THE LABOR MARKET EFFECTS OF WELFARE REFORM

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A major goal of the 1996 federal welfare reform was to increase the labor market participation of welfare recipients. Some analysts have speculated that if the reform is successful, this increase in labor supply may exert downward pressure on wages and reduce the employment rate of other low-skilled workers in the labor market. The magnitude of these hypothetical labor market effects is uncertain because there have not been large changes in eligibility for federal welfare programs from which to draw inferences. This study treats the 1991 elimination of the General Assistance program in Michigan as a rough analog to the 1996 federal reform. In all, about 82,000 able-bodied adults lost benefits. Comparisons with other states indicate that employment in Michigan increased by two to four percentage points among high school dropouts, which corresponds to 25–50% of the original GA caseload. There is little evidence of wage or employment declines.

The 1996 reform of the federal welfare system was meant to encourage recipients to leave welfare and enter the work force. To accomplish this goal, time limitations have been placed on individuals' receipt of benefits, and state governments are required to meet federal targets for moving welfare recipients into the work force. State governments have also been given increased flexibility in the design and implementation of programs to meet these goals. If the reform is successful, the increased labor supply of former recipients may lead to downward pressure on wages or decreased employment of other low-skilled workers in the labor market.[1] The magnitudes of these effects are uncertain because there have not been large changes in eligibility for benefits or in the incentives facing welfare recipients in the past. Analyses of closely related changes in the labor market and welfare programs are necessary to better inform the current debate.

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[1]See Bartik (1998) for a recent survey of this issue.

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This study analyzes an earlier welfare reform, the elimination of the General Assistance program in Michigan in October 1991, that may provide clues to the probable effects of the 1996 federal reform. In Michigan, when cash benefits for able-bodied adults without children were terminated, approximately 82,000 able-bodied adults—close to 2% of the state labor force—lost all benefits (Shapiro et al. 1991). A survey by Danziger and Kossoudji (1995) indicated that in the second year after benefits were eliminated, about 59% of former GA recipients had cash earnings from either formal or casual employment.[2] Some former recipients may have also worked while on GA, while others may have worked only sporadically after the elimination of the program. If 25% of the 82,000 former recipients entered the labor market, that would represent an increase of 0.5% in the total state labor force and an increase of 4% among high school dropouts. This increase is large enough to have had noticeable affects on the employment and earnings of other low-educated workers.[3]

An important difficulty for analyses of the labor market effects of the 1996 federal welfare reform is predicting what would have happened to low-wage labor markets in the absence of the reform. Though individual states are given vastly increased autonomy in the design of welfare programs, inter-state variation in the rate of exit from welfare will be the result of differences in local economic conditions, state policies, and other aspects of labor markets in each state. It may be very difficult to credibly identify the causal effect of welfare reform on labor market outcomes. (Indeed, recent studies collected in Danziger [1999] differed among themselves on the magnitude of the effect of federal welfare reform and state waivers on the decline in AFDC caseloads.) In contrast, a unique feature of this study is the use of data from other states to generate a counterfactual estimate for how labor markets in Michigan would have evolved had the General Assistance program not been eliminated. Specifically, my analysis identifies the impact of former GA recipients' increased labor force participation by comparing changes in employment rates and hourly wages in Michigan with changes in two sets of comparison states.[4]

The General Assistance Program in Michigan

General Assistance refers to state, county, or locally financed welfare programs designed to provide cash payments to poor individuals who do not qualify for the main federally financed income support programs, such as Temporary Assistance for Needy Families (TANF), Supplemental Security Income (SSI), or Unemployment Insurance (UI). During the period studied here, TANF had not yet been established and the primary welfare program for poor families was Aid to Families with Dependent Children (AFDC), which provided cash benefits primarily to single-parent families, although limited payments were also provided to two-parent families through the AFDC–Unemployed Parent program. Unemployment Insurance benefits are only available to those who previously held a qualifying job for a minimum length of time, and can only be drawn for up to 26 weeks. Finally, SSI provides benefits to low-

[2]In the summer of 1993, Danziger and Kossoudji surveyed 426 former General Assistance recipients from Wayne (Detroit), Genesee (Flint), Saginaw, Eaton, and Osceola counties. They were only able to locate about one-third of the sample to be drawn from Wayne county and about half of the sample in the other four counties. If the least healthy, least mobile, and thus least likely to work are more likely to have remained in the same residence, Danziger and Kossoudji's survey is likely to have understated the employment rate of former GA recipients.

[3]Studies that examine other aspects of the elimination of the GA program in Michigan include Bound, Kossoudji, and Ricart-Moes (1998) and Danziger, Carlson, and Henly (1999).

[4]Economic links between Michigan and the comparison states may lead the labor market effects to be spread throughout all of the states. This complicating factor is not directly studied, though I return to it below.

income people over the age of 65 or who are disabled. Thus, GA programs generally serve non-elderly single adults, childless couples, and families who do not qualify for AFDC or the Unemployed Parent program; people who do not meet the work history requirement for UI benefits or who exhaust their UI benefits; and disabled people who await or do not qualify for SSI benefits.

Prior to its elimination in 1991, Michigan's GA program was run through the state's Department of Social Services. The monthly benefit was calculated in a manner similar to AFDC benefits: eligibility was limited to people with income and assets below certain thresholds that varied by county and by household size. Like AFDC benefits, additional labor earnings were taxed by the system, with a dollar-for-dollar reduction in GA benefits for each increase in earnings.

Possibly because General Assistance programs vary substantially across and within states, they have not received nearly as much scholarly attention as the major federal anti-poverty programs. However, the program in Michigan was large, serving nearly half as many families as did the AFDC program in the state. The average monthly Michigan GA caseload in 1990 was 97,860, with an average of 1.3 people per case. The AFDC average monthly caseload in Michigan was 217,949, with an average of three people per case. The typical cash payments in the two programs were also similar in size. The average monthly Michigan GA grant per case in 1990 was \$237.55, or about \$6.14 per person per day. By comparison, the average AFDC family received \$464.05 per month, or \$5.16 per person per day.[5] General Assistance participants also received medical benefits and, in most cases, food stamps.

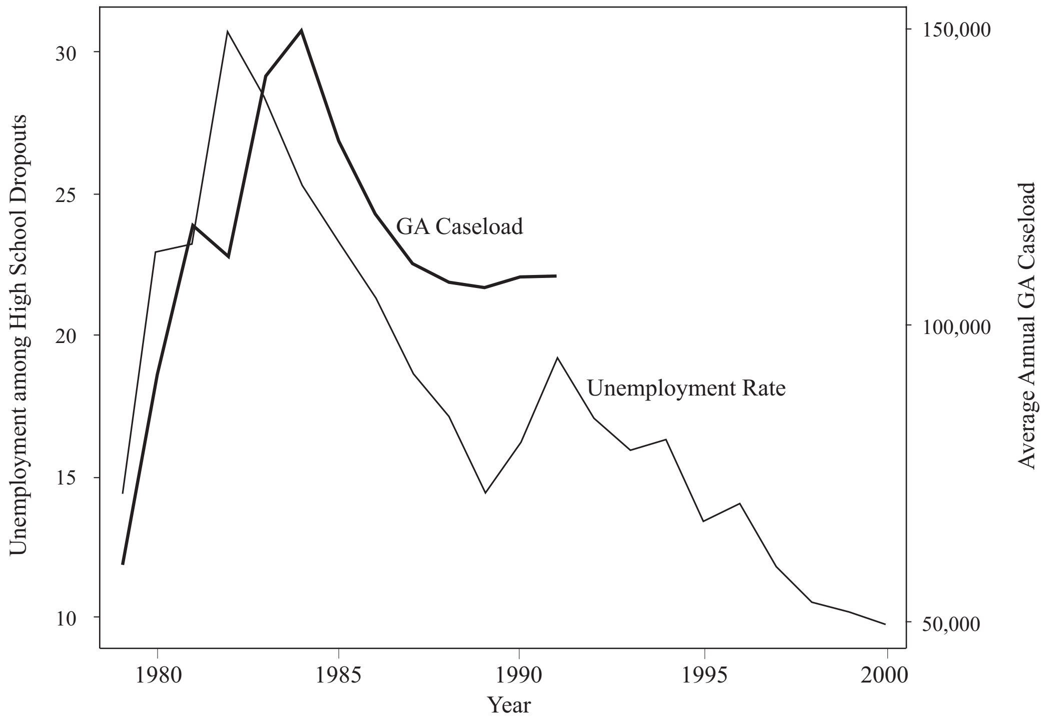
According to a 1992 survey, 21 states and the District of Columbia had a General Assistance program with uniform state-wide rules in the early 1990s (see Nichols, Dunlap, and Barkan 1992). Ten additional states did not operate a GA program in the early 1990s, but required each county or locality to do so. The remaining 19 states did not have any state-wide program or requirements, though individual counties within these states were free to operate programs.

As detailed below, two groups of comparison states are used in this study, the first consisting of Indiana, Ohio, and Wisconsin, and the second including those three states plus Missouri, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Virginia, and West Virginia. The three largest of the comparison states—Ohio, New York, and Pennsylvania—had General Assistance programs similar to Michigan's in the eligibility requirements they stipulated and the number of people they served, relative to the state population (see Nichols et al. 1992). The remaining comparison states also had GA programs, but with some variation in the eligibility requirements and benefit levels. For example, in Massachusetts, Missouri, and Virginia, benefits were not available to adults without children. West Virginia provided short-term benefits to individuals under emergency circumstances to pay for food, utilities, or medical expenses.

Figure 1 plots the average annual GA caseload in Michigan from 1979 until the elimination of the program in 1991, along with the unemployment rate among people without a high school degree from 1979 to 2000. The caseload increased substantially during the recession of the early 1980s, but then declined along with the unemployment rate during the second half of the decade. Caseload increases tended to lag behind increases in the unemployment rate, which is likely a result of people enrolling in GA after their unemployment benefits expired. The close connection between the unemployment rate and the caseload indicates that recipients had a connection to the labor market, and it is therefore reasonable to expect that the elimination of the program affected their labor supply decisions.

[5]Figures are from Department of Social Services, State of Michigan (1990). The AFDC figures refer to both Family Groups and Unemployed Parent participants.

Figure 1. Unemployment Rate and General Assistance Caseload in Michigan.



Source: The unemployment rate is calculated from the outgoing rotation groups of the Current Population Survey, and refers to individuals' labor force status at the time of the interview. The CPS sample includes labor force participants without a high school degree who are aged 16 to 54. GA caseload data are from the State of Michigan Assistance Payment Statistics, various months, 1979-91. Both series are expressed as annual averages.

As a response to fiscal pressures in the early 1990s, many state governments began to cut spending on social welfare programs in general and on General Assistance in particular.[6] The elimination of the GA program in Michigan was the most dramatic of all the early welfare reforms in terms of the number of people affected and the amount of benefits lost. On October 1, 1991, able-bodied adults without children lost all benefits. Families with dependent children were allowed to receive benefits under the new State Family Assistance program. Approximately 9,700 families were thought to be eligible for this program, though actual participation was about half that. Adults who had been disabled for at least 90 days and had not qualified for SSI were placed in the new State Disability Assistance program. The average monthly caseload in this program in 1992 was 8,253. For most of these people, SDA benefits were provided as interim assistance until SSI benefits were approved. In sum, then, about 82,000 people—or 84% of the original

[6]For a summary of such policy changes at the state level, see Shapiro et al. (1991) and Lav et al. (1993).

caseload—lost all benefits as a result of the October 1991 reforms.

How Large an Effect Would Be Expected?

A standard approach to modeling the labor market effects of the Michigan GA reform is to posit supply and demand functions for low-skilled labor, and treat the GA reform as an exogenous increase in the supply of labor. The employment and wage effects depend on the elasticities of labor supply and demand. The expected percentage change in wages is given by

$$\%\Delta Wages = \frac{-1}{\varepsilon - \eta} \times \%\Delta Labor\ force, \tag{1}$$

where $\eta < 0$ is the elasticity of labor demand, ε is the elasticity of labor supply, and $\Delta Labor\ force$ is the increase in the low-skilled labor force attributable to the elimination of GA.[7] Some workers will choose not to work at the new, lower wage rate. This change in employment among workers who were already in the labor market prior to the GA reform is given by

$$\%\Delta Employment = \frac{-\varepsilon}{\varepsilon - \eta} \times \%\Delta Labor\ force. \tag{2}$$

Finally, the net change in employment among new labor market entrants and those who were already in the labor force is

$$\Delta Net\ employment = \frac{-\eta}{\varepsilon - \eta} \times \%\Delta Labor\ force. \tag{3}$$

The net change in employment will be smaller than the increase in the labor force as long as ε is positive. Since it is impossible to distinguish former GA recipients from other low-skilled workers in the data, only the net change in total employment is empirically identifiable.

Equations (1)–(3) can be used to forecast how the elimination of the Michigan GA program will affect wages and employment. To do this, three questions have to be answered. First, what is the relevant labor market? Second, what is the size of the increase in the labor force? And third, what are the magnitudes of the elasticities? Even though close to half of the GA recipients in Michigan completed high school, it is likely that their skills were closer to those of high school dropouts in the general population than to those of high school graduates. Thus, increased labor market participation by former GA recipients will have its strongest effect on the average outcomes of high school dropouts and a very limited effect (if any) on the larger group of better educated workers in Michigan. If one-quarter of the people who lost benefits, about 20,000 people, entered the labor market, the portion of the Michigan labor force without a high school degree would increase by 4%.

Elasticity estimates from research outside the subject area of welfare and welfare reform can be used to estimate the change in employment and wages that would result from this increase in the labor force, as previous analysts did in forecasting the effects of the 1996 federal welfare reform. (See, for example, Mishel and Schmitt 1995; Bernstein 1997.) A pitfall of drawing inferences from this type of analysis, however, is that labor supply and demand elasticities for very low-skilled workers (and single parents in the case of federal welfare reform) may not be the same as those estimated for workers in general. For example, although most studies tend to find that labor supply among all workers is not very responsive to wages, Juhn, Murphy, and Topel (1991) provided evidence that this may not be true among very low-skilled workers.

There is even deeper disagreement over the magnitude of the elasticity of labor demand. For example, closely related to the labor market effects of welfare reform is how labor markets respond to the influx

[7]These formulas are found by specifying a labor market equilibrium of $D(w) = GA + S(w)$, where $D(w)$ is labor demand, $S(w)$ is labor supply, and w is the wage rate. GA is the number of new labor market entrants, here assumed to be independent of the wage rate. Rearranging the total derivative of this condition leads to equations (1)–(3). This simple model of the labor market assumes that the increase in the labor force is small relative to the size of the market, and ignores differences in skills across workers and any general equilibrium effects of welfare reform on workers' income.

of new, largely unskilled, immigrants. Most recent studies have found that immigrant inflows to specific U.S. cities have had very small effects on the earnings of native-born workers. (See, for example, the survey by Borjas [1994], as well as Borjas, Freeman, and Katz [1992], Card [2001], and Schoeni [1997].) Though small employment declines are found, these results suggest that labor demand may be quite elastic. The elasticity of labor demand also influences the employment effect of increases in the minimum wage. Although a range of estimates exists in the literature, most studies find relatively modest effects of minimum wages on employment, which points to a relatively inelastic demand for labor (see Card and Krueger 1995; Neumark and Wascher 1996). This lack of guidance about the relevant elasticities makes it very difficult to use past work to draw clear inferences about wage and employment changes in the aftermath of welfare reform, and underscores the value of examining the effects of the Michigan GA reform.

In a study of wage subsidies for low-wage workers, Katz's (1996) "best guess" was elasticities of labor demand and supply of –0.5 and 0.4. In this case, a 4% increase in the labor force would lead to a 4.4% decline in wages and a 1.8% decrease in employment among high school dropouts (who were not on GA) in Michigan. Total employment (including the former GA recipients) would increase by 2.2%. In this scenario, for each 100 new entrants to the labor market, there are only 55 new jobs and wages decline appreciably.

These predicted changes in wages and employment are, however, quite sensitive to the assumed elasticities. For example, if the elasticity of labor demand is assumed to equal –3 instead of –0.5, while the elasticity of labor supply remains 0.4, then wages will decline by only 1.2%; employment among those already in the labor market will decrease by only 0.5%; and total employment will rise by 3.5%. In contrast to the first scenario, 88% of the increase in employment represents new jobs, and wage declines are quite modest. Thus, depending on whether one believes the elasticity of demand for low-skilled labor is small in absolute value (GKeta = –.05) or large (GKeta = –3.0), the elimination of the GA program in Michigan will be expected to have a fairly large or fairly small impact on the low-skilled labor market.

Data and a Descriptive Comparison of Michigan and the Comparison States

To study the elimination of the Michigan GA program, this paper uses employment data for individuals in the twelve monthly Current Population Survey samples in each year from 1989 to 1993, and wage data that were collected from one-quarter of the sample in each month (individuals in the so-called "outgoing rotation groups"). Thus, up to eight observations per person are available for employment outcomes and up to two observations for earnings. The data cover civilians aged 16 to 54. The self-employed, individuals with hourly earnings below $2 per hour (in 1995 dollars), and those with missing data are dropped from the sample. Employment is measured by an indicator for whether the respondent was employed during the survey week. Hourly wages are measured as the ratio of weekly earnings to weekly hours on the job during the past week. There are 1,559,034 employment observations (192,237 in Michigan) and 265,461 wage observation (32,340 in Michigan).

Before turning to an analysis of the employment and wage outcomes, it is useful to examine the characteristics of GA recipients in Michigan and the full set of comparison states (described below) prior to the elimination of the program. Table 1 presents descriptive statistics drawn from the 1990 through 1992 March CPS for the general population and people who received "public assistance" income (excluding AFDC) in the previous year.[8] Public

[8]Beginning in 1976 the March Supplement to the CPS asked respondents whether they received income during the previous calendar year from AFDC or another public assistance program. Most of the major federal cash transfer programs, such as Social

Table 1. Characteristics of Public Assistance Recipients and the Overall Population, 1989–1991.

	Michigan		*Comparison States*	
Variable	*Public Assistance*	*Overall*	*Public Assistance*	*Overall*
Women	50.3%	50.0%	62.6%	51.2%
Any Kids	26.9	51.7	49.0	51.3
Nonwhite	44.8	15.6	48.5	16.0
Married	15.8	51.6	21.8	53.7
No HS Degree	48.1	18.6	45.8	18.0
HS Degree	32.4	38.6	38.8	39.6
College	19.4	42.8	15.3	42.4
MSA Resident	82.0	83.1	80.9	76.9
Large MSA Resident	47.9	50.1	48.0	29.1
Employed	23.6	70.0	19.7	72.9
Unemployed	53.0	10.2	42.8	7.3
Not in Labor Force	49.9	22.1	65.6	21.4
Hourly Wage (1995$)	$5.89	$14.00	$7.43	$14.07
Age	35.0	33.7	33.9	33.9
CPS Sample Size	154	10,397	890	78,444
Population Estimate	81,269	5,143,867	447,195	43,887,789

Source: Author's tabulations from March Current Population Survey data, respondents aged 16 to 54.
Notes: Observations are weighted using the March Supplement weights. The comparison states are Indiana, Massachusetts, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin. Large MSAs include Boston, Nassau-Suffolk counties, New York City, Newark, Pittsburgh, Philadelphia, and Detroit. The public assistance group includes all people who reported receiving any income from a cash assistance program other than AFDC during the previous calendar year. All other variables refer to the respondent's status during the week prior to the interview. Unemployment refers to people who are in the labor market, but not currently employed. The population estimate is based on the CPS weights and is an annual average between 1989 and 1991.

assistance recipients in both Michigan and the comparison states were disproportionately nonwhite, unmarried, and poorly educated relative to the general population. Contrary to some popular notions, public assistance served men and women in nearly equal numbers. Only 27% of public assistance recipients in Michigan had children, compared to 49% of recipients in the comparison states (this pattern also holds among female and married recipients). Public assistance recipients were roughly as urbanized as was the general population. Finally, and not surprisingly, people who were on public assistance in the prior year had very low employment rates and very high rates of unemployment and labor market nonparticipation at the time of the survey. In Michigan, 26% of the public assistance group were employed at the time of the survey and 50% were not participants in the labor market.

In the empirical analysis below, the comparison states provide the counterfactual estimate of how labor market outcomes in Michigan would have changed had the GA program not been eliminated. Since this identifying assumption cannot be tested, the strategy employed in this study is to use two separate comparison groups, each with different strengths. The first group is Indiana, Ohio, and Wisconsin, which are

Security and SSI, are separately identified in the CPS. Thus "public assistance" primarily covers those who receive income from General Assistance programs, though in principle it could include other programs as well. The demographic and labor market variables in the table refer to the week prior to the March interview and do not necessarily reflect individuals' status while on public assistance. The group of comparison states refers to the larger set of eleven states. The figures presented here are similar to statistics from State of Michigan administrative data presented in Danziger and Kossoudji (1995).

Table 2. Labor Force Characteristics in Michigan and the Comparison States, 1989–1991.

		Manufacturing						
State	*Percent of Sample*	*Durable*	*Non-Durable*	*Services*	*Trade*	*Other*	*No HS Degree*	*HS or Less*
Indiana	3.3	20.2	5.7	28.0	26.2	20.0	15.6	64.1
Ohio	12.9	15.7	8.2	30.7	26.8	18.8	13.9	59.1
Wisconsin	4.0	15.0	10.1	30.6	26.0	18.4	11.7	58.2
Massachusetts	11.0	12.1	6.7	36.6	27.1	17.6	13.2	47.3
Missouri	3.1	10.4	8.1	30.6	28.9	22.1	15.1	59.0
New Hampshire	2.4	19.3	5.5	29.4	27.8	17.9	13.2	51.1
New Jersey	11.9	7.8	9.8	32.4	28.4	21.6	12.1	51.8
New York	19.2	8.5	6.5	36.3	28.0	20.8	13.6	51.2
Pennsylvania	12.1	11.6	9.0	32.7	26.8	19.9	11.7	61.0
Virginia	4.3	7.8	7.1	32.2	25.7	27.1	15.6	52.3
West Virginia	3.5	7.4	7.0	29.5	26.4	29.8	15.4	66.7
Three Midwestern States		16.7	8.0	30.0	26.3	19.0	13.8	60.1
All Comparison States		11.7	7.8	32.7	27.2	20.7	13.4	55.8
Michigan	12.3	19.5	6.3	30.6	27.2	16.4	14.1	56.7

Source: Author's tabulations from March Current Population Survey data, respondents aged 16 to 54 who report being employed or looking for work in the week prior to the interview.

Notes: The percentage of the sample from each state is calculated from the CPS monthly data from 1989 to 1993, described later in the text, and refers to people both in and out of the labor force. The industry category "Trade" includes wholesale trade, retail trade, finance, insurance, and real estate. "Other" includes agriculture, mining, construction, transportation, communications, utilities, forestry and fisheries, public administration, and the armed forces. All observations are weighted by the CPS weights (column 1) or the March Supplement weights (columns 2–8).

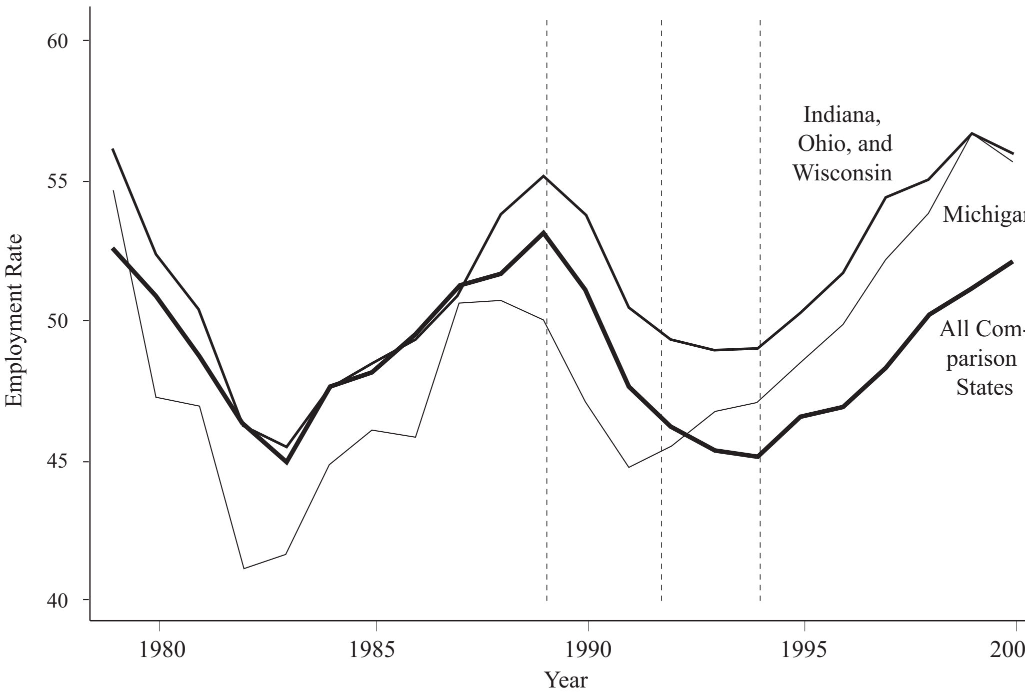
Michigan's closest neighbors in terms of geography and industrial composition.[9] These three states are likely to have been subjected to the same regional shocks that may have affected Michigan. The second group includes these states plus Massachusetts, Missouri, New Hampshire, New Jersey, New York, Pennsylvania, Virginia, and West Virginia. While this group is composed of states geographically farther from Michigan, the larger sample size allows for more precise estimates of the counterfactual change in outcomes.

Table 2 provides descriptive evidence on the comparability of Michigan and the other states. 19.5% of the labor force in Michigan is in the durable manufacturing sector, compared to 16.7% in the first comparison group and 11.7% in the second. The distribution of educational attainment is quite similar between Michigan and both comparison groups.

A more direct method to assess Michigan's comparability with the comparison states is to examine the trends in employment rates. These are plotted in Figure 2 for high school dropouts from 1979 to 2000. The vertical lines in the graph indicate the pre- and post-reform periods used in the analysis below. Prior to 1992 the employment rates in Michigan and the comparison groups followed a similar trend, though the employment level was lower in Michigan. Following a decline in the employment rates in all states between 1989 and 1991, the rate in Michigan began to trend upward in 1991, while the rate in the

[9]Illinois and Minnesota are not included in the group of comparison states because of several large changes to their General Assistance programs in the early 1990s. Wisconsin began numerous AFDC demonstration projects as early as 1987, but did not implement a widespread reform (the so-called "Wisconsin Works" plan) to move people off welfare and into employment until 1996. Wiseman (1996) documented the welfare policy initiatives in Wisconsin.

Figure 2. Employment Rates in Michigan and Comparison States among People without a High School Degree, 1979-2000.



Source: Author's tabulations from Current Population Survey outgoing rotation group data for 1979-2000. The sample includes high school dropouts aged 16 to 54.

Notes: The dashed vertical lines at the beginning of 1989, the fourth quarter of 1991, and 1994 indicate the pre- and post-reform periods used in the analysis. The full group of comparison states is composed of Indiana, Ohio, Wisconsin, Massachusetts, Missouri, New Hampshire, New Jersey, New York, Pennsylvania, Virginia, and West Virginia.

comparison states continued to decline until 1993 or 1994. The increase in employment in Michigan is consistent with the timing of the elimination of the GA program in October 1991. Finally, the employment trends were similar in all states between 1994 and 2000. The similarity in industrial composition, educational attainment, and employment trends suggests that the comparison states provide a credible basis for a counterfactual estimate of how labor market outcomes would have evolved in Michigan had its GA program not been eliminated.

Econometric Specification and Results

This section begins with a simple Michigan/comparison state overview of changes in employment and hourly wages between 1989 and 1993. Because increased labor market participation by former GA recipients in Michigan may not have been the only source of differences in labor market outcomes, subsequent models include the college-educated male unemployment rate and unobserved shocks to control for confounding factors.

To facilitate estimation of nonlinear models later in this section, I assign each individual in the sample to one of 18 groups, defined by three age ranges (16–29, 30–39, and 40–54), three levels of education (less than a high school degree, exactly a high school degree, and more than a high school degree), and gender. Individuals are also classified as living either in Michigan or in any of the comparison states. Each group is observed over twenty quarters between 1989 and 1993. The result is 720 group-state-quarter cells (18 groups × 2 "states" TimesSign 20 quarters).

The group average employment and hourly wage rates are estimated in a regression framework that also controls for additional demographic characteristics that may differ by group, state, or time. Let j index the age-education-gender group and s index whether the person lives in Michigan or the group of comparison states. The employment indicator or log wage rate, denoted by y_{ijst}, of person i in quarter t is modeled as

$$y_{ijst} = x_{ijst}\lambda + d_{jst} + \varepsilon_{ijst}, \tag{4}$$

where x_{ijst} is a set of individual characteristics, including a spline in age and its square within each of the three age ranges, and indicators for college degree or post-graduate education, married, nonwhite, both married and nonwhite, and residence in a central-city area; d_{jst} represents a set of 720 group-state-time indicators that capture the average outcome for people in each cell; and ε_{ijst} is an unobservable term that reflects individual attributes that influence economic outcomes. The log hourly wage regression is estimated only among workers. The ordinary least squares regressions of equation (4) produce estimated average employment rates and log hourly wages, d_{jst}, among people in each group-state-time cell, adjusted for differences in the individual covariates, x_{ijst}. These adjusted employment and log wage rates form the dependent variables for the remainder of the analysis.

A first estimate of the effects of the GA program's elimination is obtained by a simple "difference-in-differences" analysis comparing employment and wage changes in Michigan with those in the other states before and after the GA program was eliminated in Michigan.[10] The group-level employment rates and hourly wages are modeled as

$$\begin{aligned} d_{jst} = {} & \alpha_0 + \alpha_1 \text{Post}_t + \alpha_2 \text{Michigan}_s \\ & + \alpha_3(\text{Post}\times\text{Michigan})_{st} + \xi_{jst}, \end{aligned} \tag{5}$$

where Post_t is an indicator for observations on or after the fourth quarter of 1991 (when the GA program was eliminated); Michigan_s is an indicator for Michigan groups; (Post TimesSign Michigan)$_{st}$ is an interaction variable indicating observations of groups from Michigan after the GA program was eliminated; and ξ_{jst} is an error term that represents unobserved influences on economic outcomes, as well as sampling error in the estimated cell means.

The coefficient α_3 on $(\text{Post}\times\text{Michigan})_{st}$ is the difference between the change in outcomes in Michigan and that within the comparison states. The change in the comparison states, α_1, represents the change that would have occurred in Michigan had the GA program not been eliminated. α_3 is therefore a valid estimate of the effect of the elimination of the GA program in Michigan if there were no shocks to the Michigan labor market after 1991 that did not also affect the comparison states (formally, this requirement is that $[\text{Post}\times\text{Michigan}]_{st}$ and ξ_{jst} are independent).

The estimates of α_3 for models of employment and log wages, stratified by education and gender, appear in row 1 of Tables 3 and 4. These estimates compare outcomes in Michigan to those in the large group of comparison states. The results that use only Indiana, Ohio, and Wisconsin as a comparison group are similar and are discussed below. The standard errors of the estimates account for both multiple observations of the same individual over time and multiple observations within the same household in the individual-level data. The details of the standard error calcula-

[10]This type of estimator is studied by Meyer (1995).

Table 3. Estimates of the Percentage Point Change in Employment in Michigan by Gender and Education.

				High School Dropouts		
Specification	*All*	*College*	*High School*	*All*	*Men*	*Women*
(1) Difference-in-Differences without Additional Controls	1.9 (0.3)	0.8 (0.4)	1.3 (0.6)	4.0 (1.0)	3.9 (1.3)	4.3 (1.4)
Controlling for the College-Educated Male Unemployment Rate						
(2) with a uniform effect for all groups	0.9 (0.4)	–0.1 (0.5)	0.5 (0.6)	1.9 (1.0)	2.0 (1.4)	2.2 (1.4)
(3) with group-specific effects	0.8 (0.4)	0.1 (0.5)	0.4 (0.6)	2.1 (1.0)	1.9 (1.4)	2.2 (1.4)
(4) with group-specific effects plus an unrestricted state-time effect				1.7 (1.2)	1.3 (1.6)	2.0 (1.6)
Controlling for an Unrestricted State-Time Shock with Group-Specific Effects						
(5)	1.2 (0.4)	0.7 (0.4)	1.1 (0.7)	3.4 (1.1)	3.9 (1.4)	4.3 (1.4)
(6) plus a uniform unrestricted state-time effect				2.4 (1.9)	1.3 (2.8)	3.4 (2.8)

Notes: Each cell is from a separate regression and shows the estimated percentage point change in employment in Michigan following the elimination of the GA program in October 1991. Row 1 contains estimates of the coefficient GKalpha$_3$ from equation (5); rows 2 and 3 contain estimates of GKalpha$_3$ from equation (6), first with GKgamma*j* constrained to be equal for all *j* and then without the constraint; row 4 contains estimates of GKbeta$_3$ from equation (8); and row 5 contains estimates of GKalpha$_3$ from equation (9). The equation corresponding to row 6 is not given in the text, but is described on page $$$. Standard errors are in parentheses.

tion are described in the appendix. The group-state-quarter observations are weighted by their relative sample size.

The estimates reveal that, compared to the change in employment in the comparison states, total employment increased by nearly two percentage points in Michigan following the elimination of the General Assistance program in 1991. The change was largest among the least educated, with employment increasing by about four percentage points among both male and female high school dropouts.

How reasonable is the magnitude of this employment effect? A four percentage point increase in employment among the 500,000 people without a high school degree in Michigan corresponds to 20,000 people. About half of the 82,000 former GA recipients did not have a high school degree; thus, a back-of-the-envelope estimate is that about half of the former GA recipients became employed after the program was eliminated, which is certainly within the realm of possibility. This figure is a lower bound on the labor supply response among former GA recipients, however, if some GA recipients who entered the labor market displaced the employment of non–GA recipients.

In Table 4, there is no evidence of changes in hourly earnings in Michigan relative to the comparison states. However, the statistical precision of the wage estimate is quite low, and wage increases or decreases of 4% would fall within the 90% confidence interval.[11] When stratified by gender, the estimates reveal a 3% rise among

[11]More precisely, a wage increase or decrease of 0.04 log units would fall within the 90% confidence interval. Employing a common approximation, I treat a change of 0.01 log units as representing a 1% change.

male dropouts in Michigan and a 4% decline among female dropouts, although neither of these estimates is statistically different from zero.

The difference-in-differences estimates above may confound the effect of the elimination of the GA program with other labor market shocks that differentially affected Michigan and the comparison states. The remainder of this section presents several more robust methods to control for such shocks. A simple method to control for differences in the business cycle is to include the quarterly unemployment rate among male college graduates as a regressor in equation (5). The elimination of the GA program may have affected the unemployment rate among low-educated workers, which precludes using it as a control variable. The rate among college graduates is arguably unaffected by the program elimination, yet is correlated with the demand for low-skilled workers.

A more general method to include the unemployment rate in the regression is to allow people in different skill groups to vary in their responsiveness to changes in the unemployment rate. That is, a one percentage point decrease in the unemployment rate among college-educated workers may be associated with a larger increase in employment or earnings among low-educated workers than among better educated workers. Equation (5) becomes

$$(6) \quad \hat{d}_{jst} = \alpha j_0 + \alpha_1 \text{Post}_t + \alpha_2 \text{Michigan}_s + \alpha_3 (\text{Post} \times \text{Michigan})_{st} + \gamma_j U_{st} + \xi_{jst},$$

where U_{st} is the unemployment rate in state s in quarter t, and γ_j is a factor loading that allows the coefficient on the unemployment rate to differ by group.[12] The model also allows for group fixed effects (αj_0).

Rows 2 and 3 in Tables 3 and 4 present estimates of α_3 when the college-educated male unemployment rate is included in the model. Controlling for the unemployment rate (row 2) reduces the estimated employment gain among high school dropouts in Michigan from 4.0 to 1.9 percentage points; the standard error on the estimate is 1.0, so the gain remains statistically different from zero. Allowing the unemployment rate to have group-specific effects (row 3) does not noticeably change the estimated employment gain. The gains for men do not statistically differ from those for women.

Controlling for the unemployment rate does not alter the earlier finding that hourly earnings among low-educated workers did not change. The point estimates continue to indicate that wages among male dropouts rose by about 3% and wages among female dropouts fell by 4%, though neither of these point estimates is statistically different from zero.

There are virtually no estimated effects on high school or college graduates. This is an important validity check on the empirical model, since it is implausible that the average outcomes among these larger groups of workers could have been affected by increased labor force participation among welfare recipients. It also suggests that if there were unobserved shocks to the Michigan labor market that occurred at the same time as the elimination of the GA program, they must have been concentrated among the least educated. The next set of models controls for such a possibility.

To control for influences on labor market outcomes that may not be captured by including the college-educated male unemployment rate in the model, the next set of models allows for unobserved shocks that may have had different effects across groups and states. These models relax the assumption that the error term ξ_{jst} is independent of $(\text{Post}\times \text{Michigan})_{st}$.

A first generalization of the model is to allow the error term to have a component that uniformly affects all groups in a state at a particular time (denoted by κ_{st}) and a component unique to each group-state-time cell (η_{jst}). In this model κ_{st} reflects statewide trends that are not captured by the unemployment rate. The error term is thus given by

[12]The results are not statistically different when the factor loading is allowed to vary by both group and state.

Table 4. Estimates of the Change in Log Hourly Wages in Michigan by Gender and Education.

				High School Dropouts		
Specification	*All*	*College*	*High School*	*All*	*Men*	*Women*
(1) Difference-in-Differences without Additional Controls	–0.002 (0.006)	–0.018 (0.009)	0.010 (0.009)	0.001 (0.024)	0.030 (0.027)	–0.040 (0.040)
Controlling for the College-Educated Male Unemployment Rate						
(2) with a uniform effect for all groups	–0.002 (0.007)	–0.015 (0.011)	0.007 (0.010)	0.000 (0.025)	0.028 (0.028)	–0.041 (0.042)
(3) with group-specific effects	–0.009 (0.007)	–0.012 (0.011)	–0.004 (0.010)	–0.009 (0.025)	0.015 (0.028)	–0.042 (0.041)
(4) with group-specific effects plus an unrestricted state-time effect		(0.028)	(0.032)	–0.004 (0.044)	0.037	–0.056
Controlling for an Unrestricted State-Time Shock with Group-Specific Effects						
(5)	–0.003 (0.014)	–0.004 (0.010)	0.003 (0.013)	0.000 (0.029)	0.032 (0.033)	–0.037 (0.041)
(6) plus a uniform unrestricted state-time effect		(0.055)	(0.065)	0.001 (0.082)	0.050	–0.037

Notes: Each cell is from a separate regression and shows the estimated change in the log of hourly wages among workers in Michigan following the elimination of the GA program in October 1991. Row 1 contains estimates of the coefficient GKalpha$_3$ from equation (5); rows 2 and 3 contain estimates of GKalpha$_3$ from equation (6), first with GKgamma*j* constrained to be equal for all *j* and then without the constraint; row 4 contains estimates of GKbeta$_3$ from equation (8); and rows 5 contains estimates of GKalpha$_3$ from equation (9). The equation corresponding to row 6 is not given in the text, but is described on page $$$. Standard errors are in parentheses.

$$\xi_{jst} = \kappa_{st} + \eta_{jst}. \tag{7}$$

Since increased labor supply by former GA recipients should not have affected average outcomes among high school or college graduates, the state-time effect (κ_{st}) can be controlled for by estimating the employment and wage changes among high school dropouts relative to the changes among better educated individuals observed in the same state at the same time. To implement this estimator, define No HS$_j$ to be an indicator for cells of people without a high school degree. Introducing this effect and interactions between it and the other variables in the model, the regression equation becomes

$$\begin{aligned} \hat{d}_{jst} = {} & \alpha j_0 + \alpha_1 \text{Post}_t + \alpha_2 \text{Michigan}_s \\ & + \alpha_3 (\text{Post} \times \text{Michigan})_{st} \\ & + \beta_0 \text{No HS}_j + \beta_1 (\text{No HS} \times \text{Post})_{jt} \\ & + \beta_2 (\text{No HS} \times \text{Michigan})_{js} \\ & + \beta_3 (\text{No HS} \times \text{Post} \times \text{Michigan})_{jst} \\ & + \gamma_j U_{st} + \eta_{jst}. \end{aligned} \tag{8}$$

This model is estimated using only high school dropouts and high school graduates. The coefficient β_3 measures the high school dropout/graduate difference in changes in Michigan, relative to the corresponding dropout/graduate differences in the comparison states. The identification assumption in this "difference-in-difference-in-differences" model is that η_{jst}, but not necessarily κ_{st}, is independent of $(\text{No HS} \times \text{Post} \times \text{Michigan})_{jst}$.

Since the earlier models indicated little employment or wage change among better educated people in Michigan, it is not surprising that measuring the impact of Michigan's welfare reform as the relative change in outcomes among dropouts delivers results similar to the absolute change among dropouts. These results are presented in row 4 of Tables 3 and 4. The estimated increase in employment among high school dropouts declines slightly, from 2.1 to 1.7 percentage points, with most of the change attributable to a decline in the effect among men. As in earlier models, there is no change in hourly earnings among dropouts when men and women are pooled together, though the point estimates indicate a 4% rise in wages among men and a 6% fall among women. None of the wage effects are statistically different from zero.

A more realistic alternative to the assumption that the unobservable shock κ_{st} in equation (7) affects all groups in the state uniformly is to assume groups are affected by the observable business cycle shocks U_{st} and an unobservable shock θ_{st} to the same degree. That is, if γ_j measures the effect of both the unemployment rate and the unobserved state-time effect on group j outcomes, then the error term can be written as $\xi_{jst} = \gamma_j \theta_{st} + \eta_{jst}$, and equation (6) can be rearranged to yield

$$(9) \quad \hat{d}_{jst} = \alpha_{j0} + \alpha_1 \text{Post}_t + \alpha_2 \text{Michigan}_s + \alpha_3(\text{Post}\times\text{Michigan})_{st} + \gamma_j(U_{st} + \theta_{st}) + \eta_{jst}$$

$$= \alpha_{j0} + \alpha_1 \text{Post}_t + \alpha_2 \text{Michigan}_s + \alpha_3(\text{Post} \times \text{Michigan})_{st} + \gamma_j\theta_{st} + \eta_{jst}.$$

This formulation makes clear that the combined shock to each group at time t in state s is given by the product $\gamma_j\theta_{st}$. Nonlinear least squares is used to estimate the model, since both γ_j and θ_{st} are unobserved.[13]

The two previous cases can be combined to allow for a common unobserved shock to all groups in each state at a particular time (κ_{st}), as well as a shock that affects each group by the factor γ_j. That is, the unobservables are modeled as

$$(10) \quad \xi_{jst} = \gamma_j\theta_{st} + \kappa_{st} + \eta_{jst}.$$

The final model is given by substituting ξ_{jst} into equation (8), and rearranging the terms in an fashion analogous to equation (9). Note that it is not possible to control for an unrestricted group-state-time unobserved shock because there is no variation in (No HS$\times$ Post$\times$ Michigan)$_{jst}$ within each group-state-time cell.

The results for the final two estimators are given in rows 5 and 6 of Tables 3 and 4. Without the uniform state-time shock (Table 3, row 5), the estimates indicate an employment gain of 3.4 percentage points in Michigan. When the state-time unobserved shock is controlled for (row 6), the relative increase in employment is 2.4 percentage points—1.3 percentage points among men and 3.4 percentage points among women. These estimates are in the same range as those found from the earlier, more restrictive models.

The point estimates in Table 4 show no change in hourly earnings among pooled male and female dropouts. When stratified by gender, the estimates point to a 5.0% increase in wages among men and a 3.7% decrease among women, which are similar in magnitude to the earlier results. Again, however, the standard errors are quite large and a wide range of alternative wage changes cannot be ruled out, including the hypothesis that there was no change in wages among either men or women.

Restricting the group of comparison states to Indiana, Ohio, and Wisconsin does not alter the basic conclusions about employment and wage changes. The point estimates for these models are presented in Table 5. Controlling for either the college-educated male unemployment rate (rows 2–4) or a less-restrictive unobserved shock (rows 5 and 6) reveals an increase in employment in Michigan of between 1.7 and 2.6 percentage points. The wage changes tend to be negative among high school graduates, but are not statistically different from zero. (The estimated decline in wages among female dropouts is close to 10% in the nonlinear model, which seems implausibly large, but is nevertheless not statistically different from zero.) Overall, however, the close similarity between the estimates based on this selected group of comparison states and those based on the larger group of states suggests that the conclusions reached above are not driven by the peculiarities of any one state or small group of states.

[13]The nonlinear model is identified by normalizing one of the group fixed effects (GKalphaj_0) to be 0 and one of the group loading factors (GKgamma$j$) to be 1.

Table 5. Sensitivity Analysis with an Alternative Comparison Group.

				High School Dropouts		
Specification	*All*	*College*	*High School*	*All*	*Men*	*Women*
Percentage Point Change in Employment in Michigan						
(1) Difference-in-Differences	1.2	–0.2	0.9	2.6	2.1	3.4
Controlling for the College-Educated Male Unemployment Rate						
(2) with a uniform effect for all groups	1.0	–0.2	0.7	2.5	2.1	3.1
(3) with group-specific effects	0.9	–0.1	0.6	2.6	2.0	3.1
(4) with group-specific effects plus an unrestricted state-time effect				1.9	0.6	3.2
Controlling for an Unobserved State-Time Shock with Group-Specific Effects						
(5)	0.6	–0.2	0.8	2.5	2.0	3.5
(6) plus a uniform unrestricted state-time effect				1.7	0.5	1.0
Change in Log Hourly Earnings in Michigan						
(1) Differences-in-Differences	–0.014	–0.034	–0.002	–0.011	0.023	–0.059
Controlling for an Unobserved State-Time Shock with Group-Specific Effects						
(2) with a uniform effect for all groups	–0.011	–0.030	0.001	–0.006	0.025	–0.050
(3) with group-specific effects	–0.015	–0.024	–0.009	–0.013	0.016	–0.051
(4) with group-specific effects plus an unrestricted state-time effect				–0.004	0.034	–0.053
Controlling for an Unobserved State-Time Shock with Group-Specific Effects						
(5)	–0.035	–0.055	–0.033	–0.039	–0.035	–0.127
(6) plus an unrestricted state-time effect				–0.027	0.020	–0.099

Source: Author's tabulation of the monthly Current Population Survey, 1989–93.
Note: Each cell is from a separate regression and shows the change in employment and log hourly earnings among workers in Michigan, relative to that in Indiana, Ohio, and Wisconsin.

The estimates from Tables 3 through 5 indicate that employment increased by between two and four percentage points among high school dropouts, or by 25–50% of the original 82,000-person GA caseload. There is no evidence of changes in hourly wages. These effects are consistent with an infinitely elastic demand for low-skilled labor. In this scenario, employment increases one-for-one with increases in the labor force, and there is no employment decline among workers who were in the labor market prior to the elimination of the GA program. The stability of hourly wages is also consistent with the hypothesis that intrastate trade led the effects of the program elimination to be spread to markets outside of Michigan.

The lack of statistical precision in the wage estimates suggests that we cannot rule out a modest decline in wages. To draw out the possible implications of this, Table 6 uses the wage and employment changes among low-educated women in Michigan to illustrate a plausible range of labor demand elasticities and employment displacement. These calculations assume the elasticity of labor supply is 0.4 and are found by plugging the wage and employment changes into equations (1)–(3) and then solving for the elasticity of labor demand and the magnitude of the labor force increase. An alternative approach is to use an estimate of the labor force increase and then solve for the elasticities of both supply and demand. I employ the first strategy because there is relatively little disagreement about the elasticity of the labor supply, while there is little direct evidence on the number of former GA recipients who entered the labor market when the program was eliminated.

Three estimates are presented based on the employment and wage changes from

Table 6. Estimated Magnitudes of the Elasticity of Labor Demand, the Increase in Labor Force Participation, and Employment Displacement among Low-Educated Women in Michigan.

	Model Specification		
Statistic	*(1) Difference-in-Differences*	*(4) College-Educated Male Unemployment Rate*	*(6) Unobserved State-Time Shock*
Percent Change in Total Employment	4.3	2.0	3.4
Percent Change in Wages	–4.0	–5.6	–3.7
Labor Demand Elasticity	–1.1	–0.4	–0.9
Percent Change in Labor Force	5.9	4.2	4.9
Ratio of Employment to Labor Force Increase	0.73	0.47	0.70

Notes: Estimates are calculated from equations (1) and (3) assuming an elasticity of labor supply of 0.4. The column numbers (1), (4), and (6) above indicate the row number from Tables 3 and 4 where the employment and wages changes used in the calculations are found.

specifications (1), (4), and (6) in Tables 3 and 4. The coefficients from the simple difference-in-differences model and the more robust final model deliver labor demand elasticities of –1.1 and –0.9, whereas the intermediate model that controls for the college-educated male unemployment rate delivers an elasticity estimate of –0.4, closer to Katz's (1998) "best guess" of –0.5. These estimates also imply increases in the labor force of between 4.2% and 5.9%. The ratios of employment to labor force increases indicate that for each 100 new labor market entrants, between 47 and 70 new jobs are created. Given the large standard errors on the wage estimates, these figures are only illustrative. However, they suggest the possible degree of wage declines and employment declines that may have resulted from the elimination of the GA program.

Conclusion

Welfare reform has been claimed as one of the great political achievements of the 1990s. Recipients are required to work and are limited to two consecutive years, or five years in their lifetime, of benefit receipt. State governments must meet strict targets for moving welfare recipients into the work force and are given increased flexibility in the design of programs. The criteria for evaluating such a large change in policy must include the degree to which self-sufficiency has been promoted among the at-risk welfare population, the decline or advancement in material health and well-being among that population, and the "transition" costs of the reform. In particular, it is important to understand how increased labor force participation among former recipients will affect the overall labor market for very low-skilled workers.

This study takes a first step in that direction by evaluating how local labor markets in Michigan were affected when General Assistance, a sizable program for low-income people who did not qualify for federal assistance, was eliminated in 1991. The results suggest that increased labor force participation among former GA recipients led to increases in employment among high school dropouts of two to four percentage points. Although the standard errors do not rule out modest wage changes, the point estimates suggest that hourly earnings among low-educated workers were unaffected by the labor force increase and there was no decline in employment among low-skilled workers who were in the labor market prior to the program elimination.

Appendix
Standard Error Construction

The standard errors of the estimates reported in the "Econometric Specification and Results" section are computed using a bootstrap estimate of the full variance-covariance matrix of the cell means (the $\hat{d}_{jst}$'s). The following makes this procedure precise for the linear regression case: let Z be the $(N \times K)$ matrix of explanatory variables in equations (5), (6), and (8), and denote as $\hat{D}$ the $(N \times 1)$ column vector of either employment or wage outcomes. These linear regressions can then be represented as

$$\hat{D} = Z\Pi + \zeta, \tag{11}$$

where Π is the parameter vector and ζ is vector of error terms. The weighted least squares estimate of Π is then given by

$$\hat{\Pi} = (Z'GZ)^{-1} Z'G\hat{D}, \tag{12}$$

where g is an $(N \times N)$ diagonal weighting matrix in which the n*th* diagonal element is the ratio of the number of people in n*th* skill group-state-quarter cell to the total number of people in the sample.

If there is no specification error in equation (11) and the only source of error derives from sampling error in the estimation of the cell means, then the variance-covariance matrix of the cell means can be used to compute the standard errors of the parameter estimates. Let $\hat{\Sigma}$ be an estimate of the variance-covariance matrix of D; then the variance matrix of $\hat{\Pi}$ is given by

$$\mathrm{var}(\hat{\Pi}) = (Z'GZ)^{-1} Z'G\Sigma GZ(Z'GZ)^{-1}. \tag{13}$$

Note that this is not equal to the variance matrix computed with the weighted least squares formula, since Σ does not equal G^{-1}.[14] For the nonlinear least squares models, the matrix Z in equation (13) is replaced by the matrix of derivatives of the regression equation (9).

[14]If there is specification error in equation (11), as well as sampling error in the cell means, computation of the correct variance of Π is more complicated and requires additional assumptions about the correlation between the sampling error and the specification error, as well as about the correlation between the sampling errors of different cells. See, for example, Chamberlain (1994). When equation (11) is estimated on the individual-level data, rather than the cell means, bootstrapped standard errors are very close to those computed with equation (13), which suggests specification error is not a problem.

Because of the unique design features of the Current Population Survey, an estimate of the variance-covariance matrix of the cell means obtained from the vector of residuals from an OLS estimate of equation (4) is biased, since each individual is observed in the data up to eight times and serial correlation in the unobservable component in equation (4) is likely. Furthermore, because all members of a household participate in the CPS survey, the unobservable component will be correlated among members of the same household.

To surmount these problems, the bootstrap method is used to obtain an unbiased estimate of the variance matrix of the cell means. To mimic the randomization in the CPS sample design, households are drawn with replacement from the set of all households appearing in the data between 1989 and 1993. For each household chosen, all individuals associated with that household at any time are included in the dataset. This randomization procedure is replicated 50 times, producing 50 different "random samples" of data, upon which equation (4) is estimated. The empirical covariance matrix of the fifty sets of cell means is an unbiased estimate of the true variance matrix.[15]

[15]Given an unbiased estimate of the variance-covariance matrix, it could be used directly as a weight matrix and a generalized least squares estimate of equation (11). However, unless the number of bootstrap replications in the construction of the variance matrix is at least as large as the number of observations (the 720 cell means), the variance matrix is not invertible and therefore cannot be used in such a procedure. To see this, let $c(r)$ be a column vector of the deviation of the coefficients from the r*th* bootstrap replication from the mean of the 50 coefficients. If there are R bootstrap replications, the bootstrap estimate of the variance-covariance matrix is given by $V = (1/R)\Sigma rc(r) * c(r)'$. The rank of $c(r)$ is one, and thus the rank of $c(r) * c(r)'$ is one. Since V is the sum of R matrices each with a rank of one, the rank of V is at most R, and thus not invertible if there are fewer bootstrap replications than cell means. I thank David Card for pointing this out to me.

Even if the estimated variance matrix was invertible, any sampling error in the variance of the cell means is correlated with sampling error in the estimated variance matrix. Altonji and Segal (1996) showed that this leads to a small sample bias when the inverse of the variance matrix is used as a weight in a GMM procedure.

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