An Empirical Analysis of Joint Decisions on Labor Supply and Welfare Participation

Gi Kang, Sonya K. Huffman, and Helen H. Jensen

Working Paper 04-WP 361
May 2004

Center for Agricultural and Rural Development
Iowa State University
Ames, Iowa 50011-1070
www.card.iastate.edu

This research was conducted while Gi Kang, an associate professor at Cheju National University, China, was visiting at Iowa State University. Sonya Huffman is adjunct assistant professor in the Department of Economics and Helen Jensen is professor of economics and head of the Food and Nutrition Policy Division in the Center for Agricultural and Rural Development at Iowa State University.

The authors acknowledge helpful comments and suggestions from Peter Orazem. The Economic Research Service, United States Department of Agriculture, provided partial funding support for the research.

For questions or comments about the contents of this paper, please contact Helen Jensen, 578E Heady Hall, Iowa State University, Ames, IA 50011-1070; Ph: 515-294-6253; Fax: 515-294-6336; E-mail: hhjensen@iastate.edu.

Abstract

Economic and welfare program factors affect the well-being of low-income families and their labor supply decisions. This study uses data from the U.S. Survey of Income and Program Participation. A nested logit model is estimated to explain the joint decisions to participate in Temporary Assistance for Needy Families (TANF) and the labor market for the population of families potentially eligible for TANF. The empirical findings indicate that higher wages increase labor and decrease welfare program participation; an increase in nonlabor income decreases both labor market and welfare participation.

Keywords: labor supply, low income, welfare program, welfare reform.

AN EMPIRICAL ANALYSIS OF JOINT DECISIONS ON LABOR SUPPLY AND WELFARE PARTICIPATION

Introduction

Between 1965 and 1985 the United States experienced a large increase in the caseload of welfare programs. There are many explanations for the high caseload level, and these include long-term welfare dependency and work disincentives. In response, recent state and federal welfare reforms have been designed to increase work participation among welfare recipients. The Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) enacted in 1996 brought major changes in the scope, structure, and impact of programs targeted to the low-income population, including Aid to Families with Dependent Children (AFDC), the Food Stamp Program, Medicaid, Supplemental Security Income (SSI), child welfare, and child support. Following the introduction of PRWORA, the number of welfare recipients declined across the nation. Both the reforms introduced through PRWORA and America's growing economy contributed to the declining welfare rolls.

Linkages among social assistance programs have significant effects on the behavior of low-income individuals and families. This study examines the effects of cash transfers on labor supply and welfare participation decisions in order to better understand factors affecting welfare program and labor market activities of the poor. Many researchers have analyzed the effects of government transfer programs on labor supply decisions among the low-income population (see Moffitt 1992). Much of the empirical work provides insights on how welfare transfers affect labor supply decisions of low-income families and has focused on either females or married couples.

For example, Keane and Moffitt (1998) use a structural model to examine work and multiple welfare program participation decisions among families headed by single adult females. Hagstrom (1996) examines the effect of the Food Stamp Program on intra-family labor supply and program participation decisions. Married couples simultaneously choose the labor supply of the husband and wife and whether to participate in the Food Stamp Program. Hagstrom estimates a nested multinomial logit model and uses data from the Survey of Income and Program Participation (SIPP). He found smaller labor supply effects for married couples to changes in the food stamp benefit compared with those of single parents. He also found program participation by married couples to be responsive to changes in food stamp benefits.

The purpose of this paper is to examine the effect of the 1996 welfare reforms on the labor supply decisions of low-income families. There are three types of families: two-parent families, male-headed families, and female-headed families. The core of the transfer system for the low-income population of the nonelderly and nondisabled includes AFDC (now Temporary Assistance to Needy Families [TANF]), the Food Stamp Program, Medicaid, and public housing. Among these, the TANF program is the most widely known cash transfer program for the poor. This study uses data from the SIPP to analyze labor market and TANF participation decisions among all low-wealth families in the United States. A static model of family behavior is developed in which work and program participation is chosen to maximize a family utility function given resource constraints. The model is used to explain the joint decision to participate in TANF and the labor market for the population of families eligible for TANF. The paper provides two approaches to explaining joint decisions of families. First, we estimate a bivariate probit model of participation in the labor force and TANF program. Second, we estimate a nested logit model that incorporates simultaneous decisions on labor market and TANF participation.

TANF Program

The PRWORA gives the states a fundamental role in assisting poor families. Under TANF, the eligibility rules and benefits differ across states. To be eligible for TANF, an applicant family must pass both nonfinancial tests based on the demographic characteristics of the family and its members and financial tests based on the family's income and asset holdings. At the most basic level of nonfinancial tests, the family must include a child or, in some states, a pregnant woman. If the head of the family is a teenager, she may or may not be eligible to receive a benefit on her own. In most states, she is eligible only if she is living with her parents.

The financial tests require that an applicant family must have sufficiently low income and asset levels. The asset limits that states have adopted under TANF differ greatly by state. Thirty-nine states have increased the asset limit for recipients above the $1,000 limit allowed under AFDC. Twenty-two states allow recipients to accumulate additional savings in a restricted savings account set aside for a specific purpose allowed by the state. If the family's total assets exceed the amounts determined by the state, the family is ineligible for TANF.

Once the family has passed the state's asset tests, its available income is computed for eligibility purposes. States use the total gross income calculated from the unit's earned and unearned income as a starting point for income eligibility tests (Rowe 2000). Many states now impose just one income test on applicants; however, others use a combination of a gross income test, gross earnings test, and/or net income test. Net income tests require that net family income not exceed a maximum benefit level that varies by family size and state of residence. Net income is calculated by subtracting the state's earned income disregards from the unit's gross earned income and then adding to this amount the unit's unearned income. The net income is then compared to an income standard determined by the state. If the net income is less than the standard, then a benefit is calculated.

Although states use many different formulas to determine net income, there are general rules that most states apply. All but two states allow recipients to disregard a portion of their earned income before benefit computation and vary the units' benefits by income. In more straightforward calculations, net income is subtracted from a state-determined standard, the so-called payment standard, which varies by family size. The benefit paid is the difference.

Theoretical and Empirical Model

Theoretical Model

The family head is assumed to choose labor supply and welfare (here, TANF) participation simultaneously to maximize the family's utility subject to its budget constraint. Assume that a family's utility is a function of leisure time and disposable income and is represented by

$$U = U(H, Y, \delta) \tag{1}$$

where *H* is monthly hours of work supplied by family, *Y* is monthly disposable income, and δ represents preferences for receiving a TANF benefit. Monthly disposable income may be written as the following budget constraint:

$$Y(H, P_T) = wH + N + P_T[B(H, N) - C] \tag{2}$$

where *w* is the hourly wage rate, *N* is nonlabor income, P_T is defined to be an indicator equal to 1 if the family head participates in the TANF program and 0 otherwise, $B(\cdot)$ is the TANF benefit given the family's labor supply, and *C* is the monetary cost of participating in the TANF program. The family head is assumed to simultaneously choose *H* and P_T that maximizes his or her utility given in equation (1) subject to the budget constraint given in equation (2). That is, the family head chooses the (*H*, P_T) combination that gives the greatest indirect utility.

Participation in the welfare program is not costless. There are costs associated with the application process and with application itself. The costs include the transportation and time costs of applying for the program and some compliance costs while participating. These costs vary by individual family and by location. However, there are benefits with TANF participation. A family with no income is eligible to receive the maximum TANF grant. For a family with income, the TANF benefits are calculated as the difference between the maximum benefit and net family income. The TANF benefits are calculated according to the following formula:

$$B_T = \min\{P, G_T - [N + (wH - E(H))BRR - CC]\} \text{ if } wH + N < 1.85L \tag{3}$$

where B_T is the monthly TANF benefit, *P* is the maximum permitted payment in the state, G_T is the maximum amount paid or pay standard, $E(\cdot)$ is the earnings disregard, *BRR* is the benefit reduction rate, *CC* is child care deductions, and *L* is living costs. The variables *P*, G_T , *L*, *E*, and *BRR* vary by state and family size.

As Figure 1 shows, the labor supply decision depends on the TANF benefit through its effect on the budget constraint, and TANF participation depends on labor supply through its effect on the TANF benefit. Therefore the TANF participation and labor supply decisions are both endogenous and interdependent.

Empirical Model

The choice set is simplified by assuming that each family chooses to work or not to work under the labor supply decision and to participate or not to participate under the TANF participation decision. The resulting choice set has four alternatives, each of which is a combination of the labor supply and TANF status. Each alternative provides indirect utility V_{lt}. The subscripts *l* and *t* combined denote an alternative, which is a combination of the labor supply decision and TANF participation decision. The family chooses the alternative *lt* such that $V_{lt} \geq V_{(lt)'}$ for all $(lt)' \neq lt$.

The indirect utility V_{lt} is assumed to be a function of known, measured variables and an unobserved stochastic component. Two types of measured variables exist in the context of the TANF participation and labor supply decision problem. The first type varies across alternatives and is called a choice-specific variable or attributes of the choices. The choice-specific variables include the TANF benefit for different combinations of labor supply and wages across hours of work choices. The second type varies by family rather than by alternative and is called an individual-specific variable or

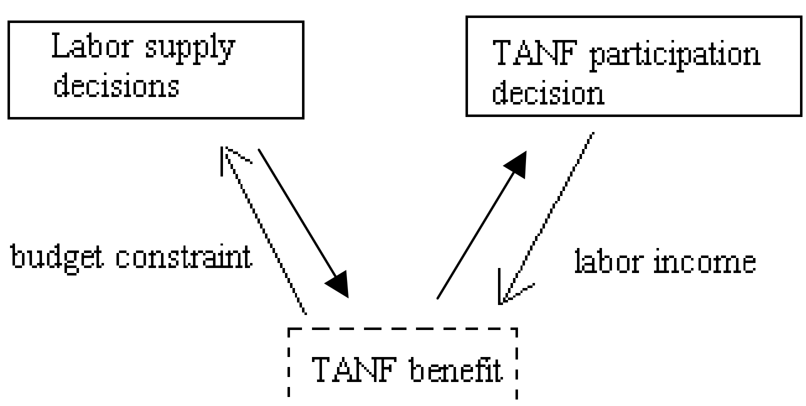

FIGURE 1: Simultaneity of labor supply and TANF participation decisions

characteristics of the individual. The individual-specific variables include information on the family head's age, education, marital status, number of children, and so forth.

The stochastic error component captures the effect of unmeasured variables and unobserved differences in preferences across families. Given the form of utility function and the probability distribution of the stochastic term, the probability that the family will choose alternative *wt* can be written $\Pr_{lt} = \Pr[V_{lt} \geq V_{(lt)'}]$, for all $(lt)' \neq lt$.

Model I: Bivariate Probit Model

Several models are available for estimating the described random utility model based on different assumptions about the stochastic component of indirect utility function, V_{lt} (Green).[1] One model for incorporating simultaneous decisions on labor market and TANF participation is a bivariate probit model. Define P_L and P_T as participation in the labor market and the TANF program, respectively. All families are then classified into four mutually exclusive regimes based on the discrete choice outcome on P_L and P_T:

R_1: $P_L = P_T = 1$ (those who participate in the labor market and TANF)
R_2: $P_L = 1$ and $P_T = 0$ (those who participate in the labor market but not in TANF)
R_3: $P_L = 0$ and $P_T = 1$ (those who participate in TANF but not in the labor market)
R_4: $P_L = P_T = 0$ (those who do not participate in the labor market or TANF)

All observations have a nonzero probability of being assigned to one of four regimes. This probability can be evaluated with the following bivariate probability statements:

$$M_{11} \equiv P(R_1) = P(P_L = 1, P_T = 1) = P[P_L^* = \theta_L' Z_L + \mu_L > 0,\ P_T^* = \theta_T' Z_T + \mu_T > 0] \quad (4)$$

$$M_{10} \equiv P(R_2) = P(P_L = 1, P_T = 0) = P[P_L^* = \theta_L' Z_L + \mu_L > 0,\ P_T^* = \theta_T' Z_T + \mu_T \leq 0] \quad (5)$$

$$M_{01} \equiv P(R_3) = P(P_L = 0, P_T = 1) = P[P_L^* = \theta_L' Z_L + \mu_L \leq 0,\ P_T^* = \theta_T' Z_T + \mu_T > 0] \quad (6)$$

$$M_{00} \equiv P(R_4) = P(P_L = 0, P_T = 0) = P[P_L^* = \theta_L' Z_L + \mu_L \leq 0,\ P_T^* = \theta_T' Z_T + \mu_T \leq 0] \quad (7)$$

Although P_L^* and P_T^* are unobservable variables, we can observe the dummy variables P_L and P_T such that $P_L=1$ if $P_L^*>0$ and $P_L=0$ otherwise, and $P_T=1$ if $P_T>0$ and $P_T=0$ otherwise. Define Z_L and Z_T as vectors of exogenous variables, θ_L and θ_T as parameter vectors, and μ_L and μ_T as disturbance terms. Maximum-likelihood estimation of bivariate probit regressions are used to estimate θ_L and θ_T. These estimates are used to calculate the probabilities of statements (4)-(7).

The empirical specification of the human-capital based wage equation is

$$Ln(W) = \beta_0 + \beta_1 X + \beta_2 Y + \varepsilon_w \quad (8)$$

where X is a vector of exogenous variables including education, marital status, gender, race, and metro/nonmetro location of the family head; Y is a vector of other exogenous variables, including local unemployment rate, experience, and an interaction term between experience and education; and ε_w is a normal random error. The wage equation also needs to be corrected for potential selection bias.

Model II: Nested Logit Model

A second model that is widely used in the discrete choice literature is the multinomial logit model (or conditional logit model), which can be easily estimated for large choice sets (Green 2000; Hensher and Green 2000). The multinomial logit model assumes that the stochastic errors are uncorrelated across alternatives. When the assumption on independence of irrelevant alternatives does not hold, a nested multinomial logit model can be used. The nested multinomial logit model allows the error terms to be correlated across alternatives in a group but to be independent of alternatives in a different group. Figure 2 shows the nesting structure of the model to be estimated.

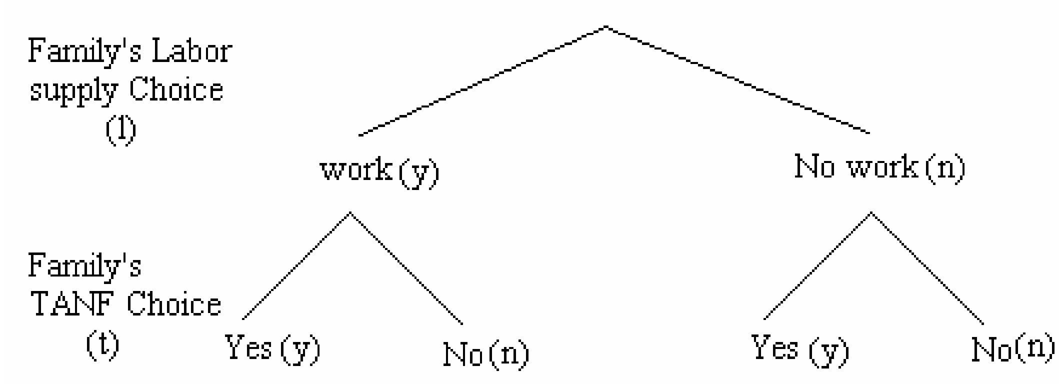

FIGURE 2: Tree structure for nested logit model

The indirect utility function V_{lt} is decomposed into components in the following way:

$$V_{lt} = X_{lt}\alpha + X\alpha_t + Y_l\beta + Y\beta_l + \varepsilon_{lt} \tag{9}$$

where X_{lt} is a vector of observed attributes that vary across TANF participation alternatives, Y_l is a vector of observed attributes that vary across the family's labor supply alternatives, and the *l* and *t* take on values to indicate whether or not there is participation in the labor force (*l*) or in TANF (*t*). In addition to these choice-specific variables, we also include the vectors *X* and *Y,* which vary by individual family rather than by alternatives.

In our specification, X_{lt} is a measure of the TANF benefit that varies across the family's labor supply choices, and Y_l is a vector of wage variables that differ across labor supply alternatives. The individual-specific characteristics include components of the budget constraint, variables that capture variations in preferences. The joint probability of choosing alternative *lt* can be written as

$$P(l,t) = P(t \mid l)P(l) \tag{10}$$

where $P(t \mid l)$ is the probability of choosing *t* conditional on the choice of *l*, and $P(l)$ is the marginal probability of choosing *l* for the family. If the ε is extreme-value distributed, then the probabilities in equation (10) can be written as

$$P(t \mid l) = \frac{\exp(X_{lt}\alpha + X\alpha_t)}{\sum_{t' \in T}\exp(X_{lt}\alpha + X\alpha_t)} \tag{11}$$

$$P(l) = \frac{\exp(Y_l\beta + Y\beta_l + \tau_l I_l)}{\sum_{l' \in L}\exp(Y_l\beta + Y\beta_l + \tau_l I_l)} \tag{12}$$

where

$$I_l = \log\sum_{t' \in T}\exp(X_{lt}\alpha + X\alpha_t). \tag{13}$$

The term I_l is the inclusive value in the labor supply equation and can be interpreted as a measure of the sum of the utility for choice *t* given choice of *l*. The "nested logit" aspect of the model arises when the coefficients of the inclusive values τ_l differ from 1.

To be consistent with the random utility model, the utility function for the four alternatives can be specified in the following way:

$$\begin{aligned}
V_{yy} &= \alpha_{yy} + \beta_b B_{yy} + \beta_r BRR + (\gamma_{W,l} + \gamma_{W,t})W + (\gamma_{M,l} + \gamma_{M,t})M + (\gamma_{C,l} + \gamma_{C,t})C \\
&\quad + (\gamma_{N,l} + \gamma_{N,t})N + (\gamma_{U,l} + \gamma_{U,t})U + \varepsilon_{yy} \\
V_{yn} &= \alpha_{yn} + \beta_b B_{yn} + \beta_r BRR + \gamma_{W,l} W + \gamma_{M,l} M + \gamma_{C,l} C + \gamma_{N,l} N + \gamma_{U,l} U + \varepsilon_{yn} \\
V_{ny} &= \alpha_{ny} + \beta_b B_{ny} + \beta_r BRR + \gamma_{W,t} W + \gamma_{M,t} M + +\gamma_{C,t} C + \gamma_{N,t} N + \gamma_{U,t} U + \varepsilon_{ny} \\
V_{nn} &= \beta_b B_{nn} + \beta_r BRR + \varepsilon_{nn}
\end{aligned} \tag{14}$$

where B_{lt} is the pay standard, *BRR* is the benefit reduction rate,[2] *W* is the predicted wage, M is a family head's gender, *C* is the number of children in the family, *N* is nonlabor income to the family, and *U* is the state unemployment rate.

Data and Estimation Results

The effectiveness of welfare programs has been debated for a long time. The difficulty of evaluating these programs comes from the lack of appropriate data. The availability of the SIPP data now provides evidence for evaluating the efficacy of welfare programs. One of the major goals of SIPP is to examine interactions among transfer programs, labor force participation, and living arrangements because it contains detailed information about the characteristics of, and actual choices made by, both participants and nonparticipants. The 1996 SIPP (wave 3) data was used in this study.

Only nonelderly (under 65 years of age), nondisabled family heads are included in the sample because both elderly and disabled people are eligible for other transfer programs. Family heads are also excluded if they are categorically ineligible for the TANF program, that is, if they do not have any children under age 18 in the family. In this study we assume that the family's assets are exogenous. Therefore families with assets that exceed the asset limit, described in Table 1, are excluded from the sample. We do not use income eligibility in selecting the sample because hours of work is an endogenous variable, that is, the family head's decision to earn an amount that causes the

TABLE 1. TANF asset limits

State	Asset Limits ($)	State	Asset Limits ($)
Alabama	2,000	Mississippi	1,000
Alaska	1,000	Missouri	5,000
Arizona	2,000	Montana	3,000
Arkansas	3,000	Nebraska	6,000
California	2,000	Nevada	2,000
Colorado	2,000	New Hampshire	2,000
Connecticut	3,000	New Jersey	2,000
Delaware	1,000	New Mexico	1,500
Dist. of Colombia	1,000	New York	2,000
Florida	2,000	North Carolina	3,000
Georgia	1,000	North Dakota	5,000
Hawaii	5,000	Ohio	1,000
Idaho	2,000	Oklahoma	1,000
Illinois	3,000	Oregon	2,500
Indiana	1,500	Pennsylvania	1,000
Iowa	5,000	Rhode Island	1,000
Kansas	2,000	South Carolina	2,500
Kentucky	2,000	South Dakota	2,000
Louisiana	2,000	Tennessee	2,000
Maine	2,000	Texas	2,000
Maryland	2,000	Washington	1,000
Massachusetts	2,500	West Virginia	2,000
Michigan	3,000	Wisconsin	2,500
Minnesota	5,000	Wyoming	2,500

Source: Gallagher et al. 1998.

family income to exceed the breakeven level is a matter of choice. We select whoever gets a higher wage as the family head in the case of married couple families, as it is more likely that the family member who receives a higher wage would work first. The resulting sample includes 6,404 families with low wealth. Of these, 58 percent are married couple families, and 78 percent live in metro areas.

All the dependent variables are defined for the month of November 1996. A family is recorded as a TANF participant if a member reports receiving TANF support in the month. For the labor supply, a family head is classified as not working if he or she reports working zero hours during the month and as working if he or she reports working at least one hour per week during the month. Variables used in our analysis include a set of demographic variables and a set of structural variables designed to capture differences in labor market conditions and transfer programs. The demographic variables for the family head include gender, education level, race, marital status, and experience, which is defined by age minus education minus 6. The set of individual characteristics include a metro variable that indicates that the family lives in a metro area versus nonmetro area, the state's monthly unemployment rate, unearned income, the number of children under age 6, and program participation choices. The wage rate is predicted and then used in the following analysis.

Table 2 displays the means and standard deviations of variables. The payment standard is the maximum TANF grant per month a participant can get if he or she is eligible for TANF. The actual TANF benefit a person can get depends on his or her participation in the labor force and income eligibility.

Table 3 shows the distribution of the dependent variables: labor market and welfare program participation. About 9 percent of the asset-eligible families receive a TANF grant, and 84 percent of them participate in the labor market. The workers are concentrated, at 81 percent of the sample, in the TANF nonparticipation cell. Ten percent of those in the sample do not work and do not participate in TANF; 6 percent do not work and participate in TANF; and 3 percent work and participate in TANF.

Before the estimation of the bivariate probit model of labor force and welfare participation, we estimate a wage equation for the family heads (if single family) and spouse (for married family), and then use the predicted wage as an instrument of the actual wage. The estimates of the wage equation are reported in Table 4. Added experience increases the family head's wage through increased labor productivity, holding other things equal. The wage equation is concave in relation to experience. One additional year of experience has the direct effect of increasing the wage by 5.4 percent. The findings on other variables are consistent with other studies. Being male increases the individual's wage. Individuals living in metro areas receive higher wage rates than those living in nonmetro areas.

TABLE 2. Definitions, mean, and standard deviations of variables (N=6,404)

Variable	Mean (Std. deviation)	Definition
Age	36.09 (8.74)	Age of family head
Education	12.25 (2.66)	Years of schooling of family head
Male	0.45 (0.5)	Dichotomous variable equal to 1 if family head is male
Married	0.58 (0.49)	Dichotomous variable equal to 1 if family head is married
White	0.75 (0.43)	Dichotomous variable equal to 1 if family head is white
Metro	0.78 (0.41)	Dichotomous variable equal to 1 if family head lives in metro
Kids6	0.71 (0.83)	Number of children under 6
Experience	18.26 (9.05)	Age-Education-6
Unemployment rate	5.25 (1.05)	Local state unemployment rate (%)
Nonlabor income	128.68 (344.06)	Family nonlabor income per month ($)
Wage	9.46 (1.99)	Predicted hourly wage ($)
Payment standard	445.00 (213.00)	Maximum TANF grant per month given participation ($)
BRR	0.53 (0.18)	The benefit reduction rate is the rate at which additional dollars of earned income reduce the amount transferred
Labor force participation	0.84 (0.37)	Dichotomous variable equal to 1 if family head works
TANF participation	0.09 (0.29)	Dichotomous variable equal to 1 if family head participates in TANF

TABLE 3. Distribution of the sample by labor supply and welfare participation

	Welfare Program (TANF)					
	Participation		No participation		All	
Work	199	3%	5,165	81%	5,364	84%
Not work	397	6%	643	10%	1,040	16%
All	596	9%	5,808	91%	6,404	100%

TABLE 4. Estimates of the log wage equation

Variables	Estimates
Intercept	1.140 (0.062)***
Education	0.054 (0.003)***
Male	0.246 (0.021)***
Metro	0.078 (0.012)***
Experience	0.021 (0.002)***
Experience squared	-0.0003 (0.0001)***
Lambda	-0.124 (0.049)***
R-square	0.22
F statistics	265.36
Number of observations	5,497

Notes: * Statistically significant at the 10% level. ** Statistically significant at the 5% level. *** Statistically significant at the 1% level. Standard errors are in parentheses.

Table 5 presents the full information maximum likelihood (FIML) estimates of the bivariate probit model of labor force and welfare participation. Variables, which enter directly into the family budget constraint, include the nonlabor income and TANF benefits. Nonlabor income includes all nonwage family income excluding income from any transfer programs. As expected, nonlabor income has a statistically significant negative effect on labor and TANF participation. Predicted wage has a statistically significant negative effect on TANF participation and a positive effect on labor force participation. As expected, a higher unemployment rate makes it difficult to find jobs and thus has a statistically significant negative effect on labor market participation and a positive effect on welfare participation. Having younger children increases the probability of TANF participation and decreases the probability of labor market participation. A TANF benefit (pay standard) would be expected to increase the probability of TANF participation and decrease the probability of labor force participation. The result is consistent with this, and the effect of a TANF benefit on both TANF participation and labor force participation is statistically significant.

Several variables are also included to capture the differences in taste and opportunities across families. The signs of these coefficients suggest that married families and

TABLE 5. Full information maximum likelihood estimates of the bivariate probit model

Variables	Labor Participation	TANF Participation
Intercept	0.255 (0.193)	-0.089 (0.241)
Married	-0.172 (0.051)***	-0.943 (0.079)***
Male	1.010 (0.095)***	-0.435 (0.115)***
White	0.149 (0.046)***	-0.381 (0.055)***
Experience	0.005 (0.006)	-
Experience squared	-0.038 (0.011)***	-
Kids6	-0.204 (0.028)***	0.201 (0.032)***
Educy	0.025 (0.015)	-0.009 (0.015)
Nonlabor income	-0.022 (0.028)***	-0.056 (0.007)***
Predicted wage	0.112 (0.029)***	-0.151 (0.031)***
Unemployment rate	-0.084 (0.022)***	0.056 (0.027)**
Pay standard	-0.040 (0.011)***	0.098 (0.014)***
BRR	-0.030 (0.121)	0.143 (0.150)
Rho (correlation coefficient)	-0.680 (0.022)***	

Notes: * Statistically significant at the 10% level. ** Statistically significant at the 5% level. *** Statistically significant at the 1% level. Standard errors are in parentheses.

those whose family head is white are less likely to participate in TANF. White or male family heads are more likely to participate in the labor market while married family heads are less likely to work. Having children increases the probability of TANF participation and decreases the probability of labor market participation.

The cross-equation correlation between the labor supply and TANF participation decisions is –0.68 and statistically significant. This is an indirect indication that the two decisions are related through the error term.

Table 6 presents the estimates of marginal effects in the bivariate probit model. In the labor supply equation, being a married family head has the strongest negative effect and being a male-headed family has the strongest positive effect on the probability of labor market participation given TANF participation. The presence of one additional

TABLE 6. Marginal effects in the bivariate probit model

	Direct	Indirect	Total	Std. Error
Labor supply				
Married	-0.0843	-0.2792	-0.3636	0.0266***
Male	0.4963	-0.1287	0.3676	0.0503***
White	0.0734	-0.1129	-0.0395	0.0234*
Unemployment	-0.0415	0.0165	-0.0249	0.0110**
Experience	0.0027	0	0.0027	0.0027
Experience squared	-0.0188	0	-0.0188	0.0055***
Kids6	-0.1002	0.0337	-0.0406	0.0114***
Educy	0.0121	-0.0028	0.0094	0.0078
Nonlabor income	-0.0107	-0.0166	-0.0273	0.0028***
Wage	0.0550	-0.0448	0.0101	0.0156*
Pay standard	-0.0194	0.0423	0.0096	0.0056*
BRR	-0.0149	0.0423	0.0274	0.0619
TANF participation				
Married	-0.0423	-0.0029	-0.0452	0.0047***
Male	-0.0195	0.0170	-0.0025	0.0048
White	-0.0171	0.0025	-0.0146	0.0026***
Unemployment	0.0025	-0.0014	0.0011	0.0011
Experience	0	0.0001	0.0001	0.0001
Experience squared	0	-0.0006	-0.0006	0.0002***
Kids6	0.0090	-0.0034	0.0056	0.0013***
Educy	-0.0004	0.0004	0.00000	0.0007
Nonlabor income	-0.0025	-0.0004	-0.0029	0.0004***
Wage	-0.0068	0.0019	-0.0049	0.0014***
Pay standard	0.0044	-0.0007	0.0037	0.0007***
BRR	0.0064	-0.0005	0.0059	0.0064

Note: * Statistically significant at the 10% level. ** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

child under age 6 would decrease the probability of working by 4 percent. Nonlabor income has a significant negative effect and wages have a significant positive effect on the probability of working; both nonlabor income and wages have statistically significant negative effects on the probability of welfare participation. In the TANF participation equation, most variables seem to have relatively smaller effects on the probability of TANF participation given labor market participation. This implies that if family heads work, it makes relatively less difference whether or not they participate in TANF.

The FIML estimates of the nested logit model are presented in Table 7. The estimated coefficients are interpreted with respect to the "no labor–no TANF

TABLE 7. Full information maximum likelihood estimates of nested logit model

Coefficients	Estimates
α_{yy}	2.818 (10.894)
α_{yn}	3.687 (10.875)
α_{ny}	1.187 (0.424)***
β_b	0.040 (0.034)
β_r	0.001 (0.003)
$\gamma_{W,l}$	0.060 (0.189)
$\gamma_{W,t}$	-0.263 (0.036)***
$\gamma_{M,l}$	0.891 (2.651)
$\gamma_{M,t}$	-1.481 (0.191)***
$\gamma_{C,l}$	0.035 (0.136)
$\gamma_{C,t}$	0.271 (0.049)***
$\gamma_{N,l}$	-0.115 (0.333)
$\gamma_{N,t}$	-0.117 (0.017)***
$\gamma_{U,l}$	-0.099 (0.311)
$\gamma_{U,t}$	0.065 (0.039)*
IV_{work}	0.853 (2.486)
$IV_{no\ work}$	3.260 (0.772)***
Log likelihood	-3707.024

Notes: * Statistically significant at the 10% level. ** Statistically significant at the 5% level. *** Statistically significant at the 1% level. Standard errors are in parentheses.

participation" category. Higher wages lead to less participation in TANF ($\gamma_{W,t}$) and, although not statistically significant, make family heads work more ($\gamma_{W,l}$). The coefficients on TANF benefits (β_b) and *BRR* (β_r) are not statistically significant. Male family heads tend to work more ($\gamma_{M,l}$) and participate less in TANF ($\gamma_{M,t}$). Families with more young children (under age 6) participate more in TANF($\gamma_{C,t}$). Family heads with more unearned income participate less in TANF ($\gamma_{N,t}$) and, although not statistically significant, tend to work less ($\gamma_{N,l}$). The unemployment rate has a positive and statistically significant effect on the probability of TANF participation ($\gamma_{U,t}$).

Elasticities for the relationship between the TANF benefit and wages and the probability of choosing alternative *lt* (labor supply and TANF participation) are reported in Table 8. A 10 percent increase in the pay standard will increase by 1.60 percent the probability of the choice to participate in the labor market and in TANF (L-T), while a 10 percent increase in the wage will increase by 4.72 percent the probability of that choice. The elasticity with respect to the (predicted) wage is quite large in the choice in which the family has determined not to work and to participate in TANF (N-T). An increase in the wage by 10 percent decreases the probability of this choice (N-T) by 28.35 percent. This result suggests the importance of improved wages for moving families into the labor force and away from welfare program participation.

TABLE 8. Elasticities of labor supply and TANF participation decisions with respect to pay standard and wages

	Direct Elasticities
Pay standard	
L-T	0.160
L-N	0.025
N-T	0.261
N-N	0.370
Wages	
L-T	0.472
L-N	0.071
N-T	-2.835
N-N	n/a

Notes: L-T is choice to work and to participate in TANF. L-N is choice to work and not to participate in TANF. N-T is choice not to work and to participate in TANF. N-N is choice not to work and not to participate in TANF.

Conclusions

This study analyzes the labor force and welfare participation choices made by low-wealth families and the effect of the 1996 welfare reform on the labor supply decisions of these families. Two models were estimated: the bivariate probit and the nested logit models. From the bivariate probit model we found evidence of endogeneity: the two choices (labor supply and program participation) are related through the error term, and the correlation is negative and statistically significant.

The estimates from the nested logit model of the joint household choices indicate that higher wages increase labor force participation and decrease welfare program participation; an increase in nonlabor income decreases both labor and welfare participation. These results support strategies for improving wages and other nonlabor income for low-resource families as a means to reduce their reliance on welfare programs.

Endnotes

1. Maddala (1983) presents an extensive discussion of limited-dependent and qualitative-variable models in econometrics.

2. The term B_{lt} is the maximum TANF grant per month; BRR is the benefit reduction rate, the rate at which additional dollars of earned income reduce the TANF benefit.

References

Gallagher, J., M. Gallagher, K. Perese, S. Schreiber, and K. Watson. 1998. “One Year After Welfare Reform: A Description of State Temporary Assistance for Needy Families (TANF) Decisions as of October 1997.” Research Report #307472. The Urban Institute, Washington, DC. May.

Green, W. 2000. *Econometric Analysis*, 4th ed. Englewood Cliffs, NJ: Prentice-Hall.

Hagstrom, P. 1996. “The Food Stamp Participation and Labor Supply of Married Couples: An Empirical Analysis of Joint Decisions.” *Journal of Human Resources* 31(2, Spring): 383-403.

Hensher, D., and W. Green. 2000. “Specification and Estimation of the Nested Logit Model: Alternative Normalisations.” Mimeo. February.

Keane, M., and R. Moffitt. 1998. “A Structural Model of Multiple Program Participation and Labor Supply.” *International Economic Review* 39(3): 553-89.

Maddala, G.S. 1983. *Limited-Dependent and Qualitative Variables in Econometrics*. Cambridge: Cambridge University Press.

Moffitt R. 1992. Incentive Effects of the U.S. Welfare System: A Review.” *Journal of Economic Literature* 30(March): 1-61.

Rowe, G. 2000. “State TANF Policies as of July 1999.” In *Welfare Rules Databook*. The Urban Institute, Washington, DC. November.