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**THE EFFECTS OF MINIMUM WAGES
ON WELFARE RECIPIENCY**

by

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Abstract

“The Effects of Minimum Wages on Welfare Reciprocity”

In his 1999 State of the Union Address, President Clinton again called for an increase the federal minimum wage from \$5.15 to \$6.15 per hour. And once again business groups and some economists argue that raising the minimum wage hinders the employment prospects of low-skilled workers. Not surprisingly, most welfare recipients are low-skilled (Ellwood 1986). The impact of raising the minimum wage in the wake of welfare reform, when the government is trying to move welfare recipients--predominately less-skilled women with children--into employment may be particularly strong. Alternatively, higher minimum wages may naturally draw women off welfare into employment--welfare reform and a higher minimum wage may be complementary.

This study examines the relationship between the minimum wage and welfare reciprocity. Using the 1990 and 1991 Survey of Income and Program Participation (SIPP), I examine the effect minimum wages have on welfare participation at a point in time (static models), and use discrete time hazard models (dynamic models) to assess whether minimum wages affect welfare dynamics--the propensity of exiting and of entering Aid to Families with Dependent Children (AFDC), the predecessor to Temporary Aid to Needy Families (TANF). The main independent variable, effective minimum wage (defined as the higher of state and federal minimum wages lagged by three months) varies over time and across states. Controlling for an array of time variant and time-invariant factors, static models predict that the proposed minimum wage increase would significantly reduce welfare participation by almost 10 percentage points (or 45 percent). Dynamic models predict that the proposed minimum wage would increase welfare exit rates by 0.7 percentage points (or 15 percent) and would reduce welfare entry rates by 1.7 percentage points (or 46 percent).

I. INTRODUCTION

Welfare reform legislation signed into law in 1996 requires states to move most of their welfare recipients into either government-sponsored employment activities or private-sector employment. In the wake of welfare reform, nominal minimum wages have increased at the federal and state levels. The Clinton Administration raised the federal minimum wage by 90 cents to its current \$5.15 per hour beginning in September, 1997. Most recently, the Administration proposed to increase the federal minimum wage again by \$1 over two years, to \$6.15 per hour. As of January 1999, nine states had minimum wages that exceeded the current federal minimum wage of \$5.15 per hour. Surprisingly, few studies have focused on the effect minimum wage increases might have on welfare reciprocity (for exceptions see Bernstam and Swan 1986; Nakosteen and Zimmer 1989; Martin and Giannaros 1990; and Page, Spetz, and Millar 1998).

Some economists and policy makers believe that a higher minimum wage will enlarge welfare rolls because employers would hire fewer low-skilled workers. This is possible given that most welfare recipients are low-skilled and have less work experience than nonwelfare recipients. While economic theory and numerous empirical studies in the literature suggest that minimum wages reduce employment opportunities for low-skilled workers little empirical research has examined how minimum wages affect welfare reciprocity. Employment is one of the main routes off of welfare.

On the other hand, proponents of a minimum wage increase argue that it would create an incentive for single mothers *not* to take up welfare and for current welfare recipients to leave welfare and to find work. Pavetti (1993) found that some women

wanted to make the transition from welfare to work, but felt that the wages were not high enough to cover the costs associated with work (e.g., child care, transportation costs, and the reduction and loss of housing benefits). She found that when welfare mothers took account of these additional expenses many low-wage jobs did not pay enough for welfare recipients to leave welfare for the labor market. Some economists and policy makers contend that a higher minimum wage would reduce welfare reciprocity because higher wages make work worthwhile (i.e., parents could then earn enough to cover the costs associated with work).

Given these conflicting viewpoints, more research about the effects of minimum wages on welfare reciprocity is necessary. This paper contributes to the minimum wage debate by empirically testing the hypothesis that minimum wage increases influence welfare reciprocity.

This project contributes to the literature because of the data used to study transitions in welfare reciprocity--the 1990 and 1991 Survey of Income and Program Participation. The data set includes a measure of monthly AFDC participation as well as a comprehensive set of demographic and family characteristics. In addition, I am able to analyze the effect minimum wages have on AFDC participation over time because these data are longitudinal--respondents are followed for up to 2½ years.

In the next section, I discuss the current knowledge about the effects of the minimum wage on welfare participation. This is followed by a further discussion of the methods and data. I then present empirical findings from cross-tabulations and multivariate analyses. The last section summarizes my findings and discusses the possible policy implications.

II. BACKGROUND

Conceptual models of welfare use, based on a discrete choice framework, suggest several reasons why minimum wages might be important. In general, models of welfare participation assume that a woman on welfare chooses between staying on or exiting welfare via a job or marriage. In these discrete choice models, a woman chooses the option that maximizes the present value of her expected future utility given her current constraints.¹

Based on this theoretical framework and earlier empirical research, welfare reciprocity depends on the value of the welfare option relative to job or marriage options through time. Employment and marriage opportunities in turn depend on (a) local labor market conditions (including unemployment rates, the cost-of-living, and minimum wage levels); (b) policy parameters such as the welfare benefit level; and, (c) personal characteristics such as age and education, number and age of children, the availability of other income (e.g., child support).

Most studies have found that welfare reciprocity is closely linked to factors that influence the relative attractiveness of work over welfare. For example, using the National Longitudinal Study of Youth (NLSY), Pavetti (1993) found that almost half of exits from welfare occurred when women entered the labor force. Harris (1991), examining data from a longitudinal survey of teenage mothers in Baltimore, reported that almost two-thirds of welfare spells ended through work. On the other hand,

¹The expected returns on these options can vary through time, as job offers are obtained producing a sequence of decisions giving rise to spells. See Wallace (1998) for a theoretical and empirical discussion of how welfare recipients go about searching for job and marriage offers.

Ellwood and Bane (1983), using annual data from 1968-1979 from the Panel Study of Income Dynamics (PSID), found that earnings gains accounted for only 21 percent of all exits, and that most welfare entries are prompted by changes in marital status, rather than changes in earnings or employment status.

Local Labor Market Conditions. Politicians and policy analysts typically attribute some of the recent reductions in welfare case loads to historically low levels of unemployment and steady wage growth. Yet, until recently these labor demand factors had received little attention in the literature. It is important that policy analysts as well as politicians understand the link between local labor market conditions and welfare utilization.

Recent studies have used local labor market conditions measured at the metropolitan area, census tract, and zip code levels in assessing how local labor market conditions affect welfare participation. For example, Hoynes (1996) used administrative data from California to examine the effect demographic characteristics, local labor market variables, neighborhood characteristics, and fixed time and county have on the probability of a welfare exit. She found that higher unemployment rates, lower employment growth, lower employment to population ratios, and lower wage growth were associated with longer welfare spells. Similarly, Fritzgarld (1995) used the SIPP merged with county and Labor Market Areas (LMA) and found that higher unemployment rates reduced welfare exit rates, especially for blacks. Specifically, he found a 2.7 percentage point increase in the local unemployment rate would reduce the welfare exit rate for blacks by 11.3 percentage points, but only by 3.6 percentage points for whites.

Surprisingly, a scant amount of research has examined the effect state or federally mandated wage floors--minimum wages--have on welfare reciprocity. Economic theory suggests that increasing the minimum wage has an ambiguous effect on welfare reciprocity. First, assuming employers typically hire fewer workers when the price of labor increases holding worker productivity constant, a higher minimum wage would reduce employment opportunities for low-skilled workers and new labor force entrants. Theory suggests that workers are paid a wage equal to their contribution to a firm's revenue, so an increase in wages which does not result from market forces would cause firms to reduce the number of people they employ or would force employers to hire more highly skilled workers. Second, assuming workers typically respond to higher wages by increasing labor force participation and hours worked, a higher minimum wage is assumed to increase labor market participation. Given these two offsetting theories, empirical evidence is needed to identify how minimum wages actually affect welfare reciprocity.

Moreover, economic theory suggests that single mothers are disproportionately vulnerable to the effects of minimum wages. In a review of the minimum wage literature, Wellington (1991) stated that demographic groups with a high proportion of workers earning the minimum wage or less may face more severe disemployment effects than other demographic groups. If minimum wages reduce employment opportunities for the low-skilled, they may also increase welfare entries and/or reduce welfare exits. Not surprisingly, a disproportionate number of single mothers, particularly those reliant on welfare, are not employed or they worked at wages less than \$6.15 per hour, the proposed minimum wage.

Public Assistance Policies. The conceptual model briefly described above suggests that welfare participation increases with welfare benefit levels. In a review of the welfare literature, Moffitt (1992) found near uniformity in the empirical effect of welfare benefit levels on welfare participation in both static and dynamic models.² For example, Fitzgerald (1991) show that welfare benefit levels had a negative effect on welfare exit rates.

A number of studies (e.g., Pavetti 1993) also control for residence in government assisted housing (i.e., public housing or section 8). Women who live in government assisted housing face higher marginal tax rates on their earned income than women who live in private-sector housing because they lose a fraction of their subsidy as their earnings rise. Thus, theory suggests that those living in government assisted housing are less likely to leave welfare, all else equal. Using the National Longitudinal Study of Youth (NLSY), Pavetti found mixed evidence for this: living in government assisted housing had a positive effect on the probability of returning to welfare but had a statistically insignificant effect on welfare exit rates.

Personal Characteristics. Studies in the literature have also found that women who leave welfare for work typically earn more than the minimum wage upon leaving welfare, have earned at least a high school degree, and have had work experience. For example, a sample of employers participating in the Welfare-to-Work Partnership reported hiring welfare recipients at an average starting wage of \$7.20 per hour. And

²In static models welfare participation is measured in a point in time. And in dynamic models most studies examine the determinants of exiting welfare, although a few also study the determinants of welfare entry.

nearly one out of five of these companies typically hire former welfare recipients for salaried positions with an average annual salary of \$17,000. When asked about their requirements for entry-level positions 40 percent of employers in a recent survey reported requiring prior work experience (Regenstein, Meyer, and Hicks 1998).

Most of the studies in the literature have found that having more children, preschool-aged children and being never-married were associated with longer welfare spells. For example, O'Neill et al. (1984) finds that having a young child significantly decreases the likelihood of leaving welfare. And Ellwood (1986) finds that young never-married mothers as being at the greatest risk of long-term welfare dependency. He found that more than half of women who ever reported receiving welfare in the NLSY were never married mothers when initially interviewed. Many of these mothers had little preparation for entering the labor force. Just over half of these young mothers had completed high school or received a GED before their entry into the welfare system; and, 49 percent had not worked in the 12 months prior to first receiving welfare.

Single Mothers and the Proposed Minimum Wage Hike. Data from the Bureau of Labor Statistics (BLS) shows that single mothers with resident children less than 18 years old makeup a small portion of the population who would likely be affected by the proposed minimum wage hike. Figure 1 indicates that these single mothers represent only 3.4 percent of respondents 16 years and older, making less than \$6.15 an hour. Nearly half (45.8 percent) of those directly affected by the proposed minimum wage increase are *other* adult women (single women without children, married women with children, or married women without children). As a percentage of hourly workers, single mothers also comprise a small portion of minimum wage workers (3.4 percent),

see Figure 2.

While single mothers with resident children make up only a fraction of the low-wage workers, the majority of these single mothers earn less than \$6.15 per hour. BLS data indicate that 68 percent of single mothers earned \$6.15 per hour or less in March 1998 (see Figure 2).³ And, 88 percent of single mothers who received welfare during the previous year earned \$6.15 per hour or less the following year (71 percent were not employed, and the remaining 17 percent were employed at hourly wages less than \$6.15 per hour). Approximately 33 percent have been married (currently separated, divorced, or widowed), while the remaining 67 percent have never been married. About 37 percent of single mothers earning less than \$6.15 per hour were the sole bread winners in their families. In addition, 36 percent of single mothers making less than the proposed minimum wage had family incomes below the poverty level during the previous year.

Unfortunately, even if these women all remain employed, the proposed minimum wage hike would not lift many of their families out of poverty. For example, a mother working full-time earning \$6.15 an hour to support two children earns \$10,760 per year, \$2,170 below the poverty line.⁴ Nonetheless, proponents of a minimum wage increase contend that increasing the minimum wage by \$1.00, to \$6.15, would narrow the gap

³In comparison, 69 percent of all teenagers earned \$6.15 per hour or less.

⁴Full-time workers are assumed to work 35 hours per week for 50 weeks. The poverty threshold in 1997 was \$12,931 for a three-person family (with two children). If she worked 40 hours per week and 52 weeks per year her earnings would still be under the poverty line. Note, however, that she could receive over \$3,600 from the federal earned income credit.

between the low-skilled workers' hourly earnings and a livable wage. A recent Urban Institute study (Acs et al. 1998) shows that a higher minimum wage combined with the Earned Income Tax Credit (EITC) makes work a more viable alternative for welfare recipients.

Recent research suggests that minimum wage increases can increase parents' earnings who leave welfare for work. Using data from Oregon's welfare agency, Lazere (1998) noted that parents who moved from welfare to work earned more following a minimum wage hike from \$4.75 an hour to \$5.50 an hour in January 1997 and then to \$6.00 an hour in January 1998. In the last quarter of 1997, for example, Lazere found that nearly one-third of the welfare recipients who found work earned the state's new minimum wage of \$5.50 an hour. He also found that Oregon's minimum wage increases boosted the earnings of many who found jobs paying slightly above the minimum wage.

III. DATA AND METHODS

The main data sets for this study are the 1990 and 1991 *Survey of Income and Program Participation* (SIPP). From the SIPP, one can draw a nationally representative longitudinal sample of female-headed households. These data contain detailed information on women's program participation (e.g., Aid to Families with Dependent Children), human capital, family composition, demographic characteristics, as well as information on the state in which they live. As such, it is an excellent data source for investigating the effect of state and federal minimum wages on welfare reciprocity. Respondents were interviewed every four months, and they answered questions about

activity in the previous four months. Each respondent was interviewed eight times, generating 32 months of data. The 1990 SIPP panel includes 23,627 households and spans October 1989 to August 1992. And the 1991 SIPP panel includes 15,626 households and spans October 1990 to August 1993.⁵

These data are uniquely suited for this analysis for a number of reasons. First, they contain detailed information on program participation reported on a monthly basis for a two and a half year span. Second, they incorporate detailed demographic characteristics and family background. Table 2 lists variable definitions.

The data set, however, has some important limitations. First, SIPP does not uniquely identify nine states: Alaska, Idaho, Iowa, Maine, Montana, North Dakota, South Dakota, Vermont, and Wyoming. Only 2.6 percent of the average monthly AFDC-Basic caseload in 1990 resided in these states. However, six of these states had state minimum wages that exceeded the federal minimum at sometime between 1989 and 1993. Unfortunately, respondents in these states are not included in our analysis. Second, SIPP only follows respondents for 2½ years and because we limit our observations to respondents who begin their spells during the span of the panel for use in the hazard models, we cannot fully gauge the effect minimum wage increases have on long-term welfare participation. Third, the smallest geographic identifier in the SIPP public-use files' is the state of residence. As a result, I am unable to gauge the influence that local labor market conditions--measured at the SMSA, county, or

⁵The SIPP uses a rotating, staggered interview design whereby one fourth of the sample is interviewed each month. Thus the calendar time span of the panel exceeds 32 months, but not all persons are interviewed at the ends.

neighborhood level--have on welfare reciprocity. Several studies (i.e., Fitzgerald and Hoynes) used datasets that contained more precise geographic identifiers. To the extent that minimum wages and labor market conditions vary intra-state, this study does not properly gauge their effects on welfare reciprocity.

Welfare Participation. Similar to Fitzgerald (1995) and others, I code welfare participation as either receipt of AFDC or general assistance during each month of the SIPP panel. This definition includes women who misreport their AFDC receipt as general assistance, a well documented problem in the SIPP (Marquis and Moore 1989).

Local Labor Market Condition. Congress amended the Fair Labor Standards Act in 1989, mandating a federal minimum wage increase in two increments--from \$3.35 to \$3.80 per hour effective April 1990, and from \$3.80 to \$4.25 effective April 1991. In addition, a number of states had minimum wages above the federal minimum. Employers in each state must pay workers the higher of the state and federal minimum wages, or the effective minimum wage. These data were reported monthly and were merged onto the SIPP panels at the state-level lagged by three months. The effective minimum wage is lagged by three months because I assume respondents do not react instantaneously to changes in minimum wages and it may take three months for respondents to find out about and respond to the new wage floor. For example, in these data, respondents' welfare participation in January 1991 is assumed to be a function of the effective minimum wage in October 1990. Table 1 shows that 19 states increased their minimum wages beyond the federal minimum wage between 1988 and 1993. Ignoring changes in the federal minimum wage, on average these states increased their minimum wages by 8.4 percent.

I use state-level unemployment rates and average manufacturing wage rates to characterize local labor markets. Unemployment rates measure the states' labor demand, while average manufacturing wage rates measure the cost-of-living. During wave 1 in the SIPP panels, the average unemployment rate was 6.3 percent and the average manufacturing wage was \$10.89 per hour.

Public Assistance Policies. State welfare benefit levels were obtained from Congressional publications, the Green Book (1990, 1991, 1992, 1993). In contrast to some other studies, I did not adjust the welfare benefit level for each respondents' family size. Instead, I used benefit levels that correspond to a family of 3 for each state, thus avoiding the possible endogeneity welfare benefit levels and changes in family structure that usually lead to changes in welfare participation.

IV. EMPIRICAL RESULTS

I used nationally representative data and three different statistical methods in determining whether the proposed minimum wage increase influences welfare participation. First, I examine the correlation between time-series data on single mothers' welfare participation rates and inflation adjusted federal minimum wages. Second, I used multivariate econometric models and a nationally representative sample of female heads of household from the SIPP to examine whether minimum wages (this time, federal and state minimum wages) affect welfare participation at a point in time. Third, I used dynamic models--discrete-time hazard models--and subsamples of single mothers from the SIPP to determine whether minimum wages affect transitions on and off of welfare.

Findings.

- Time-series data suggest that higher minimum wages are correlated with higher rates of welfare participation.
- Static econometric models predict that the proposed \$1 minimum wage hike would significantly reduce welfare participation rates.
- Discrete-time hazard models predict that the proposed minimum wage increase would increase the likelihood of leaving welfare and significantly lower the probability of entering welfare.

Time Series Correlations. Figure 3 graphs welfare participation rates and inflation-adjusted federal minimum wages from 1980 to 1997. Welfare participation rates are defined as the number of AFDC-Basic families divided by the number of female headed households with resident children less than 18 years old. Real federal minimum wage rates are calculated by dividing nominal federal minimum wage rates by the Consumer Price Index (CPI), where the CPI equals one in 1997. This graph shows that there is a positive correlation between inflation-adjusted federal minimum wages and welfare participation rates. Specifically, the correlation coefficient between these two time series is +0.5. However, these time-series and the correlation coefficient do not account for other confounding factors (i.e., business cycle effects, welfare benefit levels, and changes in societal stigma related with welfare participation). Therefore, this positive correlation between minimum wages and welfare participation should be viewed with caution and is only intended to be suggestive.

Static Models. I identified a sample of single mothers heading households during the last reference month in wave 1 in both the SIPP panels to estimate a static model of whether minimum wages affect welfare participation. The dataset includes

2,737 respondents of which nearly 30 percent received welfare. I defined female heads as unmarried adult women with resident children less than 18 years old. This population had the following characteristics: half were nonwhite, a third had never been married, 40 percent had preschool-aged children, 26 percent did not have a high school degree, 40 percent had a high school degree, and 34 percent had at least some college education. Almost 60 percent had recent work experience and 15 percent had either a physical or mental disability. And, one out of ten lived in government assisted housing (i.e., public housing or Section 8). See Table 3.

The basic choice model of welfare participation posits that female heads of household choose whether to participate by comparing utility on and off welfare. Multivariate probit models are used to estimate how minimum wages influence the probability of receiving welfare.⁶ These models assume a latent variable structure of the form:

$$W_{ij}^* = \alpha L_j + \beta X_i + \xi_{ij}$$

where W_{ij}^* is the net benefit of receiving welfare. We observe that $w_{ij}=1$ if $W_{ij}^* \geq 0$, indicating individual i received welfare, otherwise $w_{ij}=0$. L_j is a vector of variables measuring the effective minimum wage, manufacturing wages, unemployment rates, and welfare benefit levels for state j . X_i is a vector of variables measuring age, marital history, family structure, educational attainment, work experience, and family income and transfers. The term ξ_{ij} is a standard normal random error term. Female head i 's

⁶These models do not disentangle the possible differential effect minimum wages may have on welfare eligibility and receipt conditional on eligibility.

probability of receiving welfare is $\Phi(w_{ij}=1)$, where $\Phi(\cdot)$ is the cumulative distribution function. Marginal effects for each explanatory variable were calculated using population means. Population means and marginal effects are listed in Table 3.

My results indicate that minimum wages reduce welfare participation. For example, a \$1 increase in the effective minimum wage is predicted to lower welfare participation by 13 percentage points, or 45 percent.⁷ To obtain a similar effect, *other* family income (e.g., child support) would have to increase by more than \$4,000 a year.

Consistent with the earlier welfare literature, the other independent variables had predicted effects on welfare participation. Table 3 shows that nonwhites, never married mothers, those with more children, the less educated, those who had received welfare during the previous year, mothers living in government assisted housing, and those with less work experience were more likely to receive welfare. For example, nonwhite mothers were 5 percentage points more likely to receive welfare than white mothers. Mothers who had not worked during the past year were 16 percentage points more likely to be on welfare than those who had recent work experience. And, mothers living in government assisted housing were 9 percentage points more likely to be on welfare than mothers in assisted housing. In addition, higher welfare benefit levels are correlated with higher welfare participation rates.

Dynamic Models--Welfare Exit. Some policy makers and economists contend that a minimum wage hike would reduce employment opportunities for low skilled

⁷The percentage point change, or marginal effect, is calculated by multiplying the regression coefficient by the probability density function. The probability density function is calculated using population means. The percentage change is calculated by dividing the percentage point change by the average welfare participation rate.

workers and make it more difficult for welfare recipients to leave welfare by finding jobs. Others in turn argue that higher minimum wages make work relatively more attractive than welfare and thus reduces welfare participation. Here I use a nationally representative sample of single mothers initially receiving welfare and discrete time hazard models to examine whether minimum wages affect their likelihood of leaving welfare. I then use competing risk models to determine whether a higher minimum wage influence welfare-to-work transitions because of higher hourly wage rates in the low-skilled labor market.

Cross-tabulations and multivariate econometric models below suggest that the proposed minimum wage hike would stimulate welfare exits but would not significantly boost earnings-related welfare exits.

Table 4 shows that there were 16,563 welfare spells in the data, of which 15,961 (96 percent) were on-going at the beginning of the survey (left-censored) and 181 (1 percent) were on-going welfare spells at the end of the survey (right-censored). The last column in Table 4 lists the 421 completed spells that I observe the beginning and ending. Nearly a third of them end within 4 months, while more than three fourths end within 16 months after they start. The mean length is 10.1 months, overall, and was 5.9 months for completed spells.

Table 5 shows that welfare recipients in states that increased their minimum wage above the federal minimum wage (binding state minimum wage) had shorter welfare spells than recipients in states that had state minimum wages lower than the federal minimum (nonbinding state minimum wage). In particular, the average spell

length for welfare recipients in states with binding minimum wages was 9.3 months, but was 10.2 months for those in states with non-binding state minimum wage. This result may be attributable to higher minimum wages or to other confounding factors such as a strong economy. Multivariate econometric models are needed to disentangle the effect minimum wages, controlling for other confounding factors, have on welfare exits.

Minimum wage's influence on the decision to stop receiving welfare can be estimated using discrete time hazard models. These models exclude respondents who had on-going welfare spells at the beginning of the survey (i.e., the 15,961 observations that are left-censored). Such models estimate the probability that an event (in this case, welfare nonparticipation) occurs at a specific time, given that it has not already occurred. Using a standard logistic parameterization of the hazard rate, I can express the probability that a female head stops receiving welfare in a given month conditional on her received welfare during the previous month, and on local labor market conditions, and on her demographic characteristics as:

$$Exit(t) = Pr[w_{ijt} | w_{ijt-1} = 1; L_{jt}, X_{it}] = \frac{e^{\alpha L_{jt} + \beta X_{it}}}{1 + e^{\alpha L_{jt} + \beta X_{it}}} \quad (2)$$

where $Exit(t)$ is the probability of welfare nonparticipation in month t , α and β are vectors of coefficients to be estimated, and L_{jt} and X_{it} are the full set of explanatory variables, similar to the static model above. In contrast to the static model, this specification allows time-variant factors to influence a female heads' welfare participation decision over time. The unit of observation is a person-month: each female head enters the sample, at risk of exiting welfare, until she exits welfare, gets

married (spouse present), no longer has resident children less than 18, or is censored.⁸ These discrete time hazards models are estimated by compiling all “at risk” person-months and running a standard logit regression.⁹ Similar to the static model above, explanatory variables include measures of the local labor market (i.e., effective minimum wage, state manufacturing wages, unemployment rates, and AFDC benefit levels), and respondents’ demographic characteristics (i.e., age, marital history, family structure, educational attainment, work experience, and family income and other program participation). With the exception of the minimum wage variables, all time-varying variables take on their appropriate month t values.

Empirical evidence from these models indicate that President Clinton’s proposed minimum wage increase would increase welfare exit rates. Table 6 show that the effective minimum wage lagged by three months has a positive, but statistically insignificant effect on welfare exits. Specifically, a \$1 increase (1 unit change) in the

⁸The SIPP collects monthly data by interviewing respondents every four months and asking them retrospectively about the time since the last interview. Previous research has shown that this survey structure can lead to inaccurate reporting of the timing of events within the recall period because people are more likely to report the same answer for the entire four-month period. This problem is often called “seam bias.” The analysis presented below does not attempt to test or counteract possible seam bias. Later versions of this paper will test for seam bias and will take appropriate steps to account for seam bias if it is detected.

⁹Standard logit models assume independence across observations; however, person-month observations are not independent of one another, and unchanging background characteristics do not vary across person-month for the same person. Thus, the actual number of degrees of freedom is lower than the number of person-months, and the estimated standard errors on regression coefficients tend to be too small. As such, estimated coefficients that appear to be statistically significant should be viewed cautiously while inferences of statistically insignificant differences are, in general, valid.

effective minimum wage is estimated to increase welfare exits by 0.7 percentage points, or 15 percent. However, the coefficient is statistically indistinguishable from zero because the lower bound of the marginal effect's confidence interval at the 95% level is negative, -0.012.

Other labor market and demographic characteristics had the expected effects on welfare exits. For example, lower welfare exit rates are associated with never being married, more children, higher welfare benefit levels, and living in government assisted housing. And welfare mothers who are older, who have more *other* family income (e.g., monthly child support payments), and work experience are more likely to leave welfare than those who are younger, have less family income, and less work experience, all else equal.

Several independent variables had unexpected signs. For instance, having at least one preschool child is positively correlated with a welfare mother's chances of leaving welfare compared with an otherwise similar welfare mother without a preschool child. Being on welfare with older children may be correlated with unobservable disabilities or soft-skills. As a result, our estimates may incorrectly suggest that having older children is correlated with lower welfare exit rates but in actuality unobserved disability and the lack of soft-skills are negatively correlated with welfare exits.

Women leave welfare for a variety of reasons, including work, marriage and loss of eligibility through a youngest child turning 18 or leaving the household. Given the emphasis on women going to work under TANF, I am particularly interested in estimating the effect of minimum wages on leaving welfare to work versus leaving welfare for other reasons. As stated previously, economic theory suggests that the

effect of minimum wages on welfare participation is ambiguous, but its effect on employment is unambiguously negative.

For the purposes of this analysis I model two means by which a welfare spell can end. First, a spell can end because of an increase in earned income. A welfare spell is coded as ending because of an increase in earnings if during either of the first two months off of welfare, earnings exceeded earnings during the last month on welfare by more than \$50. Secondly, a spell can end because of some reason other than an earnings increase.¹⁰

Competing risk models are used to identify how and perhaps why respondents exit welfare in response to a minimum wage hike. A quarter of spells end following an increase in personal earnings of at least \$50 per month. While 42 percent of spells end for other reasons (these include marriage exits and eligibility exits). The remaining welfare spells were on-going at the end of the survey.

Results from competing risk models are presented by simulating the effect a \$1 minimum wage increase would have on the probability of being in each of these states: an earnings-related welfare exit, other welfare exit, and no welfare exit. The probability of being in each of these states is first calculated by using population means, including the population mean for the effective minimum wage (No Hike). The probabilities are re-estimated using population means for all the independent variables except for the effective minimum wage. Instead, I use the effective minimum wage's population mean

¹⁰Other studies typically include marriage as a route off welfare. However, there are not enough marriage exits in the SIPP to adequately estimate the influence of minimum wages on welfare exits due to marriage.

plus \$1 (\$1 Hike). Standard errors are then calculated to determining if these resulting simulations are statistically different. See the Technical Appendix.

Simulations in Table 7 show that minimum wages have a qualitatively small and statistically insignificant effect on welfare exits attributable to higher earnings but do significantly increase welfare exits. Simulations based on a \$1 minimum wage increase suggest that earnings related welfare exits would increase by only 0.1 percentage points, from 1.5 percent to 1.6 percent. However, this change is not precisely estimated. At the 95% significance level the change in the estimated probabilities is between -0.23 and +0.23.

Only two independent variables used in this analysis are estimated to have a statistically significant effect on the probability of an earnings related welfare exit: work experience and living in government assisted housing. A higher minimum wage is estimated to increase earnings related welfare exits for women with recent work experience compared with otherwise similar women without work experience. And living in government assisted housing is estimated to lower a woman's chances of having an earnings related welfare exit.

Similar to the earlier bivariate models, these simulations suggests that the probability of *not* exiting welfare decreases by 0.67 percentage points (or the probability of exiting welfare increases by 0.67 percentage points). In contrast to the earlier bivariate models, this estimate is statistically significant. At the 95% level the change in the probability of having a welfare exit is between 0.63 percentage points and 0.72 percentage points.

Welfare Entry. The influence of minimum wages on the decision to start receiving welfare can be estimated using discrete time hazard models. Similar to the welfare exit models, I can express the probability that a female head starts receiving welfare in a given month conditional on her not having yet received welfare, on local labor market conditions, and on her demographic characteristics as:

$$Entry(t) = Pr[w_{ijt}|w_{ijt-1} = 0; L_{jt}, X_{it}] = \frac{e^{\alpha L_{jt} + \beta X_{it}}}{1 + e^{\alpha L_{jt} + \beta X_{it}}} \quad (3)$$

where Entry(t) is the probability of welfare participation in wave t, α and β are vectors of coefficients to be estimated, and L_{jt} and X_{it} are the full set of explanatory variables.

Here I use a nationally representative sample of single mothers who initially were not receiving welfare. To identify the beginning of these non-welfare spells I excluded respondents who were not receiving welfare at the beginning of the survey. The remaining population is at risk of entering welfare, until she enters welfare, gets married (spouse present), no longer has resident children less than 18, or is censored.

Results in Table 8 suggest that a higher minimum wage would lower welfare entry rates. Specifically, a \$1 minimum wage hike (1 unit increase in the effective minimum wage) is estimated to lower welfare entries by 1.7 percentage points, or by 46 percent. The regression coefficient is statistically significant at the 10% level.

Other labor market and demographic characteristics have the expected effects on welfare entries. For example, higher welfare benefit levels and lower levels of educational attainment were associated a higher chance of a welfare entry.

Discussion. Table 9 presents simulations of a \$1 minimum wage increase for both the static and dynamic models. These simulations suggest that the Clinton Administration's proposal have the following effects on welfare participation:

- Lower welfare participation by almost 10 percentage points, from 17 percent to 7 percent.
- Increase the likelihood of leaving welfare conditional on being on welfare the previous month by 0.6 percentage points.
- Lower the likelihood of entering welfare conditional on not being on welfare during the previous month by 1.2 percentage points.

The last two simulations are not statistically significant based on the standard error calculation described in the technical appendix. Nonetheless, I did find statistically significant estimates that are nearly identical in sign and magnitude using competing risk models to examine the effect of minimum wages on welfare exits. Similarly, regression models found statistically significant estimates that minimum wages reduce welfare entries (see Table 8).

These simulations may be flawed because they are based on an extrapolation of the data. Table 1 shows that effective minimum wages varied by only 8.4 percent between 1989 and 1993, ignoring changes in the federal minimum wage. Yet, these simulations attempt to measure the effect a 19.4 percent (\$1) minimum wage hike would have on welfare participation. These simulations may be misleading if minimum wages have a different effect (sign or magnitude) on welfare participation for a little change (say 10 percent) versus a big change (say 20 percent) in the effective minimum wage. These data do not enable me to test this hypothesis, but I hope to test this hypothesis in future research.

V. Conclusion

This paper has investigated the effect of minimum wages on welfare reciprocity using micro-data from the 1990 and 1991 SIPP panels. My results suggest that minimum wages have a negative effect on welfare participation. Therefore, minimum wages will help low-income families achieve self-sufficiency. A \$1 increase in the minimum wage is estimated to reduce welfare participation rates by 45 percent. This substantial change in welfare participation occurs because higher minimum wages both increase welfare exit rates and decrease welfare entrance rates.

Increases in minimum wages might lead to lower welfare participation rates for several reasons:

- Increasing minimum wages might cause more welfare recipients to enter the labor market. However, my results suggest only a small fraction of these new entrants become employed and earn more.
- Welfare recipients may be offered more attractive marriage proposals because their potential mates now have higher earnings.
- Earnings in the low-skilled labor market increase, reducing the likelihood of entering welfare.

These estimates demonstrate that labor market policies such as the minimum wage and welfare reform are complementary. For example, they suggest that the \$1 increase in the federal minimum wage from \$5.15 to \$6.15 that was recently proposed by President Clinton would significantly reduce welfare participation rates.

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Table 1. Effective Minimum Wages: 1989 to 1993

Month and Year	State	Change in the Effective Minimum Wage	
		Nominal Change	Percentage
July 1988	California	\$3.35 to \$4.25	10.5%
--	Massachusetts	\$3.65 to \$3.75	2.7%
--	Rhode Island	\$3.65 to \$4.00	9.6%
--	Vermont	\$3.55 to \$3.65	2.8%
October 1988	Connecticut	\$3.75 to \$4.25	13.3%
--	District of Columbia	\$3.80 to \$4.75	25%
January 1989	Maine	\$3.55 to \$3.75	2.7%
--	Minnesota	\$3.55 to \$3.85	8.5%
--	New Hampshire	\$3.55 to \$3.65	2.8%
--	Washington	\$3.35 to \$3.85	15%
February 1989	Pennsylvania	\$3.35 to \$3.70	10.4%
June 1989	Wisconsin	\$3.35 to \$3.65	9.0%
July 1989	Vermont	\$3.65 to \$3.75	2.7%
August 1989	North Dakota	\$3.35 to \$3.40	1.5%
--	Rhode Island	\$4.00 to \$4.25	6.3%
September 1989	District of Columbia	\$4.75 to \$4.85	2.1%
--	Oregon	\$3.35 to \$3.85	14.9%
January 1990	Iowa	\$3.35 to \$3.85	14.9%
--	Maine	\$3.75 to \$3.85	2.7%
--	Minnesota	\$3.85 to \$3.95	2.6%
--	New Hampshire	\$3.65 to \$3.75	2.7%
--	Oregon	\$3.35 to \$4.25	10.4%
--	Washington	\$3.85 to \$4.25	10.4%
April 1990	Alaska	\$3.85 to \$4.30	11.7%
--	Vermont	\$3.75 to \$3.85	2.7%
January 1991	District of Columbia	\$4.85 to \$5.45	12.4%
--	Iowa	\$3.85 to \$4.25	10.4%

(Table Continues)

Table 1. Effective Minimum Wages: 1989 to 1992 (Continued)

Month and Year	State	Change in the Effective Minimum Wage	
		Nominal Change	Percentage
--	Minnesota	\$3.95 to \$4.25	7.6%
--	Montana	\$3.80 to \$4.25	11.8%
--	New Hampshire	\$3.80 to \$3.85	2.7%
--	Oregon	\$4.25 to \$4.75	11.8%
April 1991	Alaska	\$4.30 to \$4.75	10.5%
--	Connecticut	\$4.25 to \$4.27	0.5%
--	Rhode Island	\$4.25 to \$4.45	4.7%
January 1992	Iowa	\$4.25 to \$4.65	9.4%
April 1992	Hawaii	\$4.25 to \$4.75	11.8%
--	New Jersey	\$4.25 to \$5.05	18.8%
January 1993	Hawaii	\$4.75 to \$5.25	10.5%
Average			8.4%

Source: Book of the States

Note: States identified to increase their minimum wages met three conditions: (1) the effective minimum wage (EMW) increased, $EMW(t) > EMW(t-1)$, and (2) the new state minimum wage was higher than the federal minimum wage, $SMW(t) > FMW(t)$, and (3) the state minimum wage increased, $SMW(t) > SMW(t-1)$, where SMW and FMW are the state and federal minimum wages for time t, respectively.

Table 2. Variable Definitions

Variable Name	Definition	Frequency
Program Participation, Benefit Levels, and Income		
Received Welfare	1 if the respondent received Aid to Families with Dependent Children (AFDC) or General Assistance (GA) during the 4th reference month, wave 1	Fixed
Entered Welfare	1 if the respondent received AFDC or GA during reference month, 0 otherwise	TV
Exited Welfare	1 if the respondent did not receive AFDC or GA during reference month, 0 otherwise	TV
Months in spell: 5-8 ¹	1 if the first observed AFDC/GA (non AFDC/GA) spell is in its 5th, 6th, 7th, or 8th month, 0 otherwise	TV
Months in spell: 9-12 ¹	1 if the first observed AFDC/GA (non AFDC/GA) spell is in its 9th, 10th, 11th, or 12th month, 0 otherwise	TV
Months in spell: 13-16 ¹	1 if the first observed AFDC/GA (non AFDC/GA) spell is in its 13th, 14th, 15th, or 16th month, 0 otherwise	TV
Months in spell: 17-20 ¹	1 if the first observed AFDC/GA (non AFDC/GA) spell is in its 17th, 18th, 19th, or 20th month, 0 otherwise	TV
Months in spell: 21-24 ¹	1 if the first observed AFDC/GA (non AFDC/GA) spell is in its 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, or 28th month, 0 otherwise	TV
AFDC Benefits	Maximum state AFDC benefit levels for a family of three (thousands of dollars)	TV
Gov't Assisted Housing	1 if the respondent lived in government assisted housing (e.g., public housing or section 8) during reference month, 0 otherwise	TV
Local Labor Market Conditions		
Effective Minimum Wage	Higher of the state and federal minimum wage lagged by 3 months	TV
State Manufacturing Wages	State average hourly earnings in the manufacturing industry (1-digit SIC)	TV
State Unemployment rate	State-wide unemployment rate	TV
Human Capital		
High school degree ²	1 if the respondent received a high school degree during or prior to each reference month, 0 otherwise	TV

(Table Continues)

Table 2. Variable Definitions (Continued)

Variable Name	Definition	Frequency
Some college ²	1 if the respondent received some post-secondary education during or prior to each reference month, 0 otherwise	TV
Work experience	1 if the respondent was employed at any time during Wave 1, 0 otherwise	Fixed
Demographic Characteristics		
Nonwhite	1 if the respondent was African-American, Hispanic, Asian, Pacific Islander, American Indian, or other nonCaucasian, 0 otherwise	Fixed
Age	Respondent's age at the start of spell	Fixed
Disability	1 if the respondent has a physical, mental, or other disability that could inhibit work	Fixed
Never married	1 if the respondent was never married during the reference month, 0 otherwise	TV
Number of children	Number of resident, biological children less than 18 years old during the reference month	TV
Youngest child < 6 years old	1 if the youngest biological-resident child less than 6 years old, 0 otherwise	TV
Other Family Income	Monthly family income minus means-tested transfers and respondent's earnings	TV

Notes: TV = time -variant variable. Fixed = static variable.

Reference categories:

¹Respondent first observed AFDC/GA spell is in its 1st, 2nd, 3rd, or 4th month.

²Respondent had not received a high school diploma during or prior to each reference month.

Table 3. Effect of Minimum Wages on Welfare Participation - Static Models

[The dependent variable is welfare participation was measured during the 16th reference month]

Independent Variables	Mean (Std. Dev.)	Regression Coefficient	Standard Error	Marginal Effect
Effective Minimum Wage	4.035 (0.232)	-.5133	0.1866	-0.1302
Nonwhite	0.488 (0.500)	0.1964	0.0826	0.0498
Never Married	0.341 (0.474)	0.1671	0.0896	0.0424
Age (years)	33.338 (8.808)	-0.0281	0.0056	-0.0071
Number of Children	1.881 (1.044)	0.0700	0.0372	0.0177
Child(ren) < 6 years old	0.402 (0.490)	0.0750	0.0944	0.0190
Other Family Income	0.708 (1.335)	-0.1237	0.0348	-0.0314
High School Degree	0.397 (0.489)	-0.2941	0.0923	-0.0746
Some College	0.342 (0.475)	-0.3779	0.1009	-0.0959
Welfare Participation Last Year	0.282 (0.450)	1.9848	0.0870	0.5036
Work Experience	0.596 (0.491)	-0.6453	0.0875	-0.1637
Disabled	0.153 (0.360)	0.2632	0.0995	0.0668
State Manufacturing Wages	10.889 (1.245)	-0.0678	0.0380	-0.0172
State Unemployment rate	6.312 (1.241)	0.0336	0.0319	0.0085
AFDC Benefits	3.969 (1.703)	0.0999	0.0280	0.0253
Gov't Assisted Housing	0.100 (0.300)	0.3440	0.1168	0.0873
Prob(Welfare Xit)	0.292 (0.455)	--	--	0.1707

Marginal effects statistically significant at the 5% level in bold.

Marginal effects statistically significant at the 10% level in bold-italic.

Marginal effect are calculated by multiplying the regression coefficients by the probability density function (pdf), where the pdf is evaluated at the sample means.

Table 4. Description of Welfare Spells in the 1990 and 1991 SIPP Panels

Welfare Spells	Non-Left Censored Spells		
	Total	Right Censored	Non-Right Censored
Number of spells	602	181	421
Percentage of total	100%	30%	70%
Mean length (months)	10.1	19.9	5.9
<i>Spell Distribution</i>			
1-4	22.0	8.8	30.8
5-8	18.2	10.0	20.4
9-12	15.5	9.4	15.3
13-16	13.4	5.5	11.9
17-20	11.8	6.6	0.99
21-24	10.2	10.5	7.4
25-28	8.9	49.8	4.3

Note: First observed spell of that type from the 1990 and 1991 SIPP panels.

15,961 observations were that were on-going at the beginning of the survey (left-censored).

Table 5. Welfare Spells in the 1990 and 1991 SIPP Panels by States with Binding Minimum Wages

Welfare Spells	State Minimum Wages	
	Binding State Minimum Wage	Non-binding State Minimum Wage
Number of spells	37	565
Percentage of total	6.1%	93.9%
Mean length (months)	9.3	10.2
<i>Spell Distribution</i>		
1-4	43.7	29.1
5-8	22.7	20.0
9-12	14.6	15.1
13-16	7.7	12.0
17-20	4.7	10.2
21-24	3.1	7.9
25-28	3.5	5.9

Note: First observed non-left censored spell of that type from the 1990 SIPP panel. Welfare reciprocity is either AFDC or general assistance.

Binding State Minimum Wage: $SMW(t) > FMW(t)$

Non-Binding State Minimum Wage: $SMW(t) \leq FMW(t)$, where SMW is state minimum wage and FMW is federal minimum wage.

Table 6. Effect of Minimum Wages on Welfare Exits - Dynamic Models

[The dependent variable is welfare participation measured during each reference month]

Independent Variables	Mean (Std. Dev.)	Regression Coefficient	Standard Error	Marginal Effect
Effective Minimum Wage	4.158 (0.217)	0.1413	0.2013	0.0069
Nonwhite	0.558 (0.497)	0.0396	0.0413	0.0018
Never Married	0.429 (0.495)	-0.2603	0.1318	-0.0105
Age (years)	29.647 (7.600)	0.0352	0.0073	0.0016
Number of Children	1.886 (1.113)	-0.7408	0.0709	-0.0239
Child(ren) < 6 years old	0.498 (0.500)	0.6896	0.1287	0.0453
Other Family Income	0.354 (0.937)	0.0837	0.0373	0.0040
High School Degree	0.354 (0.478)	-0.2634	0.1277	-0.0106
Some College	0.203 (0.402)	-0.2791	0.1525	-0.0111
Work Experience	0.390 (0.488)	0.5606	0.1231	0.0343
Disabled	0.222 (0.416)	0.1030	0.1435	0.0049
State Manufacturing Wages	11.320 (1.217)	-0.0440	0.0528	-0.0020
State Unemployment rate	7.117 (1.449)	0.0634	0.0427	0.0030
AFDC Benefits	4.081 (1.692)	-0.0920	0.0413	-0.0040
Government Assisted Housing	0.188 (0.391)	-0.5708	0.1850	-0.0198
5-8 months in spell	0.190 (0.392)	-0.6527	0.1554	-0.0219
9-12 months in spell	0.156 (0.363)	-0.8452	0.1882	-0.0260

(Table Continued)

Table 6. Effect of Minimum Wages on Welfare Exits - Dynamic Models (Continued)

Independent Variables	Mean (Std. Dev.)	Regression Coefficient	Standard Error	Marginal Effect
13-16 months in spell	0.124 (0.330)	-0.8614	0.2155	-0.0263
17-20 months in spell	0.111 (0.314)	-1.5418	0.3176	-0.0359
21-28 months in spell	0.149 (0.356)	-1.1715	0.2639	-0.0315
Prob(Exit L_{jt}, X_{jt})	0.046 (0.209)	--	--	0.0395

Marginal effects statistically significant at the 5% level in bold.

Marginal effects statistically significant at the 10% level in bold-italic.

Marginal effect is the percentage point change in the probability of a welfare exit conditional on not exiting welfare the previous period,

$$[e^{\alpha} - 1]n\bar{w}$$

where α (and β) are the estimated coefficient in the complementary log-log models and $n\bar{w}$ is the sample mean of not being on welfare. Estimated probabilities were calculated using sample means.

5,006 person-month observations

Table 7. Effect of Minimum Wages on Welfare Exits--Competing Risk Models

Type of Exit	Effective Minimum Wage		Difference (Standard Error)
	No Hike	\$1 Hike	
Earnings-Related Exit	1.48%	1.55%	0.07% (0.117)
Other Exit	1.79%	2.39%	0.60% (0.040)
No Exit	96.73%	96.06%	-0.67% (0.00023)

Probability of welfare exit conditional on receiving welfare the previous month equals $P[w_{ijt}=0 \mid w_{ij,t-1}=1; L_{jt}, X_{it}]$. X_{it} is a vector of demographic characteristics at their sample means. L_{jt} is a vector of local labor market conditions at their sample means in the *No Hike* column and is the mean effective minimum wage plus \$1, every thing else equal in the *\$1 Hike* column.

Table 8. Effect of Minimum Wages on Welfare Entries - Dynamic Models

[The dependent variable is welfare nonparticipation measured during each reference month]

Independent Variables	Mean (Std. Dev.)	Regression Coefficients	Standard Errors	Marginal Effect
Effective Minimum Wage	4.215 (0.213)	-0.6148	0.3300	-0.0174
Nonwhite	0.566 (0.496)	-0.0261	0.1871	-0.0001
Never Married	0.398 (0.489)	0.1645	0.2060	0.0068
Age (years)	32.335 (8.769)	-0.0026	0.0120	-0.0001
Number of Children	1.805 (1.169)	0.0943	0.0703	0.0037
Child(ren) < 6 years old	0.475 (0.499)	0.1890	0.1998	0.0079
Other Family Income	0.530 (0.938)	-0.0024	0.0855	-0.0001
High School Degree	0.379 (0.485)	-0.4059	0.2003	-0.0126
Some College	0.285 (0.452)	-0.5586	0.2457	-0.0162
Work Experience	0.472 (0.499)	-0.1900	0.1893	-0.0066
Disabled	0.246 (0.431)	-0.0616	0.2253	-0.0023
State Manufacturing Wages	11.277 (1.357)	-0.1201	0.0877	-0.0043
State Unemployment rate	7.132 (1.472)	0.0465	0.0660	0.0018
AFDC Benefits	3.671 (1.719)	0.1351	0.0629	0.0055
Government Assisted Housing	0.076 (0.265)	0.0119	0.2788	0.0005
5-8 months in spell	0.217 (0.412)	-1.0898	0.2497	-0.0251
9-12 months in spell	0.179 (0.383)	-1.1570	0.2946	-0.0260

(Table Continued)

Table 8. Effect of Minimum Wages on Welfare Entries - Dynamic Models (Continued)

Independent Variables	Mean (Std. Dev.)	Regression Coefficients	Standard Errors	Marginal Effect
13-16 months in spell	0.137 (0.344)	-2.1323	0.5191	-0.0334
17-20 months in spell	0.096 (0.295)	-1.8076	0.5241	-0.0316
21-28 months in spell		-3.0098	1.0149	-0.0360
Prob(Wijt Xit)	0.038 (0.191)	--	--	0.0259

Marginal effects statistically significant at the 5% level in bold.

Marginal effects statistically significant at the 10% level in bold-italic.

Reported statistics is the percentage point change in the probability of a welfare entry conditional on not entering welfare the previous period,

$$[e^{\alpha} - 1]n\bar{w}$$

where α (and β) are the estimated coefficient in the complementary log-log models and $n\bar{w}$ is the sample mean of being on welfare. Estimated probabilities were calculated using sample means.

3,051 person-month observations.

Standard Errors Calculations

Objective: Calculate standard errors for the difference between two predicted probabilities when varying only one independent variable--the effective minimum wage--assuming the variances of other independent variables are proportionate.

$$V(\hat{P}_k^2 - \hat{P}_k^1)$$

where

$$\begin{aligned}\hat{P}_k^1 &= \hat{\alpha}_k L_j^1 + \hat{\beta}_k X_i \\ \hat{P}_k^2 &= \hat{\alpha}_k L_j^2 + \hat{\beta}_k X_i\end{aligned}$$

L^1 is a vector of local labor market conditions at their sample means. L^2 is a vector of labor market conditions where the effective minimum wage is the sample mean plus \$1 and the other variables are at their sample means.

$$V(\hat{P}_k^2 - \hat{P}_k^1) = \left[\frac{(1 - \hat{P}_k^2)}{N} + \frac{(1 - \hat{P}_k^1)}{N} \right] * A_k$$

where

$$A_k = \frac{V(\alpha_k | L_j, X_i)}{V(\alpha_k)}$$

$V(\alpha_k | L_j, X_i)$ is given in the regression and $V(\alpha)$ is calculated using the formula below.

$$V(\alpha_k) = \frac{(1 - \hat{P}_k^1)}{N} \left[\frac{1 - \sum_{k \neq j} \hat{P}_j^1}{1 - \sum_k \hat{P}_k^1} \right]^2 + \frac{(1 - \hat{P}_k^2)}{N} \left[\frac{1 - \sum_{k \neq j} \hat{P}_j^2}{1 - \sum_k \hat{P}_k^2} \right]^2$$

where k is equal to the number of estimated coefficients for each independent variable and $(k+1)$ are the number of outcomes. In the bivariate case k equals 1.

Table 9. Simulated Effect of a \$1 Minimum Wage Increase on Welfare Participation

Models	Welfare Participation		
	No Hike	\$1 Hike	Difference (Standard Error)
Static Model: Welfare Participation	17.07%	7.15%	-9.92% (0.027)
Dynamic Model: Welfare Exit	3.95%	4.55%	0.60% (0.037)
Dynamic Model: Welfare Entry	2.59%	1.40%	-1.19% (0.105)

No Hike =Population mean of the effective minimum wage.

\$1 Hike =Population mean of the effective minimum wage plus \$1

Difference =Row 1: Percentage point change in welfare participation. Row 2: Percentage point change in welfare exit rates. Row 3: Percentage point change in welfare entry rates.

Standard Error=See Technical Appendix for a description of how standard errors were calculated