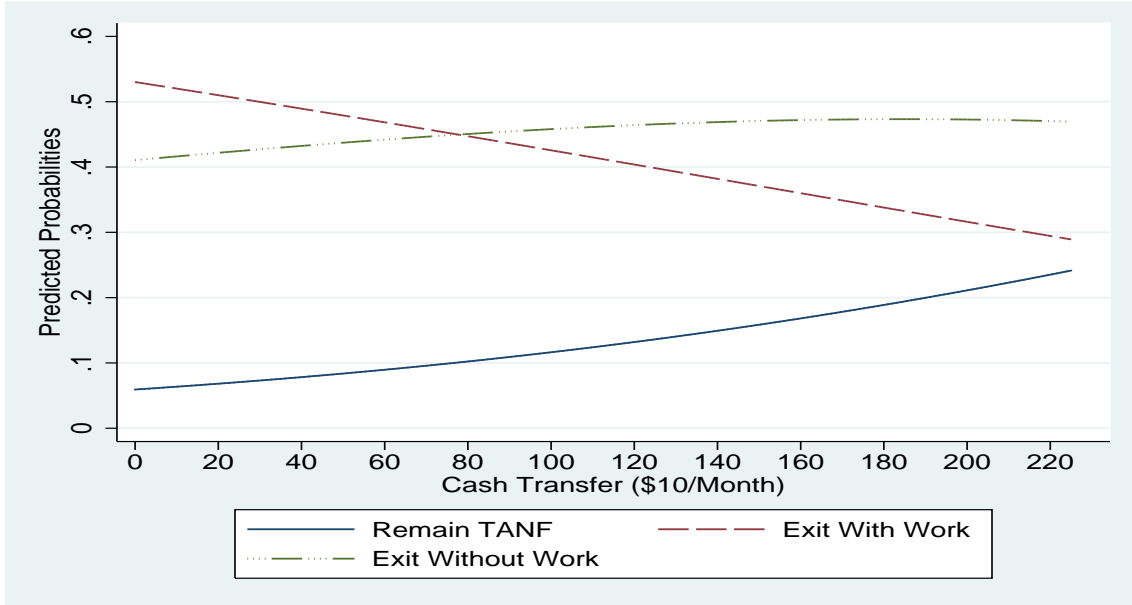


Figure 3.4: Predicted Probabilities of Outcome Depending on Child Support Assistance

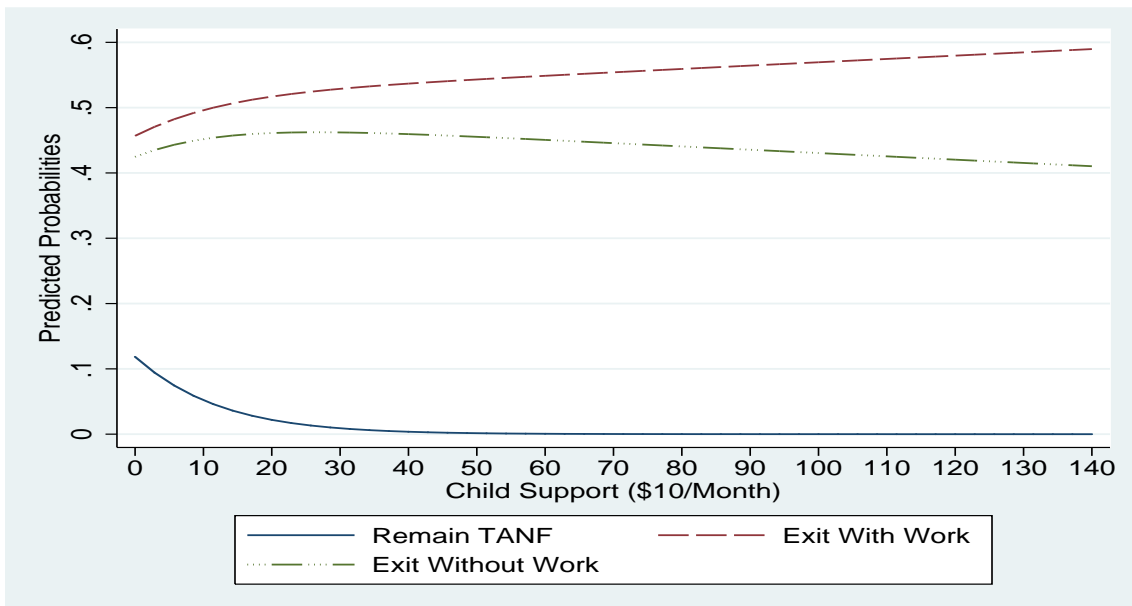


Figure 3.5: Predicted Probabilities of Outcome Depending on Health

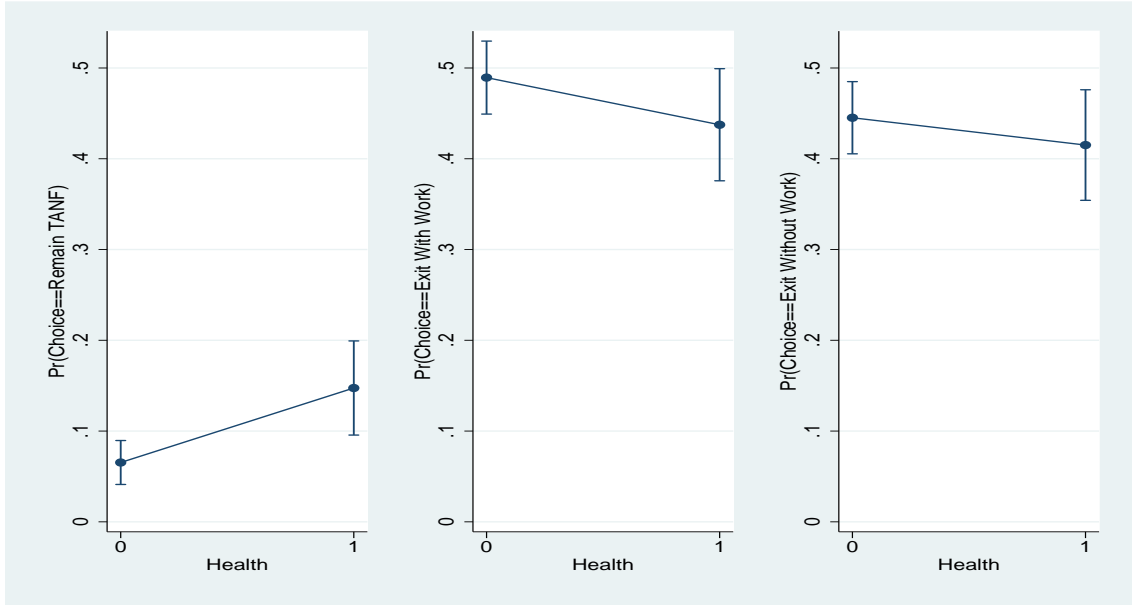


Figure 3.6: Predicted Probabilities of Outcome Depending on Race

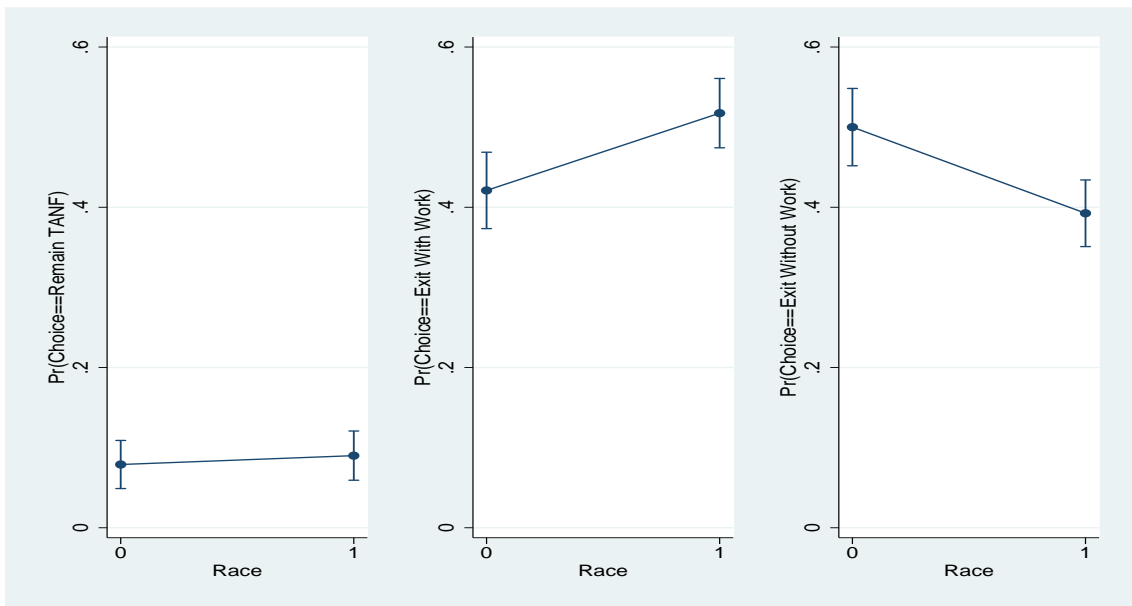


Figure 3.7: Predicted Probabilities of Outcome Depending on Work Program

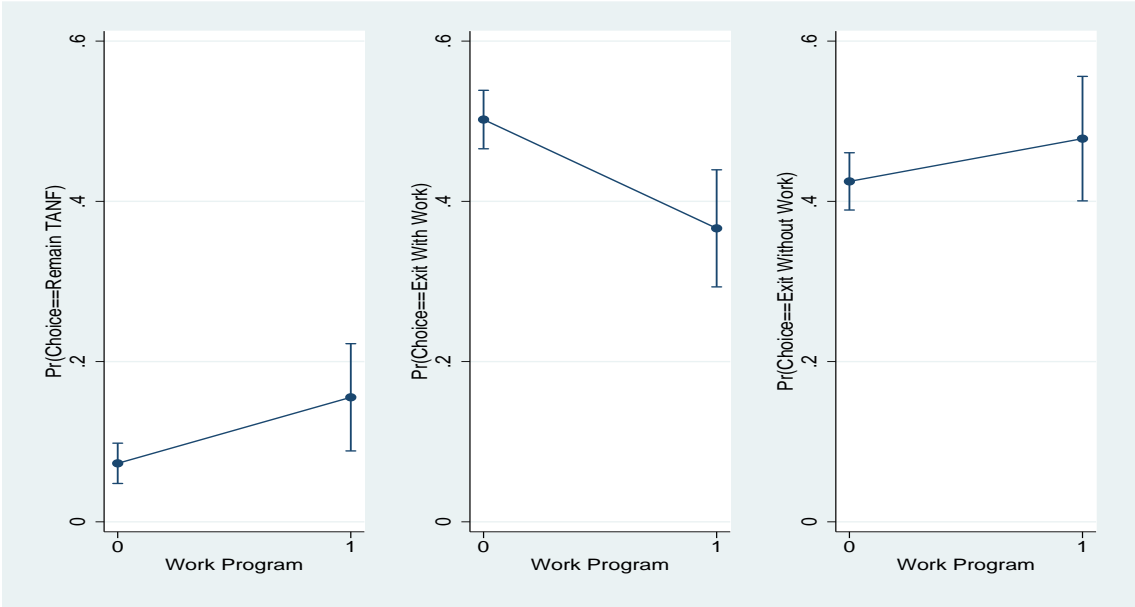
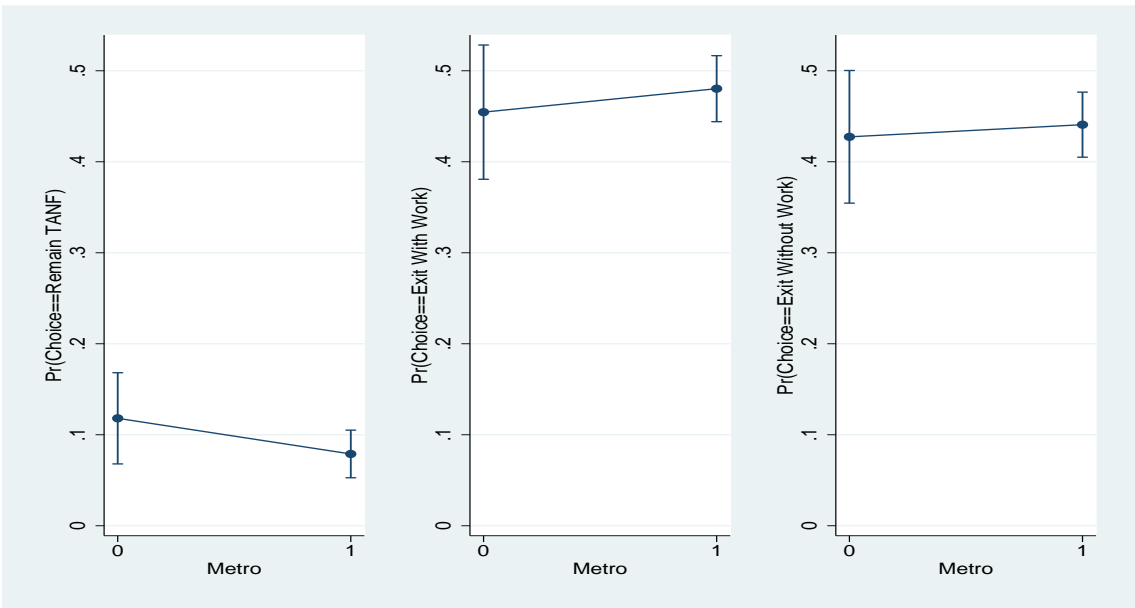


Figure 3.8: Predicted Probabilities of Outcome Depending on Living Area



TANF funds can be spent in many ways, such as child care, transportation assistance, employer subsidies, and counseling. This empirical study suggests that child support (which comes from fathers and not from government funds, and which does not go away when a woman works) can significantly encourage people exit TANF and work within four months of receiving TANF assistance. However, cash transfers, which disappear as a woman works, decrease the probability of exiting TANF. Participation in work-related programs when receiving TANF is associated with a lower rate of exit from TANF within four months. Perhaps this participation helps when training is finished. Improving the health situation of women is important to getting them off TANF.

3.4.2 IIA Test

Multinomial logistic regression is very effective to analyze probabilistic choice, but from the following equation,

$$ODDS_{ab} = \frac{P_{na}}{P_{nb}} = \frac{e^{z_n \gamma_a}}{e^{z_n \gamma_b}} = e^{z_n(\gamma_a - \gamma_b)} \quad (3.11)$$

one can see that one of the restrictions on this model is the relative probabilities for any two alternatives depend only on the attributes of those two alternatives. This is known as the independence of irrelevant alternatives (IIA) assumption. The IIA assumption implies that adding more choices or changing the characteristics of a third alternative does not affect the relative odds between alternative choices exiting with work and exiting without work, or remaining in TANF and exiting with work, or remaining in TANF and exiting without work. In some setting, the IIA assumption may not hold, making the multinomial logistic regression not valid. Therefore, a Hausman IIA test was conducted to evaluate the validity of this model.

The Hausman IIA test (also called the Hausman-McFadden test) conducts the multinomial logit

estimation twice to construct the test statistic $T = (\beta_a - \beta_b)'(\Omega_b - \Omega_a)^{-1}(\beta_a - \beta_b)$. If IIA holds, the test statistic is asymptotically distributed chi-square. First, one estimates the logit model on the full set of alternatives to obtain estimates β_a and estimated covariance matrix Ω_a . In this study, Hausman IIA test first estimates the model on choice set of remaining TANF, exit TANF with work, and exit TANF without TANF to get β_a and Ω_a . Second, one estimates the logit model on subsets of alternatives to get estimates β_b and estimated covariance matrix Ω_b . In this study, one estimates the model on a choice set of remaining TANF and exit with work or another choice set of remaining TANF and exit without work or the other subset. If IIA holds, it should be no statistical difference from choosing alternative among full set and subsets. Otherwise, IIA property fails.

Table 3.5 presents the results of the Hausman IIA test. There is no evidence from Table 3.5 that the IIA assumption is violated. The Hausman test suggests that the multinomial logistic regression model is consistent with the IIA property. Thus this TANF-leaver data set does not violate the IIA assumption. Using a multinomial logistic regression model to analyze the factors affecting single female TANF receivers' work and welfare transitions cannot be rejected by the IIA test.

Table 3.5: Hausman Tests of IIA Assumption (n=1107)

Omitted (Base Category)	Chi2	p>Chi2	evidence
Exit with Work	0.000	1.000	For H0
Exit without Work	0.000	1.000	For H0

Note: H0 is that IIA holds.

3.5 Conclusions

This study used 2008 SIPP panel data and a multinomial logistic regression model to investigate which TANF programs and other circumstances are associated with higher rates at which single

women exit TANF and are employed. The empirical results indicate that less cash transfer and more child support assistance are the two main variables that get TANF receivers off the program. The requirement of participation in work-related activities is not as good at getting people to leave TANF and enter the labor market within four months. In addition, this study suggests that health issues are an important reason why single women with children remain in the program.

The findings of my study imply that both changes in TANF policies and increases in child support payments could move TANF receivers off the program more rapidly. But some low-income single mothers have more disadvantages and less ready to move off TANF. For them, additional assistance is needed. In addition, greater child support enforcement is needed.

Chapter 4

The Effect of Marital Stability on the Labor Supply Response to Changes in Wage Rates and Taxes

(ABSTRACT)

This paper uses PSID data to analyze the effect of marital stability on the elasticity of labor supply in a life cycle setting. I estimate the Frisch elasticity or the intertemporal elasticity of substitution of the labor supply focusing on the impact of marriage. I find clear evidence that the elasticity of labor supply with respect to wages and taxes is affected by marriage decisions. The empirical results show that males who are continuously married to the same wife have a lower average Frisch elasticity than others.

4.1 Introduction

The elasticity of labor supply with respect to wage rates and taxes occupies a critical place in welfare analysis. Two central aspects of the public sector, the optimal progressivity of the tax-and-transfer system and the efficiency cost of taxation, depend on this elasticity. Many studies since the 1970s have focused on estimating it. However, much of literature employs comparative static models and estimates the Hicksian elasticity of the labor supply, using this elasticity to measure the efficiency cost of permanent tax-and-transfer programs and to evaluate the income tax system (Saez et al., 2009; Saez, 2010; Chetty et al., 2011). In practice, there are numerous tax-and-transfer programs, such as income tax deductions for charitable giving, that might or might not endure. How does an individual allow for the possibly temporary nature of tax-and-transfer programs when making long-run decisions? Moreover, from the typical humped shape of income over a lifetime, individuals know to expect that their incomes will change over time. The progressivity of the income tax system therefore implies that individuals will face tax rates that change over time. How does an individual allocate working time as income tax rates increase and decrease? To investigate the response of the labor supply to fluctuations over time in its price, economists estimate the Frisch elasticity (or intertemporal elasticity of substitution) of the labor supply. Studies of the Frisch elasticity of the labor supply generally focus on the behavior of prime-age male household heads in a dynamic model (Macurdy, 1981; Altonji, 1986; Angrist, 1991; Pistaferri, 2003; Imai and Keane, 2004; Ziliak and Kniesner, 2005; David Domeij and Martin Floden, 2006; Keane, 2009; Wallenius, 2011; Chetty, 2012)¹.

Importantly, previous studies do not include marital stability in the estimation of the Frisch elasticity. A man is defined as martially stable if he has had only one marriage and it is intact

¹Mathematically, the Frisch elasticity can be converted to the Hicksian elasticity. See Chetty (2012).

when data is gathered. Some previous studies estimate only the elasticity of maritally stable males. Then the results are generalized to all males. The advantage of this procedure is that it controls for a factor that may affect the elasticity of the labor supply, thereby permitting more statistically significant estimation results². But, these results are potentially quite biased in a society with 50% divorce rate³. Other studies employ mixed males data to estimate the elasticity of labor supply and ignore the marital stability effect. This study shows that the elasticity of labor supply with respect to wages and taxes is affected by marital stability. My empirical results show that males who are continuously married to the same wife have a lower average Frisch elasticity than others. This can be explained either by the extra cost of a wife's adjustment to her husband's labor supply changes in response to wage and tax changes or by the possibility that maritally unstable men are characterized by greater responsiveness to changes in their opportunities.

This paper makes two contributions to the literature. Firstly, this is the first study to investigate the effect of marital stability on the Frisch elasticity. Based on the 1976 to 1984 waves of the Panel Study of Income Dynamics (PSID) data, the rest of this study is an estimation exercise of the Frisch elasticity of the labor supply. The key finding is that marital stability attenuates the estimated Frisch elasticity. The estimated Frisch elasticity of males who have only one intact marriage is less than the estimated Frisch elasticity of other males. One possible explanation for this finding is that if a husband responds to changes in wage rates and taxes by changing his labor supply, his wife may need to adjust her work and life simultaneously. This causes extra cost for a husband who is continuously married to the same spouse. Due to this extra cost, these males have relatively smaller responses to wage and tax changes than others. Another possible explanation is that maritally unstable males may have a greater taste for change and therefore respond more to the incentives produced by wage and tax changes.

²For instance, using continuously married males data, the researcher can control the information on wife's age, wife's schooling, size of family, number of children and the age of youngest child.

³This information is from <http://www.divorcestatistics.org/>.

The second contribution is that I provide additional estimates of the male Frisch elasticity. I find that the Frisch elasticity of males lies in the range of 0.11-0.79, which is consistent with most of micro data evidence. In this study, the estimated Frisch elasticity of marital unstable prime-age males lies in a range of 0.61-0.79 when year dummies are excluded and 0.37-0.72 when the year dummies are included. For maritally stable males, the results are 0.22-0.47 when year dummies are excluded and 0.11-0.17 when they are included. These numbers provide more information for the design of tax-and-transfer system or other labor market policies. It also suggests that divorce legislation could affect the labor market in ways not previously recognized.

This paper is related to several literatures in labor economics and public economics. First, a large literature in labor economics is devoted to estimating the labor supply response of males to wage changes in a life-cycle setting. (See Keane, 2011, for a recent review of this literature.) Most of these papers find a small Frisch elasticity for prime-age males (with some exceptions, such as Imai and Keane, 2004). Secondly, there is a related literature in labor economics that considers both marriage markets and labor markets using non-unitary models. Those studies address the fact that a conventional unitary model is not sufficient to characterize and identify the individual preferences (Chiappori et al., 2002; Chiappori and Donni, 2009). Thirdly, a growing literature on tax-and-transfer program estimates the elasticity of taxable income and provides more estimated parameters for policy design (Eissa, 1995; Eissa and Liebman, 1996; Eissa and Hoyne, 2004; Saez, 2010; Chetty et al., 2011; Chetty, 2012).

The study is organized as follows. Section 4.2 defines the model specification. Section 4.3 provides estimation approaches. Section 4.4 describes the data set. Sections 4.5 and 4.6 report and discuss the empirical results. Conclusions are provided in section 4.7.

4.2 Model Specification

Following MaCurdy (1981), Altonji (1986) and other studies, assume separability between consumption and leisure, a constant interest rate and no fixed cost.⁴ The representative individual solves the following problem

$$V_t(A_t) = \max_{c_t, l_t} \left[\frac{c_t^{1+\eta}}{1+\eta} - b_t \frac{l_t^{1+\gamma}}{1+\gamma} + \beta E_t V_{t+1}(A_{t+1}) \right] \quad (4.1)$$

subject to the intertemporal budget constraint

$$A_{t+1} = (1+r)(A_t + w_t l_t - c_t) \quad (4.2)$$

Assuming an interior solution, the first order conditions of this maximization problem are

$$b_t l_t^\gamma = w_t \lambda_t \quad (4.3)$$

$$c_t^\eta = \lambda_t \quad (4.4)$$

$$\lambda_t = \beta(1+r)E_t[\lambda_{t+1}] \quad (4.5)$$

where λ_t is the marginal utility of wealth. Back dating equation 4.5 to obtain

$$\lambda_{t-1} = \beta(1+r)E_{t-1}[\lambda_t] \quad (4.6)$$

⁴It means that workers could freely choose labor supply.

it is easy to show that λ_t is related to λ_{t-1} through the equation

$$\beta(1+r)\lambda_t = \lambda_{t-1} + e_{\lambda t} \quad (4.7)$$

where $e_{\lambda t}$ is the expectation error relating λ_t to $E_{t-1}[\lambda_t]$.

Since consumers choose λ_{t-1} to satisfy equation 7 given the information available at age $t - 1$, $e_{\lambda t}$ will be uncorrelated with all information available to the consumer at $t - 1$ if expectations are rational.

Under the assumption of additive separable preferences over time, equations 4.3 and 4.4 imply marginal-utility-of-wealth-constant demand functions, or Frisch demand functions. The marginal utility of wealth parameter λ_t captures the information from other periods. Variables such as future wealth, wages, or personal characteristics affect consumption and hours of work only by changing the value of λ_t . If researchers could observe λ_t , all parameters involved could be estimated from equations 4.3 and 4.4. The challenge is that λ_t is not observed. This exercise conducts two different approaches to estimating the Frisch elasticity $\frac{1}{\gamma}$. In the first approach, I choose two different sets of instrumental variables to estimate the elasticity.

This life cycle model assumes that workers can freely choose their labor supply, based on their preferences. However, some workers are freer than others to choose their labor supply. For maritally unstable males (single, separated, divorced or widowed), this model can better account for their labor supply choices since they have no spouse's adjustment cost to their work hours changes. For this type of male, their spouse's adjustment cost to work hours changes is zero. However, this is not so for maritally stable males. The spouse's adjustment cost to their labor supply changes limits the choices of a maritally stable worker's labor supply, especially when the worker might change work location because of the local tax differences or wages changes.

Because of this extra cost, when I estimate the elasticity for maritally stable males, the model is less appropriate. Therefore, from this model specification, I would not expect that workers with different marital situations have the same estimated elasticity of their labor supply to wage and tax changes. A worker whose first marriage is intact and who pays attention to his spouse's cost resulting from his work changes has a greater utility cost of changing his labor supply. Thus I predict that with this model specification the Frisch elasticity of maritally stable males is less than the elasticity of others.

4.3 Estimation Approaches

4.3.1 The First-differenced Labor Supply Equation Approach

The first-differenced labor supply equation approach is an attractive estimation approach. First, if one plans to employ the after-tax wage rate to estimate the elasticity, this approach allows one to difference out most tax rate changes, because few years have tax rate changes. Thus, the approach is not constrained by tax-rate data. Second, using this approach, it is possible to estimate the coefficients without knowing future work profiles, wealth or other information. All lifecycle wage and wealth information is captured by the marginal utility of wealth. It provides a simple and accessible way to estimate the parameters.

Equations 4.3 and 4.4 may be rearranged into the following loglinear equations for l_t and c_t .

$$\ln l_t = \frac{1}{\gamma} \ln w_t + \frac{1}{\gamma} \ln \lambda_t - \frac{1}{\gamma} \ln b_t \quad (4.8)$$

$$\ln c_t = \frac{1}{\eta} \ln \lambda_t \quad (4.9)$$

Labor supply equation 4.8 does not allow for a marital stability effect on the Frisch elasticity. If one consider the marital stability effect, equation 4.8 should be arranged as

$$\ln l_t = \frac{1}{\gamma} \ln \lambda_t + \delta_0 MS + \frac{1}{\gamma} \ln w_t + \delta_1 MS \cdot \ln w_t - \frac{1}{\gamma} \ln b_t \quad (4.10)$$

where MS is a dummy variable taking on the value one for maritally stable men and the value zero for others.

Since λ_t enters 4.8 and 4.9 in log form, one can take logs of both sides of equation 4.7, perform a Taylor expansion of $\ln(\lambda_{t-1} + e_{\lambda t})$ around $e_{\lambda t} = 0$, and ignore the higher-order terms. This leads to

$$\ln \lambda_t = \ln \beta(1 + r) + \ln \lambda_{t-1} + u_t \quad (4.11)$$

where $u_t = \frac{e_{\lambda t}}{\lambda_{t-1}}$.

Following MaCurdy (1981), using equation 4.11, equations 4.8 and 4.10 can be rearranged as

$$\ln l_t - \ln l_{t-1} = \frac{1}{\gamma} [\ln \beta(1 + r) + u_t] + \frac{1}{\gamma} (\ln w_t - \ln w_{t-1}) - \frac{1}{\gamma} (\ln b_t - \ln b_{t-1}) \quad (4.12)$$

When one allows for the marital stability effect, this equation can be specified as

$$\ln l_t - \ln l_{t-1} = \left(\frac{1}{\gamma} + \delta_1 MS\right) (\ln w_t - \ln w_{t-1}) + \frac{1}{\gamma} [\ln \beta(1 + r) + u_t] - \frac{1}{\gamma} (\ln b_t - \ln b_{t-1}) \quad (4.13)$$

Following MaCurdy (1981), this exercise assumes explicitly that workers have perfect foresight, in which case u_t is zero. The expression $\ln \lambda_t - \ln \lambda_{t-1}$ is assumed to be constant since the interest

rate is assumed to be constant. Thus equation 4.13 can be rewritten as

$$Dl_{it} = \frac{1}{\gamma} \ln \beta(1+r) + \left(\frac{1}{\gamma} + \delta_1 MS_i\right) Dw_{it} + \nu_{it} \quad (4.14)$$

With the marital stability effect, it becomes

$$Dl_{it} = \frac{1}{\gamma} \ln \beta(1+r) + \frac{1}{\gamma} Dw_{it} + \delta_1 MS_i \cdot Dw_{it} + \nu_{it} \quad (4.15)$$

where D is the difference operator, that is $Dl_{it} = \ln l_{it} - \ln l_{it-1}$, $Dw_{it} = \ln w_{it} - \ln w_{it-1}$, $\nu_{it} = -\frac{1}{\gamma}(\ln b_{it} - \ln b_{it-1})$, which is a disturbance term that is independently distributed across individuals once common time effects are removed with the inclusion of year dummies in the labor supply equations.

As mentioned earlier, this approach allows for a spouse's adjustment cost induced by the response of a husband's labor supply to wage and tax changes. If the worker does not have to deal with such an adjustment cost, the model specification keeps the classical form. If the worker does have to deal with such an adjustment cost,⁵ it can be predicted that marital stability will reduce the elasticity of labor supply. Thus I expect that the sign of δ_1 will be negative. The wage growth rate Dw_{it} in equation 4.15 will be affected by individual tastes. Following MaCurdy, I use age, education, interactions of these variables, and a set of year dummies as the principal instrumental variables for the change in wages. Considering measurement error, Altonji (1986) suggested that the first difference of a second wage measure Dw_{it}^{**} could be used as instrumental variable for the first difference of the first measure, Dw_{it} . The first measure of the wage rate is calculated as annual labor income divided annual work hours. The second measure of the wage rate is the reported hourly wage rate, which is only available for workers who are paid on an hourly basis. This study

⁵By definition of marginal utility of wealth does not consider this cost. Thus, this adjustment cost could not be captured by marginal utility of wealth.

implements both sets of instrumental variables and finds that results from the two approaches are consistent with each other.

4.3.2 Use of Consumption as a Proxy for $\ln \lambda_t$

One innovation of Altonji (1986) is using consumption as a proxy for marginal utility. In principle, the marginal utility of wealth parameter λ_t captures all wages and wealth information needed to estimate the Frisch elasticity, and it determines the consumption choice in each period. Even though researchers cannot observe λ_t directly, they can observe consumption choices. Consequently, one can estimate parameters by using consumption as a proxy for $\ln \lambda_t$.

Solving equation 4.9 to express $\ln \lambda_t$ as a function of c_t ,

$$\ln \lambda_t = \eta \cdot \ln c_t \quad (4.16)$$

Substituting this in equation 8, following Altonji, yields

$$\ln l_t = \text{constant} + \frac{1}{\gamma} \ln w_t + \frac{\eta}{\gamma} \ln c_t + \varepsilon_t \quad (4.17)$$

where $\varepsilon_t = -\frac{1}{\gamma} \ln b_t$. Similarly, if I introduce the marital stability effect, equation 4.17 can be rewritten as

$$\ln l_t = \text{constant} + \delta_0 MS + \frac{1}{\gamma} \ln w_t + \delta_1 MS \cdot \ln w_t + \frac{\eta}{\gamma} \ln c_t + \varepsilon_t \quad (4.18)$$

This alternative approach has several drawbacks. First, considering the fact that consumption choice is highly correlated with individual taste variations and income, the endogenous variable

consumption c_t must be instrumented using variables that are correlated with wealth and the lifetime wage profile. Second, the endogeneity of wage growth still exists in equation 4.15, as mentioned earlier. Third, the strong assumption of separability between consumption and leisure might not be consistent with the available evidence. In this approach, consumption choice depends on the wage profile only through $\ln \lambda_t$. Since the substitution for $\ln \lambda_t$ using c_t does not introduce variables from other periods, identification is mainly from cross-sectional information. If the assumption of separability between consumption and leisure does not hold for a more general maximization of lifetime utility model, then changes in the current price of one good affect the demand for the other goods even when $\ln \lambda_t$ is held constant. Altonji added cross-substitution terms B_{nc} and B_{cn} to equations 4.8 and 4.9 to show the empirical consequences of failure of the separability assumption. With nonseparability, equations 4.8 and 4.9 are changed to the following equations:

$$\ln l_t = \frac{1}{\gamma} \ln w_t + \left(\frac{1}{\gamma} + B_{nc}\right) \ln \lambda_t + e_t \quad (4.19)$$

$$\ln c_t = \text{constant} + B_{cn} \ln w_t + \left(\frac{1}{\eta} + B_{cn}\right) \ln \lambda_t \quad (4.20)$$

where $e_t = -B_3 \ln b_t$, with B_3 as the new coefficient in front of $\ln b_t$ due to nonseparability. Calculating the first difference for equation 4.19, equation 4.12 still holds. Thus, Equation 4.15 still holds in this case.

$$Dl_{it} = \text{constant} + \frac{1}{\gamma} Dw_{it} + \delta_1 MS_i \cdot Dw_{it} + \mu_{it}$$

where μ_{it} is the error term⁶. However, equation 4.17 is replaced by

$$\ln l_{it} = \text{constant} + \left(\frac{1}{\gamma} - \Gamma \cdot B_{cn}\right) \ln w_{it} + \Gamma \ln c_{it} + \epsilon_{it} \quad (4.21)$$

⁶Constant term is $\left(\frac{1}{\gamma} + B_{nc}\right) \ln \beta(1+r)$ in this equation.

where $\Gamma = \frac{\frac{1}{\gamma} + B_{nc}}{\frac{1}{\gamma} + B_{cn}}$. The coefficient of $\ln w_{it}$ in equation 4.21 is no longer $\frac{1}{\gamma}$ if separability between consumption and leisure does not hold. This means that if consumption depends on wages, then even though the marginal utility of wealth, λ_t , controls wages and wealth information, the estimation results are biased. The magnitude and sign of the bias depend on $\Gamma \cdot B_{cn}$. Therefore, when I estimate the Frisch elasticity of males using equation 4.18, I would not expect to have evidence of the effect of marital stability on the Frisch elasticity. What I get from this estimation is the effect of marital stability on $(\frac{1}{\gamma} - \Gamma \cdot B_{cn})$, rather than on $\frac{1}{\gamma}$.

4.4 Data

The sample is drawn from the male heads of household who are part of the PSID 1976-1984 data tape. The PSID is the longest longitudinal study of a sample of American individuals and families. Since 1968, the PSID has interviewed over 18,000 individuals from 5,000 families in the initial samples. Adults have been followed as they have grown older, and children have been observed as they have advanced into adulthood, forming family units of their own. Survey waves are annual from 1968 to 1997 and biennial since then. The data are selected as follows. First, to minimize the complications associated with schooling and retirement, the sample includes observations of male heads of household aged 24-54. Second, to avoid selection problem, observations are dropped if worked hours is zero or the subject had a zero wage rate. Besides the above information, the hourly paid observations have valuable hourly paid wage rate data as well. For Table 4.4, I include consumption, wives' education, family size, number of children, region, race and health status data. Finally, all observation included in this exercise have valuable marriage history information⁷.

⁷The marriage history information collected from the 1985 wave through the most current wave of cross-year individual information included on the file.

There are two wage variables employed in this exercise. The first one, w_{it} , is obtained by dividing annual labor earnings by annual hours of work. The second measure of wage, w_{it}^{**} , is the reported hourly wage for those who are paid on an hourly basis. The data on consumption expenditure are limited to food used at home. The deflators from CPI-U released by Bureau of Labor Statistics are used to adjust for the effect of inflation on average wage rate, hourly wage rate and consumption, with 2011 as the base year. To avoid excessive impacts from outliers, following the literature, observations are excluded if work hours or wages or consumption or wife age is below the 1st percentile or above the 99th percentile of the corresponding sampling distribution. The surviving sample has 6699 person years. Only 2739 person years have the information of the reported hourly wage rate. Furthermore, we group both the full sample and hourly paid subsample into a maritally stable group and maritally unstable group. There are 4269 maritally stable observations and 2430 maritally unstable observations among the full sample. 1764 maritally stable observations and 975 maritally unstable observations are in the subsample with hourly wages. Maritally stable males are males whose first marriage year is before 1976 and have been maritally intact over the observed time period. Others are placed into the maritally unstable group.

Table 4.1 presents the summary statistics for the main variables of full sample and the subsamples.

Table 4.1: Summary Statistics

Variables(Units)	Full Sample		Hourly Paid Subsample ¹		Hourly Paid Subsample ²	
	MS ³	MU ⁴	MS	MU	MS	MU
Work Hours(hours/year)	2228.06 (472.32)	2235.25 (506.50)	2141.99 (401.49)	2135.48 (472.99)	2142.47 (402.39)	2139.29 (471.08)
age(years)	36.66 (6.52)	36.17 (5.95)	36.28 (6.55)	36.41 (6.33)	36.29 (6.56)	36.42 (6.32)
Wage(\$/hour)	27.61 (12.05)	26.80 (11.13)	24.71 (9.13)	25.02 (8.85)	24.58 (9.01)	24.91 (8.72)
Hourly Wage ^a (\$/hour)			23.06 (7.28)	24.03 (7.30)	22.92 (7.12)	23.75 (7.00)
Schooling(years)	13.32 (4.80)	12.96 (2.64)	11.96 (6.65)	11.58 (2.16)	11.96 (6.67)	11.56 (2.16)
Father's Schooling ^b	3.34 (2.02)	3.53 (2.05)	2.79 (1.68)	3.27 (2.21)	2.78 (1.68)	3.26 (2.21)
Mother's Schooling ^b	3.74 (1.98)	3.83 (1.98)	3.47 (2.05)	3.48 (2.09)	3.48 (2.05)	3.47 (2.10)
Consumption(\$/year)					9770.14 (3577.67)	9816.49 (3832.27)
Wife's Schooling(years)					12.21 (6.48)	13.20 (11.01)
Wife's age(years)					33.87 (6.78)	33.22 (6.85)
Family Size(persons)					4.22 (1.32)	4.20 (1.51)
Number of Children					1.97 (1.24)	2.00 (1.38)
Person-years	4269	2430	1764	975	1751	960

Notes:

1.Hourly paid subsample is used in the first-difference equation approach.

2.Hourly paid subsample is used in the consumption as a proxy for marginal utility of wealth approach. Missing data on consumption results loss of observations.

3.MS represents maritally stable subsample.

4.MU represents maritally unstable subsample.

a.Hourly wage is reported wage rate from the question "What is your hourly wage rate for your regular work? "

b.Parent's schooling is recorded by education levels rather than years of grades. 0="could not read or write"; 1="0-5 grades"; 2="6-8 grades"; 3="9-11" grades; 4="12 grades";5="12 grades plus nonacademic training"; 6="college but no degree"; 7="College BA"; 8="College and advanced or professional degree".

Standard errors are in parentheses.

4.5 Empirical Results

This section reports the estimation results from equation 4.15 and equation 4.18. The results indicate that marital stability attenuates the elasticity of labor supply with respect to wage and tax changes. The estimated Frisch elasticity from first difference equation 4.15 is reported in Table 4.2 and Table 4.3. As expected, the estimated Frisch elasticity of maritally stable males is significantly less than the estimated Frisch elasticity of others. Table 4.2 shows the estimation results using the differenced reported hourly wage rate Dw_t^{**} as the instrument for differenced average wage rate Dw_t in the first-stage equation. Table 4.3 presents the full sample results of the first difference approach using age, schooling, parent's financial situation, and parents' education as instruments for Dw_t . The first stage results are presented in Table 4.A.

Table 4.2: First-Difference Equations for Labor Supply, IV: Reported Hourly Wage

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	-.0060 (.0053)	-.0088 (.0296)	.0190 (.0134)	.0140 (.0353)
Dw_t	.7855** (.2423)	.7870** (.2458)	.7217** (.2550)	.7229** (.2562)
$MS \cdot Dw_t$	-.5713* (.2749)	-.5716* (.2752)	-.5641* (.2737)	-.5640* (.2737)
Age		.0001 (.0008)		.0001 (.0008)
Year Dummies	No	No	Yes	Yes
F-ratio	6.43	4.54	4.03	3.63
R^2	.0062	.0066	.0174	.0175
Person-years	2052	2052	2052	2052

Notes:

1. Standard errors are in parentheses.
2. The first-stage equations are presented in table 4.A.
3. Missing data on the lag of average wage rate results in loss of 688 person-year data.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

Based on the subsample that is paid on an hourly basis, Table 4.2 reports the estimation results using differenced reported hourly wage as the instrument for differenced average wage rate. The estimated Frisch elasticity lies in the range of 0.72 to 0.79 for maritally unstable males. This indicates that there is 0.72-0.79 percentage increase in labor supply when the wage rate increases by 1 percent, holding constant the marginal utility of wealth in the life cycle. Because it is affected by the adjustment cost, the estimated Frisch elasticity for maritally stable men is estimated to be between 0.16 to 0.22. The difference in the Frisch elasticity for maritally stable males and unstable males is about 0.57. Columns 1 and 2 report the results from a constant-interest-rate model specification. Columns 3 and 4 present the results allowing the interest rate to be different in each period, by including year dummies. When one adds year dummy variables in this model, one cannot interpret the results as the response of labor supply to wage and tax changes induced by interest rates changes. Controlling for age (column 2 and column 4) increases the estimated Frisch elasticity a little. All these empirical results provide the evidence of a substantial effect of marital stability on the Frisch elasticity.

Table 4.3: First-Difference Equations for Labor Supply, IVs: Age, Education, Family Background, Year Dummies

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	-.0033 (.0030)	-.0121 (.0198)	.0059 (.0101)	.0194 (.0315)
Dw_t	.6059*** (.1452)	.6258*** (.1519)	.3684 (.1998)	0.3200 (.2374)
$MS \cdot Dw_t$	-.1665 (.1793)	-.1605 (.1798)	-.1950 (.1877)	-.2111 (.1925)
Age		.0002 (.0005)		-.0002 (.0006)
Year Dummies	no	no	yes	yes
F-ratio	14.90	10.00	4.06	3.67
R^2	.0054	.0054	.0066	.0066
Person-year	5538	5538	5538	5538

* Significant at the 5-percent level.

** Significant at the 1-percent level.

*** Significant at the 0.1-percent level.

Table 4.3 presents the full sample results of a first-differenced approach using age, schooling and family background variables as instruments for Dw_{it} . As I expected, it provides evidence that marital stability matters. The estimated Frisch elasticity of maritally stable males is less than it is for others. The estimates of the Frisch elasticity of maritally unstable males in columns 1-2 are 0.61 and 0.63 respectively, while the results for maritally stable males are 0.44 and 0.47 respectively. Adding year dummy variables to allow interest rates to be different in each year slightly decreases the estimated elasticities, which are reported in column 3-4⁸. However, the fact that marital stability attenuates the estimated Frisch elasticity still holds when year dummy variables are used.

⁸The pattern is same as MaCurdy (1981) and Altonji (1986).

Table 4.4: Labor Supply Estimates Using Food Consumption as A Proxy for λ

Explanatory Variable	Estimate	SE
Constant	10.2361***	(1.4039)
MS	-1.9516**	(.7134)
w_t	-.3672**	(.1320)
$MS \cdot Dw_t$.6235**	(.2271)
c_t	-.1434	(.1603)
Health	-.0458***	(.0112)
Age	-.0114	(.0127)
Age^2	.0002	(.0002)
Size of Family	.0101	(.0217)
Number of Children	.0039	(.0110)
South	.0218	(.0214)
West	.0049	(.0189)
North Central	-.0071	(.0268)
Year Dummies	yes	
F-ratio	4.35	
Observations	2711	

* Significant at the 5-percent level.

** Significant at the 1-percent level.

*** Significant at the 0.1-percent level.

As mentioned earlier, first difference equation 4.15 still holds, even relaxing the assumption of separability between consumption and leisure. However, if the separability assumption does not hold, then the estimated elasticity from equation 4.18 is biased. Thus one would not necessarily expect to have the relatively smaller elasticity of maritally stable males in this case. Table 4.4 presents the results from using consumption, c_t , as a proxy for marginal utility of wealth, λ . The estimating equation is equation 4.21. The results stand in contrast to the results in Tables 4.2 and 4.3. Before discussing the estimated parameters in Table 4.4, it is important to be familiar with the first stage regression, which is necessary due to the endogeneity of the wage rate and consumption in equation 4.21. The reported hourly wage rate w_{it}^{**} and an estimated individual-specific fixed permanent component of wage w_i are the instruments for average wage rate, w_{it} . The intuition of an individual-specific fixed permanent part of wage is the assumption that the specific individual's characteristics (such as education, experience and region) determine the fixed permanent component of wage, w_i . Consequently, after regressing w_{it} on such variables and variables that fluctuate

over time, one can obtain the estimated w_i^{**} for w_i . w_{it}^{**} and w_i^{**} are principle instrumental variables for consumption c_t as well. w_i^{**} controls for invariant information from wage or income affecting consumption expenditure. w_{it}^{**} controls for variable information from a wage profile (the change of occupation, the evolution of health status and many other unobserved individual characteristics), conditional on a given w_i . These variations affect the consumption choice as well. Following Altonji, if the wife's education and the husband's parents' financial condition affect a man's wealth and consumption c_t , then I add wife's schooling and parents' financial background variables as instruments. I report the first-stage regressions for w_t and c_t in Table 4.A. The exogenous variables are age, age squared, year dummies, health status, region, race, family size and number of children in the family unit.

The estimated coefficient on consumption is -0.1434 in Table 4.4. It has a negative sign as expected. The estimated coefficient on log wage in Table 4.4 is no longer the Frisch elasticity. As mentioned earlier, the assumption of separability between consumption and leisure might be violated. In addition, the consumption expenditure data in this exercise is limited to food expenditure at home. These limitations can be expected to affect the results. As I expected, in this case, I do not see a spouse effect on the estimated Frisch elasticity.

Overall, the estimated results suggest that marital stability has a substantial effect on the responses of the labor supply to wage and tax changes. Males who are continuously married the same wife have an extra utility cost to changing their labor supply, especially when they need to change where they work. As a result, they have relatively lower response of work hours to the wages and tax changes.

4.6 Discussion of Results

Table 4.5: Summary of Estimated Frisch Elasticity from Studies

Study	Marital Stable Data			Marital Unstable Data				Mixed
	$\hat{\epsilon}^3$ w/o dum ⁴	$\hat{\epsilon}$ w/ dum	$\hat{\epsilon}$ Summary	IV ¹		IV ²		
				$\hat{\epsilon}$ w/o dum	$\hat{\epsilon}$ w/ dum	$\hat{\epsilon}$ w/o dum	$\hat{\epsilon}$ w/ dum	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MaCurdy (1981)	.23 (2.42)	.15 (0.98)						
Altonji (1986)			0 -.35					
Angrist (1991)								.6 - .8
Pistaferri (2003)								.70*** (.09)
Ziliak & Kniesner(2005)								.54*** (.12)
This Study	.22 ⁵	.17 ⁶	.11 -.47	.61*** (.15)	.37 (.20)	.79** (.24)	.72** (.26)	.39 ⁷

Notes:

- 1.IVs are age, education, etc.
- 2.IV is the reported hourly wage.
3. $\hat{\epsilon}$ represents the estimated Frisch elasticity from studies.
- 4."dum" represents year dummies. It is applied to all columns.
- 5.Calculated from Table 3.
- 6.Calculated from Table 3.
- 7.It is weighted average.

Standard errors are in parentheses.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

*** Significant at the 0.1-percent level.

How do this empirical results compare with those of others? While this study is the first study to investigate the marital stability effect on the labor supply response to wage and tax changes, Table 4.5 provides the evidence that the magnitudes of estimates of marital stable subsamples of this study are consistent with previous studies, allowing for sampling error. Based on males aged 25-46 and continuously married to the same spouse during the period 1968-77 from PSID,

MaCurdy's two-stage least square (2SLS) estimates were 0.23 when year dummies were excluded and 0.15 when they were included. Following MaCurdy's methodology, my results are 0.22 when the model excludes year dummies and 0.17 when the model includes year dummies. Altonji (1986) used males who were married to the same wife for the years 1968-79 from the 12 year PSID family tape and had an estimation range of 0-0.35 for the Frisch elasticity of the labor supply. This study uses the sample of prime-age males from the period 1976-84 in the PSID and suggests that the Frisch elasticity of the labor supply of maritally stable males is 0.22-0.47 when year dummies are excluded and 0.11-0.17 when they are included. Based on data for prime-age male household heads from the 1969-79 waves of the PSID, Angrist (1991) reported a Frisch elasticity between 0.6 and 0.8. Using prime-age male data in Italy, Pistaferri (2003) suggested the estimated Frisch elasticity was around 0.7. Ziliak and Kniesner (2005) found that, relaxing the separability assumption between leisure and consumption, the estimated Frisch elasticity is 0.54 with a standard error of 0.12, employing prime-age male American data from 1980-99 waves of PSID⁹. Chetty (2012) used set estimation to handle model mis-specification caused by omitting friction. He suggested that the Hicksian elasticity is 0.33 on intensive margin and that the Frisch elasticity cannot be much larger than that. In this study, the estimated Frisch elasticity of marital unstable prime-age males lies in a range of 0.61-0.79 when year dummies are excluded and 0.37-0.72 when the year dummies are included. For maritally stable males, the results are 0.22-0.47 when year dummies are excluded and 0.11-0.17 when they are included. Thus, overall, the empirical results of this study are in reasonable with previous results and provide evidence that marital stability affects the labor supply response to wages and taxes.

⁹In their model, they allow interest rates change over time.

4.7 Conclusions and Future Work

A large body of studies has evaluated the response of the male labor supply to wage and tax changes, but this is the first study to examine the impact of marital stability on the intensive margin elasticity of prime-age males. This study indicates that the Frisch elasticity of males who have been continuously married to the same wife is less than that of other males. This can be interpreted as a reflection of the extra utility cost of wives' adjustment costs.

I investigate the Frisch elasticity of males using both a first-differenced labor supply equation approach and an approach using consumption as a proxy for the marginal utility of wealth. When I employ the first approach, I use two different instruments sets. Differences in my estimates of the Frisch elasticity between maritally stable males and other males are significant. This is robust to different instrument sets. The estimated results are informative for the magnitude of labor supply fluctuations over the life cycle. They provide information to predict the impact of tax changes on the labor supply. A relatively larger intensive margin labor supply elasticity for the maritally unstable males implies that the deadweight loss due to income tax changes is more for this group people than it for others. On the other hand, the maritally stable males don't have much responsiveness to income tax changes. Finally, this result implies that the design of divorce law has effect on labor market.

In this study, I have introduced a marital stability effect into the labor supply equation through an exogenous dummy variable and have interpreted the results as a reflection of a utility cost of changing one's labor supply that is induced by a spouse's adjustment cost. In the future one could further specify the marital stability effect on the labor supply elasticity by observing the elasticity changes of males when they divorce during the observed period.

4.8 Appendix

Table 4.A: First-Stage Equations

Explanatory Variable	Dependent Variable			
	Dw_t (1)	Dw_t (2)	w_t (3)	c_t (4)
Intercept	.0178*** (.0049)	-.0146 (.1236)	-1.0560** (.3597)	5.0629*** (.9765)
Dw_t^{**}	.2905*** (.0372)			
w_t^{**}			.9297*** (.0143)	.2766*** (.0216)
w_i^{**}			.2729** (.1060)	.5784 (.3125)
$Wife_{Schooling}$.0012 (.0008)
$Parent_{Average}$		-.0019 (.0083)		-.0863 ^[**] (.0287)
$Parent_{Rich}$		-.0038 (.0108)		-.0557 ^[**] (.0302)
Year Dummies		yes	yes	yes
white			-.0228* (.0103)	.0558*** (.0155)
South			.0875 ^[**] (.0234)	.0201 ^[**] (.0565)
West			.0232 ^[**] (.0217)	-.0714 ^[**] (.0458)

North Central			.0593 ^[**]	-.1326 ^[**]
			(.0146)	(.0230)
Size of Family			.0017	.1333 ^{***}
			(.0084)	(.0126)
Number of Children			.0058	-.0278 [*]
			(.0091)	(.0137)
Health			.0107	-.0046
			(.0107)	(.0161)
Age	.0003		.0194 [*]	.0472 ^{***}
	(.0032)		(.0081)	(.0123)
Age ²			-.0002 [*]	-.0005 ^{**}
			(.0001)	(.0002)
Schooling	.0070			
	(.0114)			
Schooling ²	-.0059			
	(.0200)			
Age*Schooling	-.0002			
	(.0003)			
Age * Schooling ²	.0001			
	(.0007)			
Father's Schooling	.0019			
	(.0019)			
Mather's Schooling	.0009			
	(.0019)			
F-ratio	61.30	3.79	276.21	44.98
R ²	.0290	.0109	.6610	.2691
Person-years	2052	5538	2711	2711

Notes: Column 1 and 2 are the first-stage equations for Dw_t in table 4.2 and table 4.3, respectively. Column 3 and 4 are the first stage equations for w_t and c_t in table 4.4, respectively.

* with \square are the results of F tests; * without \square are the results of t tests. Standard errors are in parentheses.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

*** Significant at the 0.1-percent level.

Data Appendix

The sample is drawn from the 33,170 male household heads who were continuously interviewed by the Panel Study of Income Dynamics (PSID) for the 16 years from 1976 to 1991. A full sample would have each individual's characteristics in each year. But only 1,474 males had valid labor income, age and work hours information over all these years. From this sample, the data are further reduced as follows. First, only 997 men who were older than 25 in 1976 and younger than 60 in 1991 remain in the sample. Loss: 477 persons. Second, persons with 4,860 or more work hours in any year are excluded. Loss: 32 persons. Third, persons are excluded if their consumption data during any of these years were missing or recorded as zero. Loss: 70 persons. This brings the sample down to 895 persons and 14,320 person years.

Further reductions in the data involve dropping some years of data for a person while retaining others. First, person-years with work hours, wages, consumption or wife age below the 1st percentile (but above zero) or above the 99th percentile of the corresponding sampling distribution are dropped. Loss: 4,005 person-years. Second, observations must have valid wife schooling information. This drops data over the period 1985-1991. Loss: 3,607 person-years. Third, observations with missing marriage information are dropped. Loss: 9 person-years. In two instances a person-year was dropped for two reasons. Thus the surviving sample consists of 857 persons and 6,699 person-years.

Among these observations, only 2,739 person-years have a nonzero reported hourly wage rate. Because of missing data on lags of 1976 variables, in Table 3, the surviving full sample consists of 857 persons and 5,538 person-years. Similarly, because of missing data on lags of 1976 variables in Table 2, the surviving hourly paid subsample consists of 2,052 person-years of observations. For Table 4, observations with an hourly reported wage below the 1st percentile (but above zero) or above the 99th percentile of the corresponding sampling distribution are dropped. Loss: 28

person-years of observations. The surviving subsample for Table 4 consists of 2,711 person-years of observations.

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