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WELFARE REFORM AND THE WELL-BEING OF SINGLE FEMALE-HEADED FAMILIES: A SEMI-PARAMETRIC ANALYSIS

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Single female-headed families with children (SFHFwC) have historically been the primary recipients of federal public cash assistance payments in the United States. Recent welfare reform initiatives established work requirements and cumulative time limits on public cash assistance payments. Three findings in this paper have significant implications for the long-term efficacy of welfare reform initiatives. First, SFHFwC made significant and broad-based gains in their economic well-being from 1993 to 1999. Second, increased propensities of single mothers to leave welfare and enter the workforce from 1993 to 1999, behavior consistent with incentives created by welfare reform measures, do *not* account for a major portion of these observed gains. Third, improved area economic conditions and increased educational levels of single mothers account for a major share of gains in well-being.

1. Introduction

Recent welfare reform measures in the United States have been widely hailed as a success in the popular press, but many concerns remain about their long-term impact. The most notable reform was the replacement, under the 1996 Personal Responsibility and Work Opportunity Act (PRWORA), of the Aid to Families with Dependant Children (AFDC) public cash-assistance payment program with state-specific cash assistance programs funded by federal Temporary Assistance to Needy Families (TANF) block grants. TANF grant guidelines require able-bodied individuals to work within two years of receiving TANF assistance and set five-year cumulative time limits on the receipt of TANF funds. A number of exemptions are attached to these requirements. Most notably, states can exempt up to 20 percent of families from cumulative time limits and can exempt single mothers with children under six years of age from work requirements if childcare is unavailable. Still, states are provided with clear incentives to move recipients off welfare and into the workforce and are penalized with grant reductions for failure to meet specific targets. States are also given autonomy to set more stringent cash assistance eligibility requirements than mandated under TANF (see Gallagher *et al.*, 1998 for a review of state guidelines).

By the end of 1998, TANF work requirements were just beginning to become binding in most states. Aggregate indicators suggest that the family type receiving the majority of TANF benefits, single female-headed families with children (SFHFwC), had, on average, made economic gains during the initial implementation of welfare reform initiatives. In 1993, 48.6 percent of SFHFwC had income levels that placed them below the official poverty line, and another 8.5 percent

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were near-poor (with income levels between 1 and 1.25 times the poverty line).[1] By 1999, the poverty rate among SFHFwC had declined to 41.0 percent, while another 9.2 percent were near-poor. Average per-capita total cash and non-cash receipts of SFHFwC in real 1999 dollars also showed a significant increase between 1993 and 1999. Yet, the underlying causes of these economic gains, as well as the distribution of gains among families, have not been analyzed. Are gains attributable to incentives that work requirements and lifetime benefit limits have created for family heads to leave welfare and enter the workforce? Alternatively, are observed economic gains the result of dramatic increases in educational levels and other changes in the characteristics of single mothers, or the strengthening of economic conditions in areas where SFHFwC live?

This paper explores recent shifts in the economic well-being of SFHFwC from 1993 to 1999. First, the statistical significance of the 1993 to 1999 shift in economic well-being is established by comparing non-parametric density estimates of per-capita total family receipts for the respective years. Second, the importance of factors underlying observed shifts in this distribution is analyzed using density re-weighting methods. Specifically, the contribution of the increased propensity to be in the workforce and off welfare, an outcome consistent with the goals of welfare reform initiatives, is explored. The additional contributions of changes in the educational levels of family heads and other characteristics of SFHFwC, as well as changes in area economic conditions, are then examined.

To pursue these issues the paper is organized as follows. Section 2 describes the data used in the study and provides descriptive statistics on changes in the economic well-being, characteristics, and area economic conditions of SFHFwC from 1993 to 1999. Section 3 outlines non-parametric density estimation methods and presents estimation results for per-capita receipts, earnings, and public assistance distributions. Section 4 presents the method for density re-weighting and the results from four density re-weighting experiments. Section 5 then discusses the results, limitations of the approach, and briefly concludes.

2. Data

The 1993 and 1999 Annual Demographic Files of the Current Population Survey (CPS) are the main datasets used in the analysis. The CPS is a nationally representative survey of US families. The Annual Demographic Files contain data on earnings, public assistance, and "other" receipts of SFHFwC, as well as on the characteristics of families and their heads.[2] Public assistance receipts include public cash assistance payments and the imputed value of benefits from Food Stamp and Medicaid programs.[3] Samples of 4,603 and 3,957 SFHFwC with heads

[1]Statistics are derived from the 1993 and 1999 Current Population Survey Annual Demographic files, unless noted.

[2]Figures represent receipts over the previous calendar year. 1993 receipts are expressed in 1999 real dollars.

[3]Imputed values of non-cash benefits are based on CPS datafile calculations. Food Stamp receipts are set equal to their face value. Medicaid receipts are imputed as the amount of family income, up to the amount of mean Medicaid outlays for families in the risk class, available for medical care after basic food and housing needs were met. For more information on the progressive discounting of Medicaid benefits among poorer families, see US Department of Commerce (1992). No attempt is made to impute the non-cash benefits from employment, like health insurance, in the analysis. Similarly, costs associated with employment, like childcare, are not included in the analysis.

age 18 to 64 are drawn from the 1993 and 1999 CPS, respectively. Because the specific county of residence is withheld in Current Population Survey data, area unemployment rates are calculated by aggregating Bureau of Labor Statistics employment and unemployment data for non-metropolitan and metropolitan counties within the state of residence.

Descriptive statistics on total per-capita receipts and the earnings, public assistance, and "other" components of total receipts are presented in Table 1. Average per-capita total receipts of SFHFwC in real 1999 dollars show a significant increase from 1993 to 1999. This average increase is fueled by growth in the "earnings" and "other" components of total receipts, as average cash and

TABLE 1

LOCAL ECONOMIC CONDITIONS AND INDIVIDUAL ATTRIBUTES, SINGLE FEMALE-HEADED FAMILIES WITH CHILDREN

	1993		1999	
Variable	Mean	Standard Error	Mean	Standard Error
Area unemployment rate (%)[a]	7.399	0.025	4.486	0.023
Education				
Below high school[b]	0.254	0.006	0.210	0.006
High school degree[b]	0.380	0.007	0.354	0.008
Some college[b]	0.269	0.007	0.312	0.007
College degree[b]	0.097	0.004	0.125	0.005
Age[a]	34.622	0.121	35.229	0.135
Children				
Under 6[c]	0.615	0.012	0.538	0.012
6 to 17[c]	1.261	0.015	1.328	0.017
Race (White = 0)				
Black[b]	0.265	0.007	0.244	0.007
Other non-white	0.040	0.003	0.041	0.003
Hispanic (non-Hispanic = 0)[b]	0.188	0.006	0.217	0.007
Never married[b]	0.305	0.007	0.368	0.008
Total cash and non-cash receipts[a]	7454.7	93.7	8605.3	123.9
Earnings[a]	5122.4	92.8	6471.2	115.6
Other[a]	1237.0	37.7	1429.4	47.0
Public assistance[a]	1095.4	21.6	704.7	17.9
No. observations	4603		3957	

Source: Bureau of Labor Statistics, 1999; Current Population Surveys, March 1993 and March 1999.

Notes: [a]1993 and 1999 means are significantly different at p = 0.05 level in two tailed t test.

[b]1993 and 1999 means are significantly different at p = 0.05 level in a logit regression.

[c]1993 and 1999 means are significantly different at p = 0.05 in a Poisson regression.

Earnings are defined as wage and self-employment income (including farming). Other income is defined as unemployment, social security, supplemental social security, veterans, disability, retirement, interest, dividend, rental property, child support, alimony, educational assistance, and other miscellaneous income sources. Public assistance income is defined as cash public assistance payments, as well as the imputed value of Food Stamps, Medicaid, and federal housing subsidy programs. All figures are in 1999 real dollars.

non-cash payments from public assistance programs show a significant decline over the same period.[4]

Descriptive statistics on attributes of family heads also show significant shifts between 1993 and 1999 (Table 1). In 1993, 25.4 percent of single mothers did not have a high school degree, but by 1999 only 21.0 percent did not have a high school degree. Similarly, the proportion of single mothers with education beyond high school increased from 36.6 percent to 43.7 percent between 1993 and 1999.[5] This rather dramatic shift in the educational levels of single mothers may be partially related to the decline in teenage births throughout the 1990s and the fact that mothers are, on average, older in 1999. Children of single mothers also tend to be older on average in 1999 than in 1993. Single mothers are also slightly less likely to be Black but more likely to be Hispanic in 1999 than 1993.

Area economic conditions also improved dramatically from 1993 to 1999. The average area unemployment rate faced by SFHFwC in 1993 was 7.4 percent. By 1999, the average area unemployment rate had declined to 4.5 percent. Concurrently, the proportion of single mothers not working declined from 38.3 to 27.1 percent between 1993 and 1999, while welfare participation decreased from 29.0 to 17.1 percent in the same period (Table 2).

TABLE 2

Distribution of Single Mothers' Workforce and Welfare Participation Status

	Total	
	1993	1999
Not workforce participant, not welfare participant	15.9	17.0
Workforce participant, not welfare participant	53.1	65.9
Workforce participant, welfare participant	6.6	7.0
Not workforce participant, welfare participant	22.4	10.1

Note: Welfare program participation indicates AFDC program participation in 1993 and TANF program participation in 1999.

3. Non-Parametric Kernel Density Estimation

A comparison of means provides only limited information on the nature of shifts in the underlying distribution of SFHFwC per-capita total receipts between 1993 and 1999. Therefore, non-parametric kernel density estimation techniques are employed to visualize the 1993 and 1999 distributions and identify where shifts occurred, without imposing rigid assumptions associated with parametric specification of the distributions. Density re-weighting methods are then

[4]Coder and Scoon-Rogers (1996) find that receipts in many income categories are underreported in the CPS, but that the magnitude of underreporting does not change over time. The value of imputed benefits like Food Stamps may be less susceptible to underreporting, but participation in Food Stamps declined during the 1993 to 1999 period along with public assistance payments. As a result, changes in underreporting of income over time and shifts in shares of income categories are unlikely to have substantially contributed to reported shifts in per-capita receipts.

[5]Dramatic increases in education levels of single mothers from 1993 to 1999 are the result of a long-term and relatively smooth trend. For example, the CPS Annual Demographic Files show that the percent of single mothers with education beyond high school was 34.6 in 1992; 39.3 in 1994; 40.7 in 1995; 42.2 in 1996; 41.2 in 1997; and 43.2 in 1998.

employed to identify the factors that have contributed to observed shifts in the distribution of per-capita receipts.

The basic kernel density estimator can be written as

$$\hat{f}(w) = \frac{1}{nh} \sum_{i=1}^{n} K\left(\frac{w - W_i}{h}\right) \tag{1}$$

where n is the number of observations, W_i are sample observations, h is the bandwidth of the kernel estimator and K denotes the kernel. The choice of bandwidth is crucial in density estimation. Since the 1993 and 1999 CPS samples of SFHFwC differ in size, the bandwidth for initial density estimates is calculated using an adaptive measure of spread for the pooled sample.[6] Calculation of bandwidths with the adaptive bandwidth estimator and data pooled across the 1993 and 1999 samples ensures that density estimates are under-smoothed, a less serious problem for exploratory data analysis than over-smoothing. Density estimates are less dependent on the choice of kernel than on the choice of bandwidth. The Epanechnikov kernel is used because it is optimal among non-negative kernels in minimizing the integrated mean square error (Silverman).

Results

Probability density function estimates of the logarithm of real per-capita total annual family receipts are presented in Figure 1, panel A. Shifts in estimated densities from 1993 to 1999 are presented on the right hand side of panel A by subtracting 1993 density estimates from the 1999 estimates. The resulting difference curve is positive at per-capita receipt levels above $7,000, indicating that a larger share of single mothers report per-capita receipts above $7,000 per year. Correspondingly, the difference curve shows a decrease in the share of families in the $1,500–7,000 per year range. A Kolmogorov–Smirnov test of the equality of the 1993 and 1999 distributions indicates that the rightward shift in the 1999 distribution is statistically significant at the $p = 0.01$ level.

The total per-capita receipts shift is then decomposed into earnings, public assistance, and "other" income components. The distribution of per-capita earnings, like that of per-capita receipts, shows a significant ($p = 0.01$ level in a Kolomogorov-Smirnov test) rightward shift from 1993 to 1999 (Figure 1, panel B). A smaller share of households with no or very low levels of wage and self-employment earnings accounts for a major portion of this shift. The share of families with earnings slightly below $1,500 per year also decreases, while the share of families with per-capita earnings above $1,500 per year increases.

The distribution of per-capita public assistance receipts, by contrast, shows a significant ($p = 0.01$ level in a Kolomogorov–Smirnov test) leftward shift from 1993 to 1999 (Figure 1, panel C). Density estimates for per-capita public assistance receipts in both periods are concentrated around zero and relatively low

[6]The adaptive bandwidth formula is: $h = 0.9An^{-1/5}$, where $A = \min(\text{standard deviation, interquartile range}/1.34)$. This bandwidth estimator results in a minimal increase in the mean square error for Gaussian densities and does not exhibit the same tendency to over-smooth skewed uni-modal and bi-modal distributions as the optimal bandwidth selector for normal distributions (Silverman, 1986).

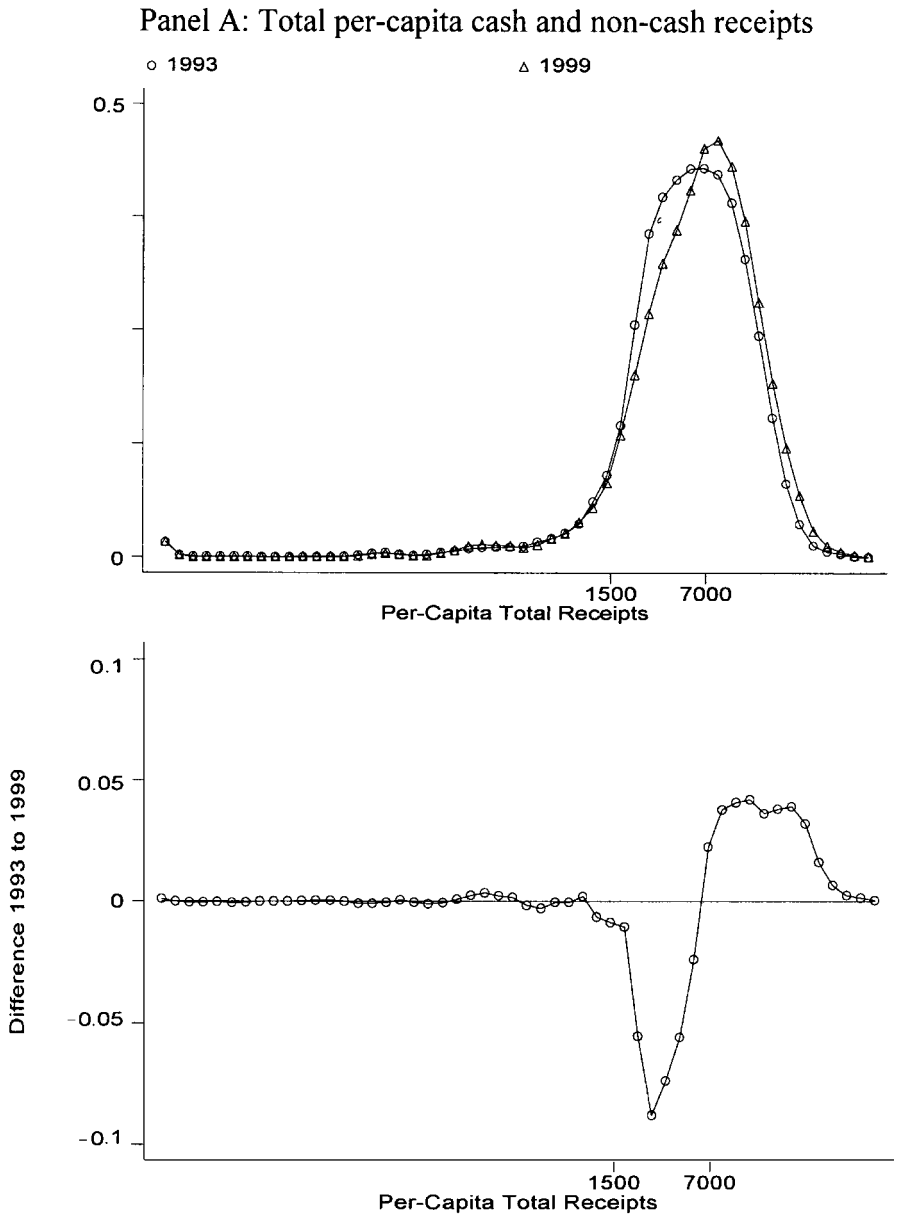


Figure 1. Non-Parametric Density Estimates

positive per-capita levels. However, when compared to the 1993 distribution, the 1999 distribution of per-capita public assistance payments reveals a slight increase in the share of families with no public assistance receipts and receipts in the $150–900 per year range and a decrease in the share of families with per-capita benefits in the $900–15,000 per year range. The density for the residual "other" category

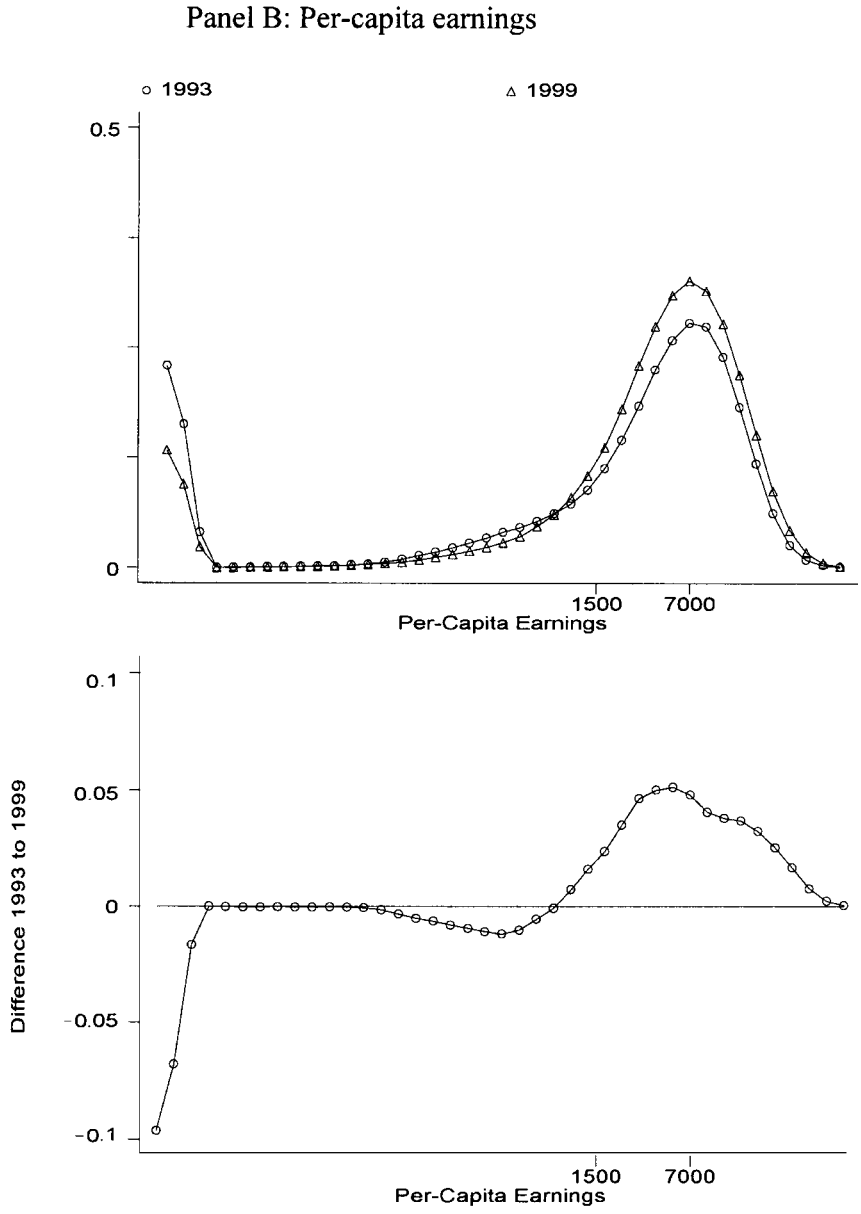
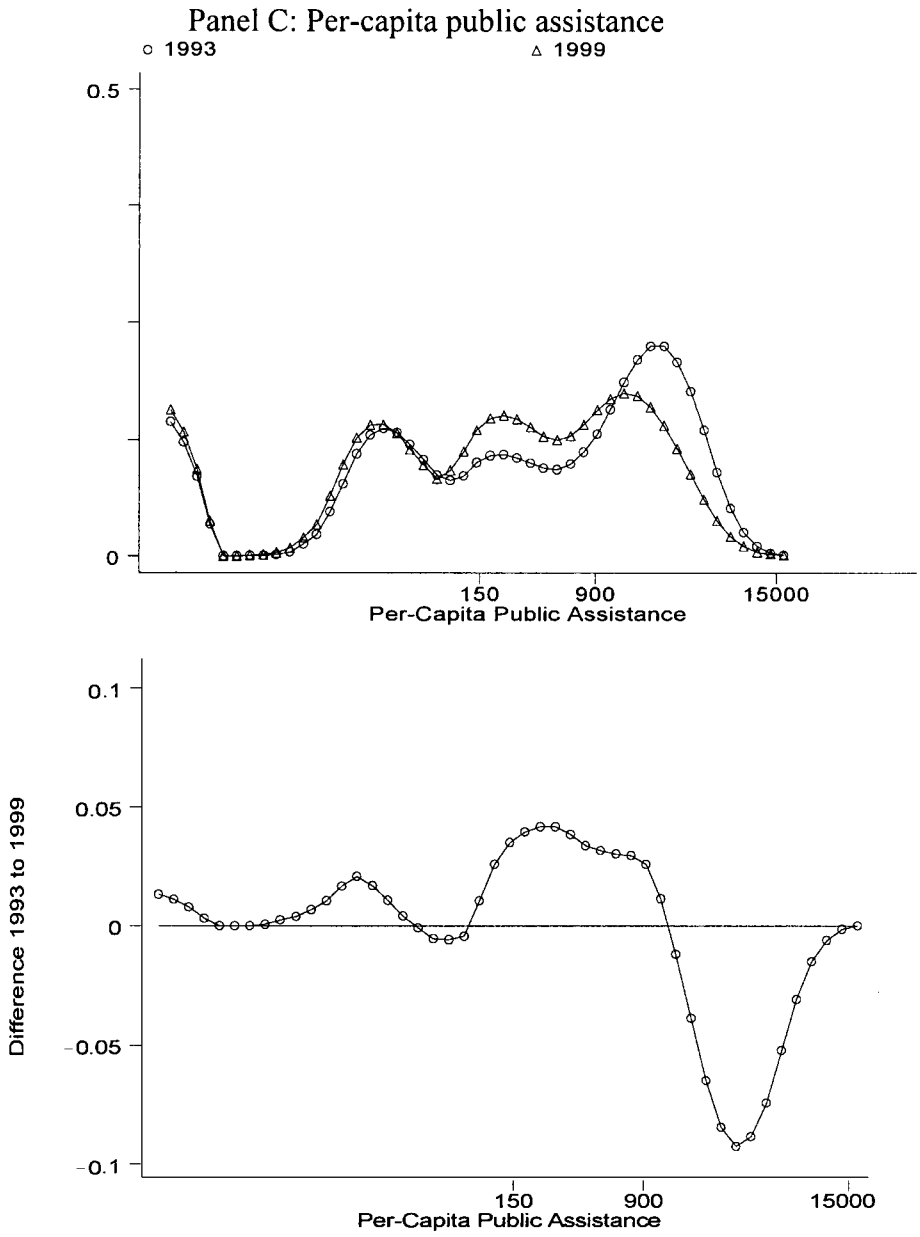


Figure 1—continued

of cash and non-cash receipts (not shown) also shows a rightward shift from 1993 to 1999 (at the $p = 0.01$ level in a Kolmogorov–Smirnov test). The results indicate that decreases in public assistance had a negative (leftward) influence on the distribution of SFHFwC per-capita receipts from 1993 to 1999. But, overall, the positive influence of the rightward shift in the distribution of per-capita earnings



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appears to have more than offset the negative influence of public assistance decreases during the period. Four experiments are presented next that re-weight the 1999 per-capita receipts distribution to isolate factors contributing to the observed 1993 to 1999 shift in the density of per-capita receipts.

4. Re-weighting the 1999 Distribution

The density re-weighting method used in the paper is a generalization of the familiar Oaxaca method for decomposition of changes in means (Oaxaca, 1973).[7] In order to illustrate the method, a relatively straightforward re-weighting function is employed to answer the question, ''What would be the distribution of total per-capita receipts in 1999 if levels of welfare program participation had remained at 1993 levels?'' The 1999 distribution of per-capita total receipts is decomposed into the weighted sum of the distributions of families on welfare and families not on welfare in Figure 2, panel A. Families on welfare and not on welfare represent 17.1 and 82.9 percent, respectively, of the total distribution.

Next, in panel B a counterfactual distribution is created by replacing the relative weight of families on welfare to families not on welfare in 1999 (0.206) with the relative weight in 1993 (0.449). This re-weighting captures the greater frequency of families on welfare in 1993, but explicitly assumes that the distribution of total per-capita receipts within both 1999 sub-populations is otherwise unchanged. Since the distribution of per-capita total receipts of families on welfare lies to the left of the distribution for families not on welfare, giving greater weight to observations of families on welfare causes the ''re-weighted'' distribution to shift leftward relative to the 1999 density. The difference between the re-weighted 1999 distribution and the ''actual'' 1999 distribution is then compared to the difference between the actual 1993 distribution and the actual 1999 distribution in panel C. The difference between the re-weighted distribution and the actual 1999 distribution appears to correspond closely to the observed difference between the actual 1993 and 1999 densities. In fact 76 percent of the probability mass associated with the shift in the distribution of receipts between 1993 and 1999 is associated with the difference between the re-weighted 1999 distribution and the actual 1999 distribution. This result suggests that changes in welfare program participation account for a substantial portion of the observed shift in economic well-being between 1993 and 1999. It should be noted that Kolomogorov–Smirnov tests are not applied to test for statistical differences between the re-weighted distribution and the 1999 distribution because the former is a hypothetical distribution based on a re-weighting of the latter.

Welfare program participation decisions are highly correlated with workforce participation decisions and some of the observed changes in welfare program participation may represent responses to concurrent changes in workforce participation. Figure 3 shows the results of a similar re-weighting of the 1999 density for 1993 levels of the four discrete states of workforce–welfare participation reported in Table 2: (1) in the workforce, not on welfare; (2) not in the workforce, not on welfare; (3) in the workforce, on welfare; and (4) not in the workforce, on welfare. Again, the re-weighted distribution lies to the left of the 1999 density. Indeed, over 85 percent of the probability mass associated with the shift in the distribution of receipts between 1993 and 1999 is also associated with the difference between the re-weighted 1999 distribution and the actual 1999 distribution.

[7]See DiNardo, Fortin, and Lemieux (1996) for one of the first economic applications of density re-weighting methods

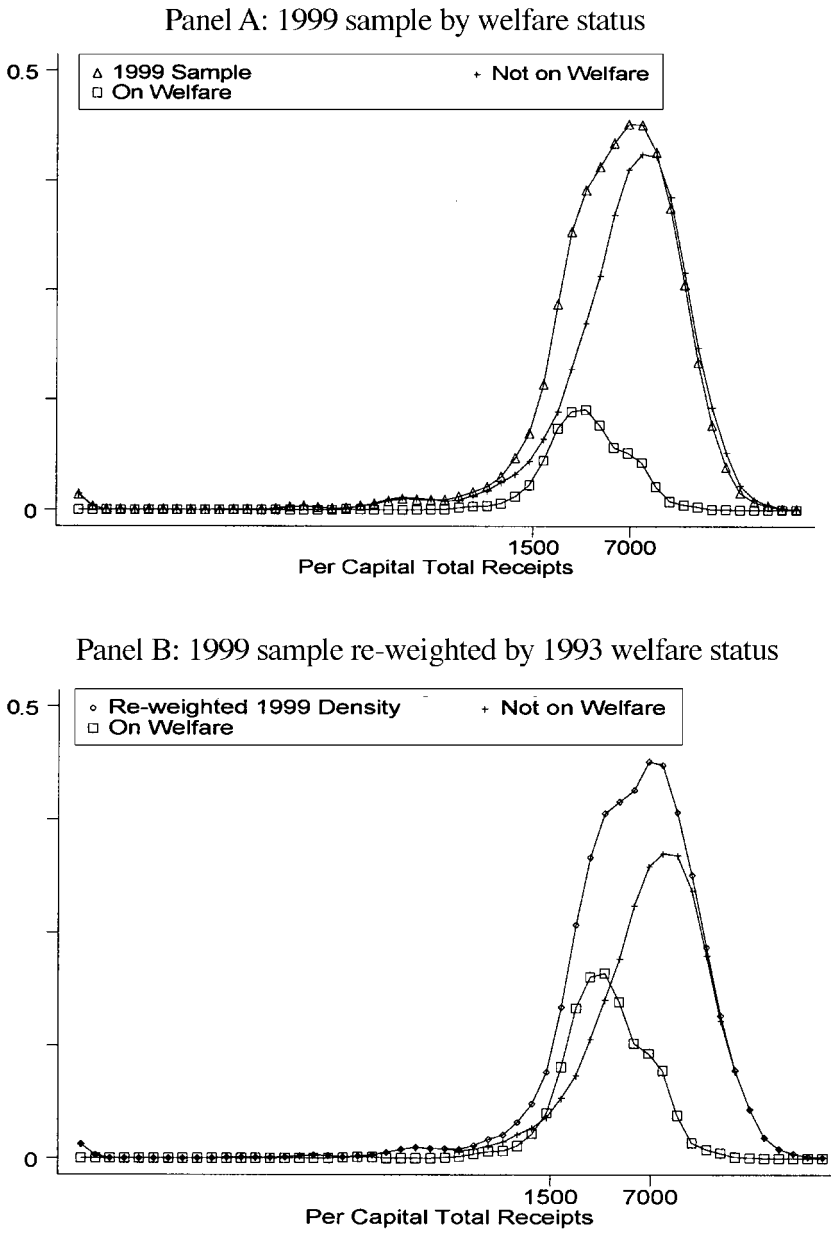

Figure 2. Density Re-weighting Using 1999 and 1993 Frequencies of Welfare Participation

Overview of Experiments

Despite the predictive power of the simple density re-weighting examples presented above, the observed shift in economic well-being between 1993 and 1999 is not entirely attributable to changes in workforce–welfare participation.

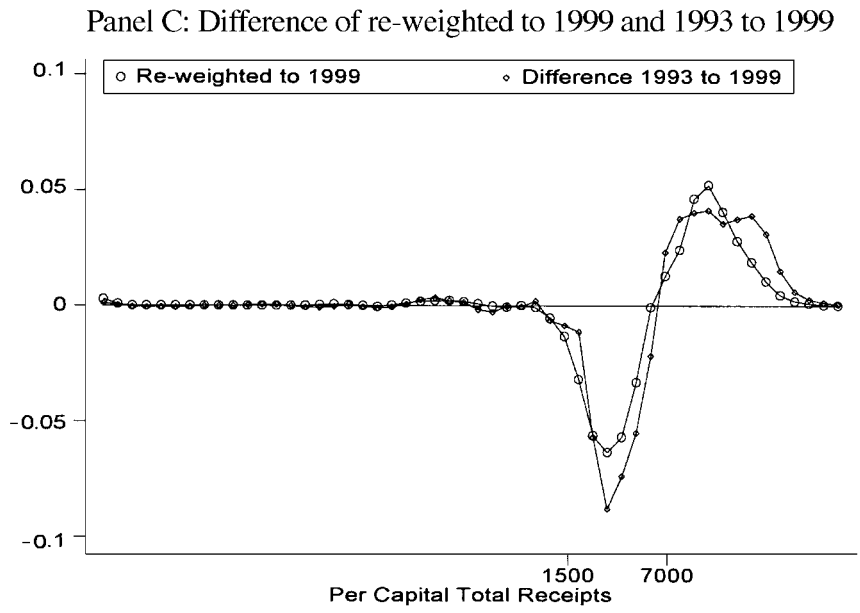

Figure 2—continued

Other factors that interact with workforce–welfare participation to change the economic well-being of SFHFwC are outlined in Figure 4.

Denote per-capita total receipts by w and the workforce–welfare states by z. Changes in the attributes of single mothers and their families, as well as changes in area economic conditions, indirectly influence per-capita receipts by causing shifts in welfare–workforce participation decisions. Family and area attributes may also directly influence the distribution of per-capita receipts within a given workforce–welfare state. For example, increased education may raise the earnings of a single mother who is working and not on welfare. Denote this set of family and area attributes as x. Welfare reform initiatives, in conjunction with other policies like Earned Income Tax Credits, have created constraints to remaining on welfare and incentives to work. The influence of these policies will be manifest in increased probabilities of working and decreased probabilities of being on welfare for a given set of family and area attributes.

Four experiments are performed by re-weighting the observations in the 1999 per-capita receipts distribution to examine the contributions that changes in propensities to work and to be on welfare, family attributes, and area economic conditions have made to the observed 1993 to 1999 shift in the distribution of per-capita receipts.

Experiment 1: Structural Change in Workforce–Welfare Participation Decisions

The major goal of welfare reform is to create a set of incentives and constraints that increase the propensity of single mothers to work and decrease their propensity to rely on cash public assistance. Shifts in workforce–welfare states

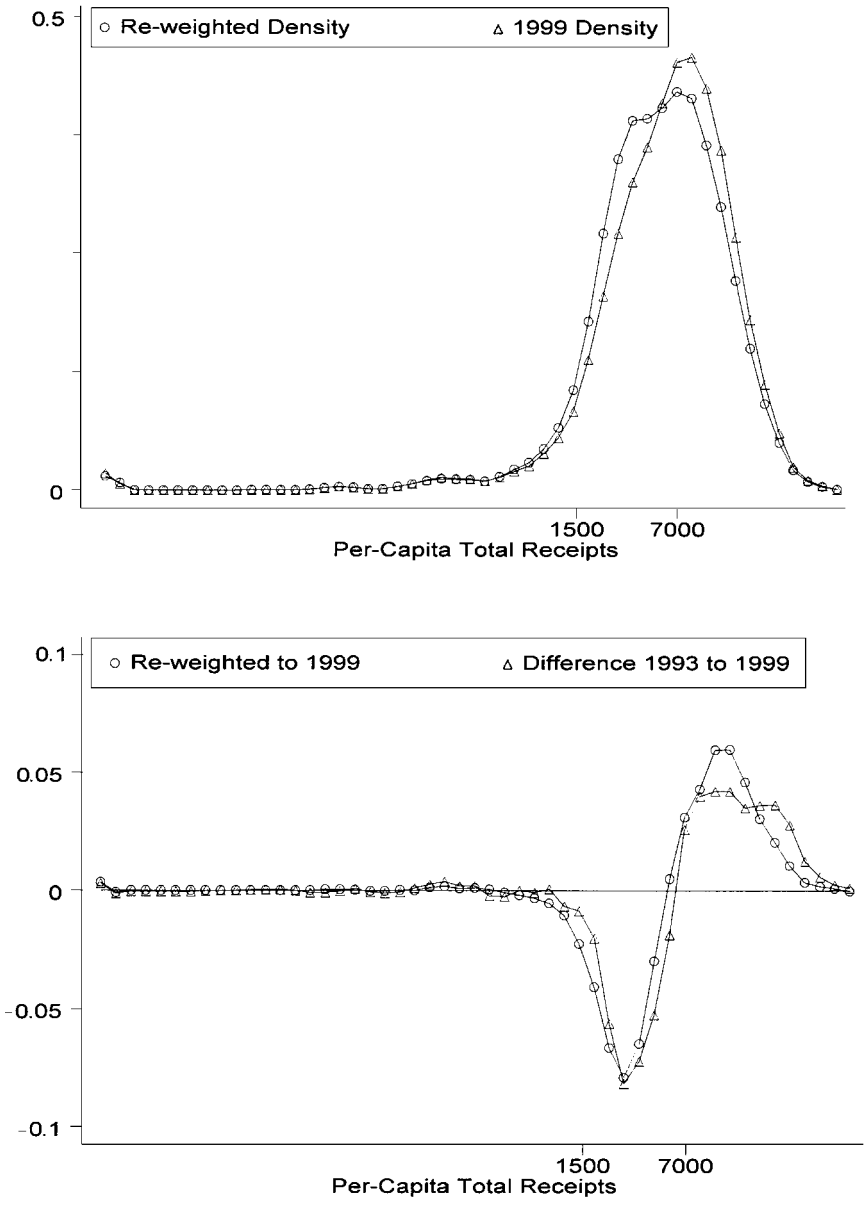

Figure 3. 1999 Per-capita Receipts Density with 1993 Workforce–Welfare Participation Levels

highlighted in Table 2 may result from changes in these propensities. But, as indicated in Figure 4, changes in workforce–welfare participation may also stem from changes in the characteristics of family heads and changes in area economic conditions. This experiment isolates the contributions that changes between 1993 and 1999 in the propensity to be in each workforce–welfare state have made to shifts in the distribution of per-capita receipts, while keeping the characteristics

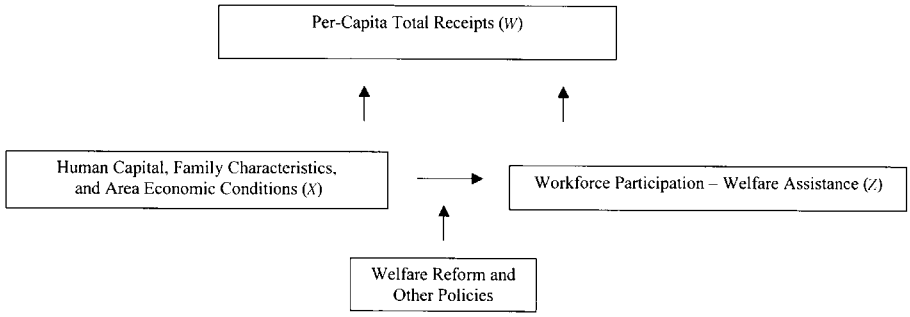

Figure 4. Factors Influencing the Well-being of SFHFwC

of single mothers and area economic conditions at 1999 levels. Changes in the distribution of per-capita receipts arising from changes in the propensity to be in each workforce–welfare state, personal and area characteristics held constant, may be taken as an of the impact of welfare reform measures and related changes in Earned Income Tax Credits for single mothers.

Let $f(w, z, x)$ be the joint distribution of per-capita total receipts, workforce–welfare participation states, and family–area economic attributes. The 1999 distribution of per-capita total receipts can be written as:

$$f(w; t_w = 99, t_{z|x} = 99, t_x = 99) = \int\int f(w|z, x, t_w = 99)\, dF(z|x, t_{z|x} = 99)\, dF(x|t_x = 99). \tag{2}$$

where $dF(x|t_{z|x} = 99)$ represents the probability of family–area economic attribute set x in 1999 and $dF(z|x, t_{z|x} = 99)$ represents the 1999 conditional probability of being in workforce–welfare state z given the set of family head characteristics and area economic conditions x. If the conditional distribution of per-capita total receipts is assumed to be structurally invariant to the distribution of workforce–welfare participation states, the distribution of receipts in 1999 that would have prevailed with 1993 propensities to be in specific workforce–welfare states, but family head characteristics and area economic conditions held at 1999 levels is:

$$f(w; t_w = 99, t_{z|x} = 93, t_x = 99) = \int\int f(w|z, x, t_w = 99)\Psi_{z|x}\, dF(z|x, t_{z|x} = 99)\, dF(x|t_x = 99) \tag{3}$$

where $\Psi_{z|x}$ is the re-weighting function $\Psi_{z|x} = dF(z|x, t_{z|x} = 93)/dF(z|x,\ t_{z|x} = 99)$. For the 1999 data, an estimate of $\Psi_{z|x}$ for the observed workforce–welfare state, $\hat{\Psi}_{z|x}$, is developed as the ratio of the predicted probability of being in that state in 1993 to the predicted probability of being in that state in 1999, given 1999 family head and area economic attributes. Multinomial logit models of workforce–welfare participation are estimated separately with the 1993 and 1999 data in order to develop these predicted probabilities. The regressors chosen in the specification of the multinomial logits are expected to be highly correlated with

workforce–welfare participation decisions and, thus, significantly contribute to the probability of being observed in each state. The multinomial logit results are presented in Appendix 1, Tables A.1.1 and A.1.2. The denominator of the ratio $\hat{\Psi}_{z|x}$ is the predicted probability of being in the observed workforce–welfare state in 1999 based on the multinomial logit model for 1999. The numerator of the ratio $\hat{\Psi}_{z|x}$ is the predicted probability of being in the state based on parameter estimates of the multinomial logit model for 1993 but observed 1999 family and area economic attributes.

The estimated weights $\hat{\Psi}_{z|x}$ are then used in the kernel density estimator:

$$\hat{f}(w;\, t_w = 99,\, t_{z|x} = 93,\, t_x = 99) = \sum_{i \in S_{99}} \frac{1}{h} \hat{\Psi}_{z|x}(z_i) K\left(\frac{w - W_i}{h}\right). \tag{4}$$

The re-weighted 1999 per-capita total receipts distribution with 1993 propensities to work and to be on welfare, but 1999 family–area economic attributes is presented in Figure 5. The re-weighted distribution of 1999 per-capita receipts shifts slightly leftward when compared to the actual 1999 distribution and, therefore, accounts for some of the observed shift in the distribution of per-capita total receipts from 1993 to 1999. This result is confirmed by comparing the difference between the re-weighted density and the actual 1999 density to the difference between the actual 1993 and 1999 densities in the bottom portion of Figure 5. Increased propensities to be in the workforce and off welfare account for 33 percent of the shift in the distribution of per-capita receipts of SFHFwC between 1993 and 1999. Since welfare reform measures and increases in Earned Income Tax Credits significantly increased incentives for mothers to work and to leave welfare between 1993 and 1999, these policy changes plausibly account for much of this 33 percent.

Experiment 2: 1993 Workforce–Welfare Propensities and 1993 Family Attributes and Area Economic Conditions

As discussed, education levels of single mothers and area unemployment rates showed significant changes from 1993 to 1999 (Table 1). To account for the role of changes in the characteristics of single mothers and economic conditions in the area where they reside, as well as changes in workforce–welfare participation propensities isolated in experiment 1, a counterfactual 1999 distribution of per-capita total receipts is generated that re-weights the 1999 distribution for 1993 levels of family attributes and area economic conditions and for 1993 workforce–welfare propensities. The counterfactual 1999 per-capita total receipts density is now written as:

$$\begin{aligned} f(w;\, t_w = 99,\, t_{z|x} = 93,\, t_x = 93) \\ &= \int\int f(w|z,\, x,\, t_w = 99)\, dF(z|x,\, t_{z|x} = 93)\, dF(x|t_x = 93) \\ &= \int\int f(w|z,\, x,\, t_w = 99)\, dF(z|x,\, t_{z|x} = 99)\, dF(x|t_x = 99)\Psi_{z|x}\Psi_x \end{aligned} \tag{5}$$

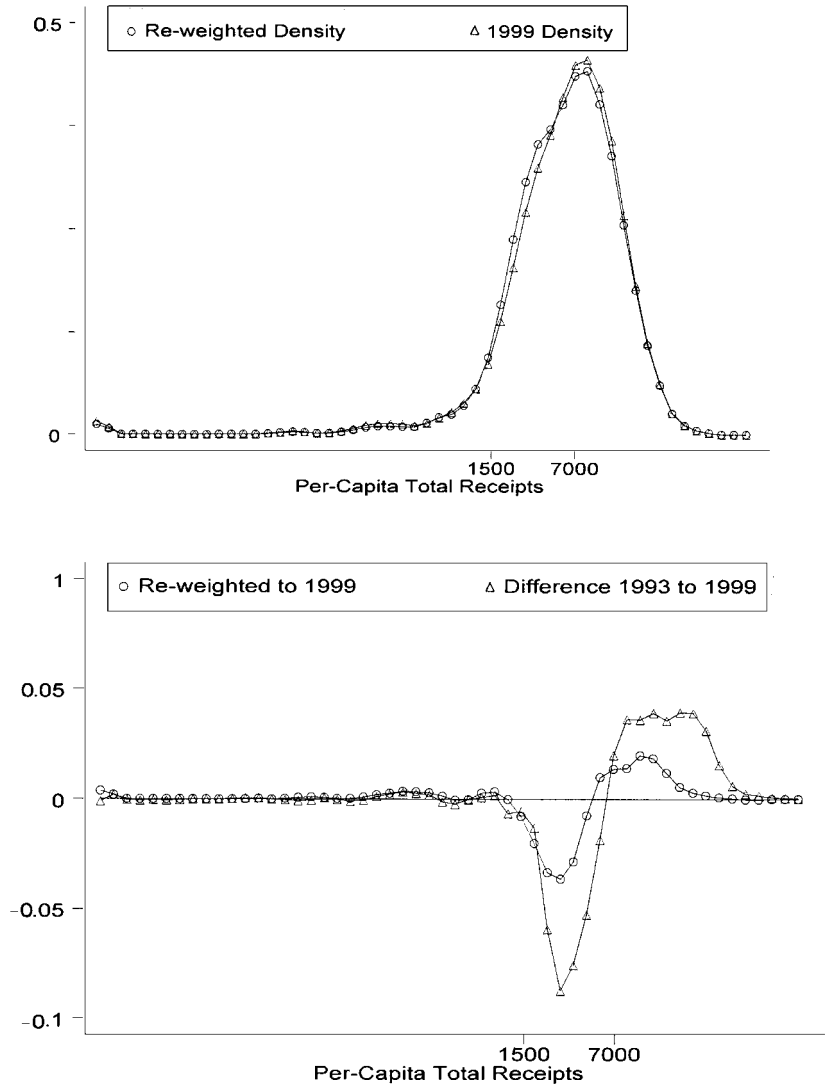

Figure 5. 1999 Per-Capita Total Receipts Density Adjusted for 1993 Propensities for Workforce–Welfare Participation

Note: The re-weighted density represents the 1999 distribution of per-capita receipts that would have prevailed if the 1993 structural relationship between workforce—welfare participation decisions and area and individual attributes remained, but area and individual attribute were at 1999 levels.

where by Bayes' rule:

$$\Psi_x = dF(x|t_x = 93)/dF(x|t_x = 99) = \left(\frac{\Pr(t_x = 93|x)}{\Pr(t_x = 99|x)}\right)\left(\frac{\Pr(t_x = 99)}{\Pr(t_x = 93)}\right).$$

The probability of being in sample period t given a set of family characteristics and area unemployment rates, $\Pr(t_x = t|x)$, is estimated by a logit model using the

1993 and 1999 samples of SFHFwC (see Appendix 2, Table A.1.2). The same covariates are employed in the logit as in the previously specified multinomial logit model, except for a quadratic specification of area unemployment rates to account for a possible non-linear relationship. $\Pr(t_x = t)$ is simply the number of observations in sample year t divided by the number of observations in both sample years.

The re-weighted 1999 distribution of per-capita total receipts with both workforce–welfare participation propensities and family–area economic attributes adjusted to 1993 levels is presented in Figure 6. Compared to experiment 1, the additional adjustment for 1993 family and area economic attributes produces a strong leftward shift in the distribution of per-capita total receipts. The re-weighted distribution now accounts for 98 percent of the shift in the distribution of per-capita receipts between 1993 and 1999. In fact, the re-weighted distribution produces a larger leftward shift in the distribution of per-capita receipts than actually occurred during the period. In other words, SFHFwC would be worse off with 1999 distributions of per-capita total receipts, adjusted for 1993 attributes and workforce–welfare propensities, than with the actual 1993 distribution of per-capita receipts. This result implies that changes in family and area economic attributes and changes in workforce–welfare participation propensities should have resulted in greater gains in the distribution of per-capita total receipts from 1993 to 1999 than have been observed. The residual negative shift from 1993 to 1999 is attributable to a change in the conditional distribution of per-capita total receipts $f(w|z, x, t_w = t)$ over the period. This change in the conditional distribution may stem from reduced public assistance benefits for a given workforce–welfare program participation state and set of area and individual attributes. The change may also stem from general equilibrium effects like reduced returns to individual attributes because of the significant influx of single mothers into the labor market (Bartik, 1998).

Experiment 3: The Influence of 1993 Area Unemployment Rate Changes on 1999 Workforce–Welfare States

This experiment explores the contribution to the shift in the distribution of per-capita total receipts of changes in workforce–welfare participation propensities that arise from widespread area unemployment rate decreases between 1993 and 1999. The experiment is conducted by re-weighting the 1999 density with weights developed by replacing 1999 area unemployment rates with 1993 rates for the same location in the 1999 workforce–welfare multinomial logit, but holding all family attributes at 1999 levels. This experiment has important policy implications since area economic conditions and associated workforce–welfare participation decisions are likely to vary with national economic cycles and be relatively transient compared to gains associated with human capital investments. The question has previously been addressed through parametric estimation of the relationship between caseload numbers and economic conditions (see, among others, Blank, 1997 and Zilak *et al.*, 1997).

Formally, let $z(x)$ now indicate the 1999 distribution of workforce–welfare program participation decisions associated with area economic conditions x.

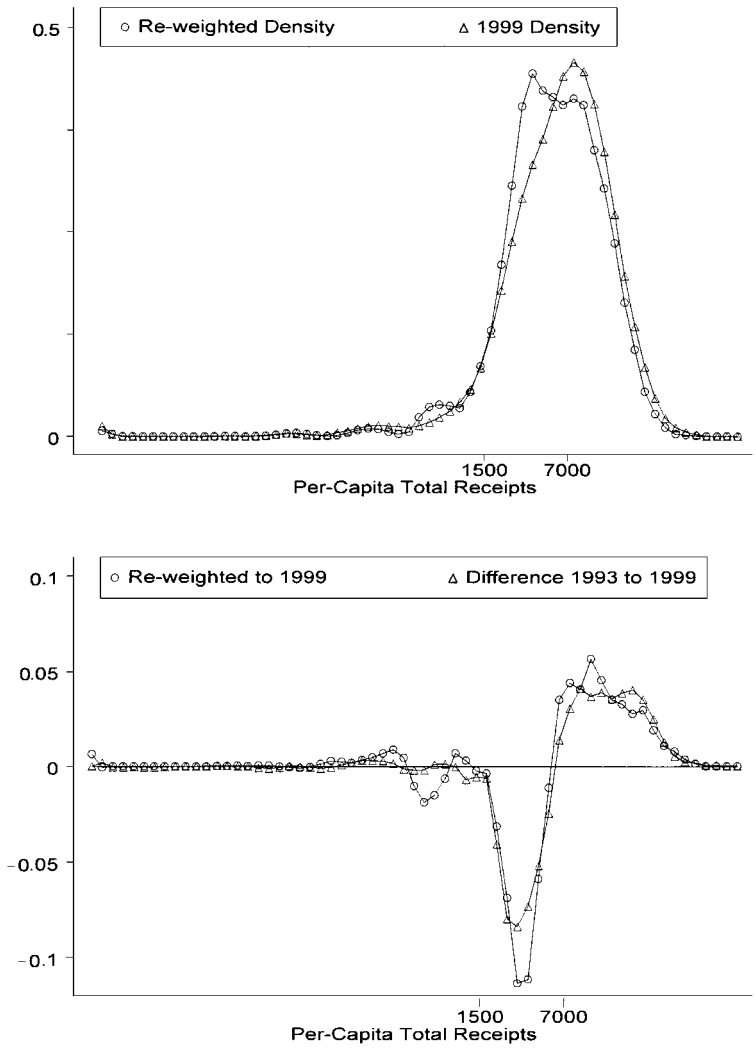

Figure 6. 1999 Per-Capita Total Receipts Distribution Adjusted for 1993 Workforce–Welfare Propensities and 1993 Family and Area Economic Characteristics

Note: The re-weighted density represents the 1999 distribution of per-capita receipts that would have prevailed if both the structural relationship between workforce–welfare participation and area and individual attributes and area and individual attributes were held at 1993 levels.

When area economic conditions are set to 1993 levels, the density function can be expressed as:

$$(6) \qquad f(w;\, t_w = 99,\, t_{z(x)} = 93) = \int f(w|z(x),\, t_w = 99)\, dF(z(x)|t_{z(x)} = 93)$$

$$= \int f(w|z(x),\, t_w = 99)\psi_{z(x)}\, dF(z(x)|t_{z(x)} = 99)$$

where

$$\psi_{z(x)} = \frac{dF(z(x)|t_{z(x)} = 93)}{dF(z(x)|t_{z(x)} = 99)}.$$

Probabilities associated with $dF(z(x)|t_{z(x)} = 99)$ are generated from the previously specified multinomial logit for 1999. As noted, $dF(z(x)|t_{z(x)} = 93)$ probabilities are generated using 1999 multinomial logit parameter estimates and 1999 observations of workforce–welfare states and family head characteristics, but with 1993 area unemployment rates instead of 1999 rates.

The results in Figure 7 show a leftward shift in the re-weighted distribution of per-capita receipts when compared to the 1999 distribution. Further, the difference in the density of the re-weighted distribution and the 1999 distribution accounts for 69 percent of the shift in the distribution of per-capita receipts between 1993 and 1999. The experiment provides evidence that widespread improvements in economic conditions have assisted welfare to workforce transitions and, thereby, increased the well-being of SFHFwC.

Experiment 4: 1993 Education Levels

Single mothers also showed dramatic increases in education between 1993 and 1999. Ideally, the influence of education would be examined after controlling for concurrent shifts in other attributes of single mothers and area unemployment rates. Workforce–welfare multinomial logit results for both 1993 and 1999 suggest that the probability of being in the workforce and off welfare increases significantly at higher levels of education. However, unlike unemployment rates that are historically attached to places, 1993 education levels are not available for individuals in the 1999 sample and an analysis similar to that undertaken in experiment 3 cannot be performed. Experiment 4 instead re-weights the 1999 total receipts distribution for 1993 frequencies of the four education categories: no high school degree, high school degree, some college, and college degree and above. The experiment addresses the question, "What would the 1999 per-capita receipts look like if education levels of single mothers were at 1993 levels, but other attributes maintained their 1999 conditional relationship with educational levels?"

Let $f(w, x_1, x_2)$ be the joint distribution of receipts, unemployment rates and attributes other than education x_1, and education levels x_2. The counterfactual density is written as:

$$(7) \qquad \int\int f(w|x_1, x_2, t_w = 99)\, dF(x_1|x_2, t_{x_1|x_2} = 99)\Psi_{x_2}\, dF(x_2, t_{x_2} = 99)$$

where:

$$\Psi_{x_2} = \frac{dF(x_2, t_{x_2} = 93)}{dF(x_2, t_{x_2} = 99)}.$$

Similar to the welfare–not on welfare re-weights in the initial example, this experiment is implemented by simply re-weighting 1999 observations in the four education categories for 1993 frequencies in the same category. Note that while

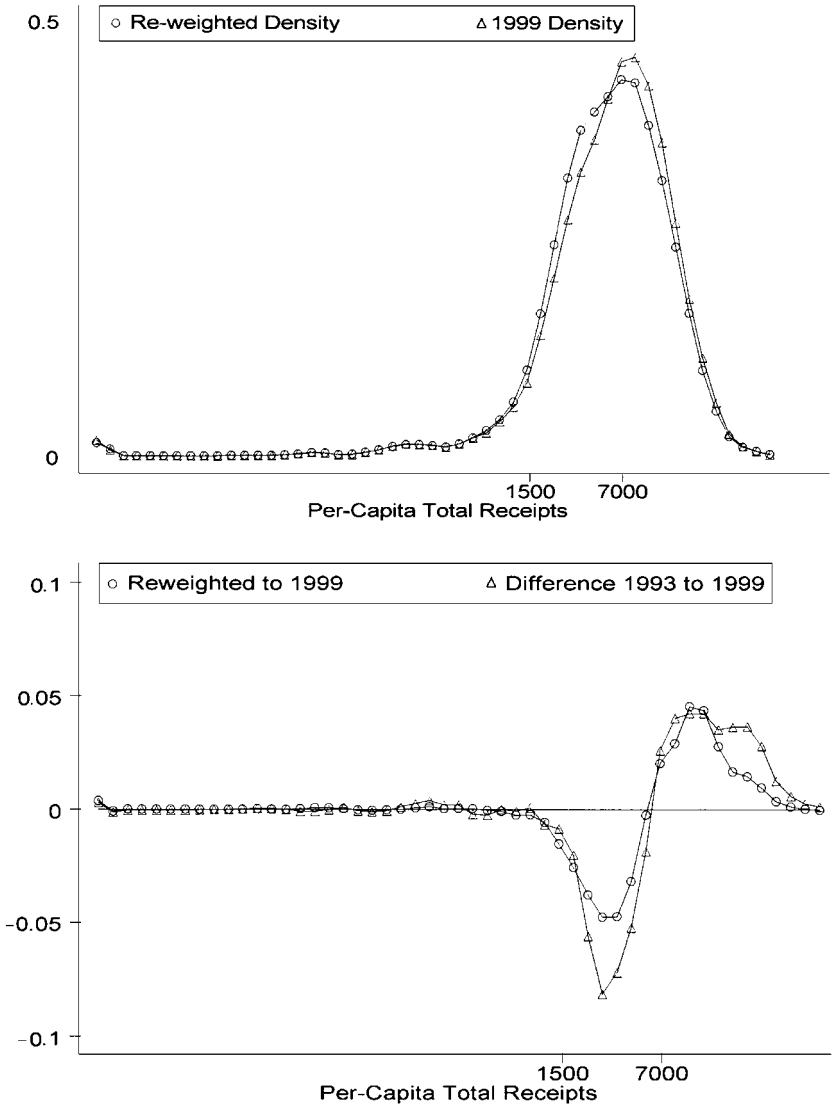

Figure 7. 1999 Per-Capita Total Receipts Distribution Adjusted for the Influence of 1993 Area Unemployment Rates on 1999 Workforce–Welfare States

Note: The re-weighted density represents the 1999 distribution of per-capita receipts that would have prevailed with 1999 workforce–welfare participation decisions arising from 1993 levels of unemployment.

information on area economic conditions and attributes other than education are not included in the experiment, their distribution will also implicitly change with changes in education levels based on their conditional relationship to education levels in 1999, $dF(x_1|x_2, t_{x_1|x_2} = 99)$. The results of the experiment are presented in Figure 8. Re-weighting for change in education creates a slight leftward shift in

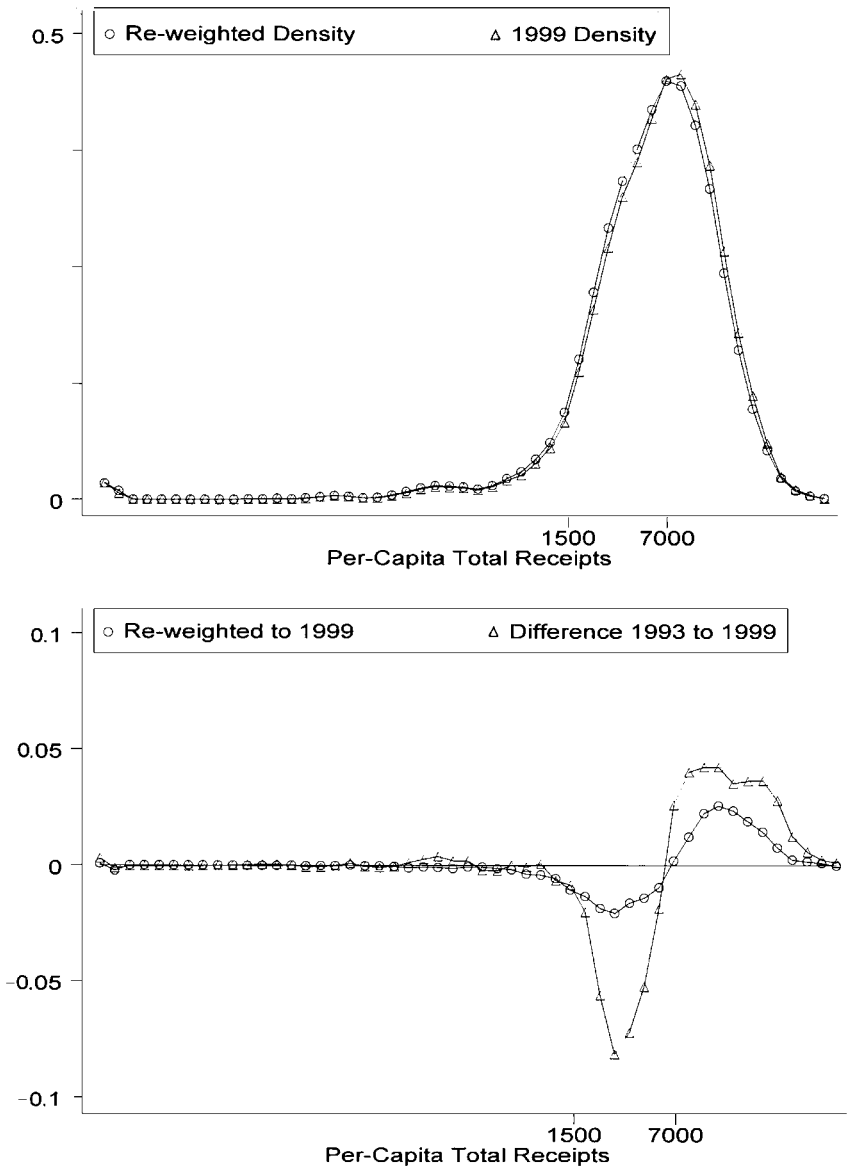

Figure 8. 1999 Per-Capita Total Receipts Distribution Adjusted for 1993 Education Levels

Note: The re-weighted density represents the 1999 distribution of per-capita receipts that would have prevailed if education levels of single mothers were held at 1993 levels.

the 1999 distribution of per-capita receipts. This shift accounts for 39 percent of the total shift in the distribution of per-capita receipts from 1993 to 1999. The result suggests that increased educational levels will allow single mothers to retain some of the gains in well-being that they have made when future downturns return area economic conditions toward 1993 levels.

5. Discussion and Conclusions

The nonparametric and semiparametric methods demonstrated in the paper provide a useful complement to standard regression analysis and decomposition techniques, particularly when concern focuses on the distributional impacts of policies. The techniques allow analysts to visualize shifts across entire distributions. Further, unlike mean decomposition techniques, the re-weighting methods allow shifts to manifest themselves within specific segments of the distribution.

Since the methods employed in the paper are rather novel, several limitations and areas for further research are worth noting. Like most decomposition techniques the magnitude of the contribution of specific factors to shifts in economic well-being are not invariant to the order of decomposition and are not additive when decompositions are performed one-at-a-time rather than sequentially. Even within a sequential decomposition like experiment 2, the combined factors will not account for exactly 100 percent of the observed shift in economic well-being. The unexplained or residual shift in the distribution can be attributed to a structural shift in the conditional distribution of receipts. In experiment 2 the residual leftward shift in the re-weighted density relative to the observed 1993 to 1999 shift suggests that total per-capita receipts have generally decreased after controlling for the attributes of single mothers and area economic conditions. This weakening of the conditional receipts distribution is consistent with the general finding that the earnings of low-skilled workers have deteriorated in the 1990s (e.g. Gottschalk, 1997). Further research is needed to identify shifts in labor demand and labor supply that are associated with this residual shift.

Similarly, experiments 3 and 4 are not linked as part of a sequential decomposition. Between 1993 and 1999, unemployment rates decreased in most areas and educational levels of single mothers generally increased. If these shifts are strongly correlated, the separate experiments may result in some double counting of the contributions of these factors to the total shift in well-being. The results of experiment 4 suggest that increased educational levels of single mothers have made an important contribution to improvements in their well-being. But additional research using parametric regression methods is needed to control for possible correlation between changes in area economic conditions and education levels.

Application of density estimation and re-weighting techniques to the distribution of per-capita total receipts of SFHFwC produces three findings with significant implications for the long-term efficacy of welfare reform initiatives. First, welfare to work transitions have resulted in significant gains in per-capita total family receipts between 1993 and 1999. Further, in 1999, single mothers were less likely to be on welfare and more likely to be working. Eighty-five percent of the observed rightward shift in per-capital total receipts of SFHFwC can be explained by the movement of single mothers out of the state of not in the workforce and on welfare and into the generally more remunerative state of in the workforce and not on welfare. It is worth noting, however, that childcare and transport costs associated with working are not netted out of total receipts. Therefore, net gains in economic well-being from welfare to work transitions may be lower than indicated by changes in total receipts.

Second, changes in the propensity of single mothers to leave welfare and enter the workforce, given a set of family characteristics and area economic conditions, account for only a moderate portion (33 percent) of the observed rightward shift in the per-capita distribution of total receipts from 1993 to 1999. Thus, incentives that welfare reform initiatives have created to leave welfare and enter the workforce appear not to be the major cause of gains in economic well-being. Concurrent increases in education levels and decreases in area unemployment rates, as well as other changes in the characteristics of family heads from 1993 to 1999, appear, on the other hand, to account for most of the observed rightward shift in the distribution of per-capita receipts. Admittedly, some key components of welfare reform legislation, like cumulative time limits on benefits, were not yet binding by the end of the period of analysis. But, to date, favorable changes in area economic conditions and the characteristics of family heads, not welfare reform initiatives, appear to be responsible for most of the observed economic gains of SFHFwC.

Third, many analysts note that future economic downturns may reverse observed shifts from welfare to work and associated gains in SFHFwC well-being. Lower unemployment rates are positively associated with being in the workforce and not on welfare, relative to being on welfare and not in the workforce. The influence of shifts in unemployment rates on workforce and welfare participation explains 69 percent of the change in per-capita receipts from 1993 to 1999. Therefore, some erosion in gains in the well-being of SFHFwC can be expected to occur in the next general economic downturn. However, educational levels of single mothers also increased rather dramatically over the period of the study. These increases have created gains in economic well-being that will be relatively resistant to future economic downturns. As a result, the distribution of well-being is unlikely to return to pre-reform levels under economic conditions similar to those seen in 1993. Given the relatively short time horizon of the study, it is unlikely that investments in education by single mothers have been influenced by welfare reform measures. Further research is needed to identify the factors that have motivated the investments by single mothers in education and to understand how further reform efforts can best support these investments.

Appendix 1: Parameter Estimates for the Multinomial Logit Model of Labor Force and TANF Program Participation Decisions (Workforce = 1, Welfare = 0 as Base)

TABLE A.1.1

Results for 1999

	Workforce = 0, Welfare = 0		Workforce = 1, Welfare = 1		Workforce = 0, Welfare = 1	
Variable	Coefficient	ASE	Coefficient	ASE	Coefficient	ASE
Constant	–2.132***	0.297	–1.574***	0.441	–1.869***	0.376
Unemployment rate	0.091**	0.037	0.188***	0.053	0.226***	0.048
South	0.111	0.116	–0.619***	0.198	–0.475***	0.171
Non-metro	0.005	0.140	–0.206	0.211	–0.407**	0.201
High school degree	–0.734***	0.119	–0.289*	0.176	–0.976***	0.140
Some college	–1.124***	0.127	–0.521***	0.187	–1.739***	0.169
College degree plus	–1.942 ***	0.201	–1.513***	0.359	–2.453***	0.328
No. children under 6	0.4678	0.071	0.629***	0.092	0.666***	0.080
No. children 6 to 18	0.028	0.048	0.353***	0.061	0.301***	0.054
Black	0.131	0.117	0.550***	0.159	0.773***	0.142
Other non-white	0.559***	0.210	0.351	0.316	0.330	0.298
Hispanic	0.222*	0.119	–0.134	0.180	0.240***	0.150
Age	0.021***	0.006	–0.059***	0.010	–0.029***	0.008
No. observations	671		277		401	
Total number of observations	3,957					
Log likelihood	–3,532.54					

TABLE A.1.2

Results for 1993

	Workforce = 0, Welfare = 0		Workforce = 1, Welfare = 1		Workforce = 0, Welfare = 1	
Variable	Coefficient	ASE	Coefficient	ASE	Coefficient	ASE
Constant	–1.377***	0.324	0.295	0.476	0.596*	0.311
Unemployment rate	0.075***	0.028	–0.034	0.041	0.082***	0.028
South	–0.085	0.112	–0.142	0.156	–0.489***	0.114
Non-metro	0.246**	0.112	0.328**	0.162	–0.129	0.116
High school degree	–0.971***	0.114	–0.509***	0.170	–1.346***	0.104
Some college	–1.167***	0.125	–0.419**	0.181	–1.800***	0.121
College degree plus	–1.704***	0.181	–1.985***	0.413	–3.392***	0.298
No. children under 6	0.472***	0.071	0.586***	0.091	0.892***	0.063
No. children 6 to 18	0.003	0.050	0.195***	0.070	0.274***	0.045
Black	0.160	0.111	0.651***	0.150	0.688***	0.103
Other non-white	0.072	0.231	–0.660	0.476	0.646***	0.206
Hispanic	0.204	0.125	0.315*	0.186	0.272**	0.118
Age	0.005	0.006	–0.074***	0.010	–0.056***	0.006
No. observations	733		303		1,125	
Total number of observations	4,603					
Log likelihood	–4,570.11					

Note: 1 = Participated in state.

*Indicates significance in a Wald test at the p = 0.10 level, **indicates significance in a Wald test at the p = 0.05 level, and ***indicates significance in a Wald test at the p = 0.01 level.

Appendix 2

TABLE 1.2

Logit Estimates of Probability of Being in 1999 Sample

Variable	Coefficient	ASE
Constant	9.270***	0.455
Unemployment rate	–2.289***	0.134
Unemployment rate squared	0.077***	0.010
South	–1.110***	0.085
Non-metro	2.274***	0.097
High school degree	–0.023	0.092
Some college	0.168*	0.097
College degree plus	0.254**	0.128
No. children under 6	–0.055	0.052
No. children under 6 to 18	0.036	0.035
Black	0.391***	0.084
Other non-white	–0.024	0.167
Hispanic	1.392***	0.096
Age	0.015***	0.005
Total observations	8560	
Log likelihood	–2920.21	

Note: *Indicates significance in a Wald test at the p = 0.10 level, ** indicates significance in a Wald test at the p = 0.05 level, and ***indicates significance in a Wald test at the p = 0.01 level.

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