Bounding the Labor Supply Responses to a Randomized Welfare Experiment: A Revealed Preference Approach

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First version: November, 2012
This version: August, 2014

Abstract

We study the impact of Connecticut's Jobs First (JF) welfare reform experiment on the labor supply decisions of a sample of welfare applicants and recipients. Although the experiment identifies the distribution of choices made in the absence and presence of reform, each woman's counterfactual choice is unknown. We show that economic theory restricts the set of counterfactual choices compatible with each woman's actual choice. We use these restrictions to develop bounds on the frequency of intensive and extensive margin responses to reform. Our results indicate that the JF experiment led some women to work and others to reduce their earnings.

Keywords: labor supply, bounds, intensive/extensive margin response, revealed preference

JEL Codes: J22, H20, C14

*This paper previously circulated under the title "What Distributional Impacts Mean: Welfare Reform Experiments and Competing Margins of Adjustment." We thank Andres Santos and seminar participants and discussants at the NBER Public Economics and Labor Studies Program Meetings, the Insitute for Research on Poverty meetings, the Federal Reserve Bank of Chicago, the Harris School, the New Economic School, Mannheim University, the Minneapolis Federal Reserve, MIT, Queens University, UC Berkeley, University College London, UCLA, UCSD, University of Sydney, University of Technology Sydney, Stanford, and Yale for useful comments. Stuart Craig and Attila Lindner provided outstanding research assistance. This research was supported by NSF Grant #0962352.

The U.S., like other advanced economies, has an extensive system of transfer programs designed to provide social insurance and improve equity. By affecting work incentives, these programs can induce individuals to enter or exit the labor force (extensive margin responses) or to alter how much they earn conditional on working (intensive margin responses).[1] The relative magnitude of these responses is an important input to the optimal design of tax and transfer schemes (Diamond, 1980; Saez, 2002; Laroque, 2005).

Much of the empirical literature concludes that adjustment to policy reforms occurs primarily along the extensive margin.[2] Two sorts of evidence are often cited in support of this position. First, several studies exploiting policy variation fail to find evidence of mean impacts on hours worked among the employed (Eissa and Liebman, 1996; Meyer and Rosenbaum, 2001; Meyer, 2002). Second, in both survey and administrative data, earnings tend not to exhibit much bunching at the budget "kinks" induced by tax and transfer policies, suggesting that intensive margin elasticities are small (Heckman, 1983; Saez, 2010). Both forms of evidence are subject to qualification. In addition to being susceptible to sample selection bias, mean impacts on hours worked ignore the potentially offsetting labor supply effects of program phase-in and phase-out provisions (Bitler, Gelbach, and Hoynes, 2006). And although excess mass at kink-points is a non-parametric indicator of intensive margin responsiveness (Saez, 2010), labor supply constraints may confound the quantitative inferences drawn from bunching approaches (Chetty et al., 2011).

This paper studies the impact of Connecticut's Jobs First (JF) welfare reform experiment on the labor supply decisions of a sample of welfare applicants and recipients. We develop and implement a new approach to measuring intensive and extensive margin responses to policy reforms that remains valid in the presence of labor supply constraints, impact heterogeneity, and self-selection. Conceptually, detecting adjustment along a given margin in response to a policy reform requires inferring what choices a decision maker would have made if the reform had not taken place. Because choices are only observed under the policy regime to which the decision maker is exposed, the problem of distinguishing response margins is closely tied to fundamental challenges in causal inference. To address these challenges, we use revealed preference arguments, analogous to those of Manski (2014), to restrict the set of counterfactual choices compatible with each decision maker's actual choice. These restrictions are shown to yield informative bounds on the frequency of intensive and extensive margin responses to reform when policy regimes are randomly assigned.

The JF experiment offers an interesting venue for studying labor supply because the reform provided a mix of positive and negative work incentives. First, it strengthened work requirements

[1] Blundell and Macurdy (1999), Moffitt (2002), and Grogger and Karoly (2005) provide reviews.

[2] Heckman (1993), for instance, concludes that "elasticities are closer to 0 than 1 for hours-of-work equations (or weeks-of-work equations) *estimated for those who are working.* A major lesson of the past 20 years is that the strongest empirical effects of wages and nonlabor income on labor supply are to be found at the extensive margin." (emphasis in original). Likewise, many modern models of aggregate labor supply are now predicated on the notion that labor supply is "indivisible" (Hansen, 1985; Rogerson, 1988; Ljungqvist and Sargent, 2011). See Chetty et al. (2011) for an assessment of how macro estimates of these models compare to estimates from micro data.

and increased sanctions for welfare recipients who fail to seek work. Second, it changed the manner in which welfare benefits phase out by disregarding earnings up to an eligibility threshold (or "notch") above which benefits abruptly drop to zero. Bitler, Gelbach, and Hoynes (BGH, 2006) show that the JF reform induced a nuanced pattern of quantile treatment effects (QTEs) on earnings qualitatively consistent with intensive margin responsiveness. They find that JF boosted the middle quantiles of earnings while lowering the top quantiles, yielding a mean earnings effect near zero. The negative impacts on upper quantiles provide suggestive evidence of an "opt-in" response to welfare (Ashenfelter, 1983), whereby working women are induced to lower their earnings in order to qualify for transfers. Corroborating this interpretation, we demonstrate that the JF reform led to a reduction in earnings mass above the eligibility notch.

Quantifying the magnitude of the intensive and extensive margin responses to this reform requires additional structure, as the reform may have shifted women between many points in the earnings distribution. For instance, JF might have induced some skilled women to work and earn above the eligibility notch while inducing other women to lower their earnings below the notch through an opt-in response. To systematically establish which sorts of responses might occur, we develop a non-parametric optimizing model of labor supply and welfare participation.[3] In the model, women value consumption and dislike producing earnings, and potentially face labor supply constraints. Women can under-report their earnings to the welfare agency. The addition of under-reporting opportunities introduces margins of adjustment that are not typically modeled but are potentially important for many transfer programs (Greenberg, Moffitt, and Friedman, 1981; Greenberg and Halsey, 1983; Hotz, Mullin, and Scholz, 2003). Notably, the JF reform might have induced some women who would not have worked to earn relatively large amounts which were under-reported to the welfare agency.

Unlike traditional parametric models of labor supply (e.g. Burtless and Hausman, 1978; Hoynes, 1996; Keane and Moffitt, 1998), our model has no refutable predictions for the cross-sectional distribution of earnings and program participation under a given policy regime.[4] We show however that the model places strong restrictions on the manner in which a woman's earnings and welfare participation choices may respond to reform. These restrictions follow from three basic observations. First, a utility maximizing woman will not choose a dominated option. Second, she will not respond to reform by choosing an alternative made less attractive. Third, she will not respond by choosing an alternative unaffected by reform unless the experiment reduces the payoff to the option she

[3] An alternative approach would entail invoking a "rank invariance" assumption that a woman's rank in the distribution of earnings is preserved across policy regimes. Under rank invariance, QTEs can be used to identify the joint distribution of potential earnings (Heckman, Smith, and Clements, 1997) and hence to quantify extensive and intensive margin responses. However, there are many reasons to be dubious of this assumption. As mentioned above, opt-in behavior in conjunction with incentives to work may lead women to exchange ranks in the earnings distribution. BGH (2006) are also skeptical of the rank-invariance assumption. In a related analysis (BGH, 2005), they provide evidence of rank reversals in the Canadian Self-Sufficiency Project experiment.

[4] See Macurdy, Green, and Paarsch (1990) for an early critique of parametrically structured econometric models of labor supply with nonlinear budget sets.

would have chosen in the absence of reform. We use these simple restrictions to develop analytical bounds on the proportion of women responding along each of eight allowable margins, some of which involve intensive margin adjustments and some of which involve extensive margin adjustments.

Applying our identification results, we find evidence of substantial intensive and extensive margin responses to reform. Jobs First incentivized at least 13% of the women who would not have worked to do so and roughly 38% of women who would have worked off welfare at low earnings to participate in the JF program. Importantly, we find that at least 19% of those women who would have worked off welfare at relatively high earnings levels were induced to reduce their earnings and opt-in to welfare, demonstrating that reform led to substantial intensive margin responses. We also find that the JF work requirements induced at least 2% of the women who would have not worked while on welfare to work and under-report their earnings in order to maintain eligibility for benefits.

Our results demonstrate that simple revealed preference arguments allow researchers studying policy reforms to derive informative bounds on the size of competing response margins under very weak assumptions. This insight was anticipated by Heckman, Smith, and Clements (1997) who, in the context of an application to the U.S. Job Training Partnership Act, considered the identifying power of Roy (1951)-type models of optimization for the joint distribution of potential outcomes. Our approach is applicable to more general settings that do not obey strong Roy-style dependence between choices and outcomes, and can easily be adapted to other reforms which alter the value of alternatives in known directions.

Finally, our results also contribute to a recent literature on partial identification of labor supply models. The bounding approach developed here is closely related to the theoretical analysis of Manski (2014) who considers the use of revealed preference arguments to set-identify tax policy counterfactuals. Our analysis extends his by adding program participation and reporting decisions, allowing for heterogeneous labor supply constraints, and by accommodating partial observability of budget sets. We also empirically analyze an actual policy reform and conduct inference on intensive and extensive margin response probabilities, while Manski's analysis is confined to computational experiments. Blundell, Bozio, and Laroque (2011a,b) also implement a bounds based analysis of labor supply behavior but are concerned with a statistical decomposition of fluctuations in aggregate hours worked rather than formal identification of policy counterfactuals. Their findings, which are compatible with ours, indicate that adjustments along both the intensive and extensive margins are important contributors to fluctuations in aggregate hours worked. Chetty (2012) considers bounds on labor supply elasticities in a class of semi-parametric models with optimization frictions. He also finds evidence of non-trivial intensive margin responsiveness, but relies on stronger parametric assumptions and does not model program participation.

The remainder of the paper is structured as follows. Section 1 describes the Jobs First Experiment. Section 2 describes the data from the Jobs First experiment. Section 3 examines experimental impacts on the earnings distribution and provides a test for anticipatory behavior. Section 4 describes our optimizing model and Section 5 studies identification of response margins under the model's restrictions. Section 6 provides our main empirical results and Section 7 discusses the robustness of our results to a variety of extensions. Section 8 concludes.

1 The Jobs First Evaluation

With the passage of the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) in 1996, all fifty states were required to replace their Aid to Families with Dependent Children (AFDC) welfare programs with Temporary Assistance to Needy Families (TANF) programs. This change involved the imposition of time limits, work requirements, and enhanced financial incentives to work. The state of Connecticut responded to PRWORA by implementing the Jobs First (JF) program. To study the effectiveness of the reform, the state contracted with the Manpower Development Research Corporation (MDRC) to conduct a randomized evaluation comparing the Jobs First TANF program to the earlier state AFDC program. Table 1 provides a detailed summary of the JF and AFDC program features.

A primary feature of the JF reform was the enhancement of financial incentives to work while on assistance. The JF program disregarded 100% of earnings up to the federal poverty line in the determination of both eligibility and welfare transfers. This zero implicit tax on earnings is to be contrasted with the positive implicit tax faced by women on welfare relative to AFDC. The JF earnings disregard was meant to incentivize work but also created an eligibility "notch" in the transfer scheme, with a windfall loss of the entire grant amount occurring if a woman earned a dollar more than the monthly federal poverty line.

Another important feature of JF was the imposition of lifetime limits on the number of months during which a person may receive welfare assistance. The JF reform also involved more stringent work requirements and imposed sanctions on cases that failed to seek work. This created further incentives to work while on welfare, as non-working recipients were "hassled" into either getting off welfare or working. Finally, the JF reform extended the duration of two post-welfare exit services (child care assistance and health insurance coverage through Medicaid) and increased the amount of income in the form of child support transfers that is disregarded in the computation of the welfare transfer.

We next provide details about the individual components of the JF reform, referencing often MDRC's final report (Bloom et al., 2002) which describes the reform's implementation. We conclude with a summary of the findings from prior analysis of the JF reform.

Changes in the Treatment of Earnings

In Connecticut, as elsewhere in the nation, earned income reduced the AFDC benefits paid out to a recipient down from a maximum "base grant" amount. However, some earned income was disregarded when calculating benefits. Specifically, AFDC recipients were eligible for a fixed earnings disregard of \$120 for the twelve months following the first month of employment while on assistance and \$90 afterwards. They were also eligible for a proportional disregard of any additional earnings. Connecticut's implementation of AFDC used a proportional disregard of 51% for the four months following the first month of employment while on assistance and 27% afterwards. Accordingly, we refer to the 51% and 27% rates as the *unreduced* and *reduced* proportional disregards respectively, and to the \$120 and \$90 set asides as the *unreduced* and *reduced* fixed disregards. A distinguishing feature of the JF program is its 100% earnings disregard which provides a dramatic reduction in the implicit tax on earnings faced by women on welfare relative to AFDC. This notch created strong incentives to earn less than the poverty line.[5]

Figure 1 provides a stylized depiction of the incentives generated by the cash assistance component of the JF reform. Specifically, the Figure depicts the transfer scheme faced by a woman with two children who, under AFDC, has access only to the reduced fixed and proportional disregards and, under JF, has not yet hit the time limits. The vertical axis of the graph gives earned income plus welfare assistance while the horizontal axis gives earned income E. $\overline{G}$ is the base grant amount which is common to JF and AFDC. Transfers under JF exhibit a large discontinuity, a "notch", at the Federal Poverty Line (FPL): at earnings below the FPL the woman receives a transfer equal to $\overline{G}$, while at earnings beyond the FPL she is ineligible for assistance. The presence of the notch implies that total income when monthly earnings equal the FPL exceeds that for earnings in the range $(FPL, FPL+\overline{G})$. The JF transfer scheme is to be contrasted with the AFDC scheme which exhibits no discontinuities: the transfer phases out smoothly, reflecting an implicit tax rate of 73% on earnings above a \$90 disregard.

We can formalize the rules governing welfare transfers by means of the transfer function $G_i^t(E)$ which gives the monthly grant amount associated with welfare participation at earnings level E under policy regime $t \in \{a, j\}$ (AFDC or JF respectively). The i subscript acknowledges that the grant amount varies across women with the same earnings due to variation in the size of their Assistance Unit (AU)[6] and based upon recent assistance history. Letting $\mathbf{1}[.]$ be an indicator for

[5] The reform also induced a second notch specifically for applicants who faced a strict earnings test in order to establish eligibility. AFDC did not have an earnings test for applicants, but benefits for that program phased out at an amount above the JF earnings test. Hence, it became harder under JF for high earning applicants to establish eligibility.

[6] The assistance unit consists of the woman receiving welfare plus eligible dependent children. Children are eligible if they are under age eighteen or under age nineteen and in school.

the expression in brackets being true, the regime specific transfer functions can be written:

$$G_i^a(E) = \max\left\{\overline{G}_i - \mathbf{1}[E > \delta_i](E - \delta_i)\tau_i, 0\right\} \tag{1}$$
$$G_i^j(E) = \mathbf{1}[E \leq FPL_i]\overline{G}_i,$$

where $\delta_i \in \{90, 120\}$ and $1-\tau_i \in \{.27, .51\}$ are the fixed and proportional AFDC earnings disregards, and i subscripts have been added to the base grant amount ($\overline{G}_i$) and the federal poverty line (FPL_i) to acknowledge that they vary with AU size. Although in Figure 1 the AFDC transfer is fully exhausted at an earnings level that is strictly below the FPL, this is not always the case. A woman with access to the *unreduced* proportional and fixed disregards exhausts her AFDC transfer at an earnings level slightly above the FPL (specifically, $0 < G_i^a(FPL_i) < \$75$, depending upon AU size).

Welfare is, of course, part of a broader web of tax and transfer programs. Figure 2 depicts the woman's monthly income accounting for the other tax and transfer programs that are empirically relevant for would-be welfare recipients, namely the Food Stamps (FS) program and the federal tax system, including payroll and Medicaid taxes, and the Earned Income Tax Credit (EITC). The FS program interacts with welfare assistance both because welfare recipients are categorically eligible for FS and because welfare transfers are treated as income in the determination of the FS transfer. The JF reform introduced a further link between cash and in-kind assistance: conditional on joint take up, earnings up to the FPL were disregarded in the determination of both the welfare and the FS transfers. This feature is clearly visible in Figure 2: under JF, the combined welfare and FS transfer depends only on whether earnings exceed the FPL, in which case assistance is terminated. Thus, JF's impact on the FS program amplifies the notch at the FPL.[7]

Work Requirements, Sanctions, and Time Limits

AFDC recipients were subject to Connecticut's pre-existing employment mandates, which specified work requirements for all parents except those caring for a child under age two. The MDRC final report describes the AFDC employment-related services as "a small-scale, largely voluntary, education-focused welfare-to-work program" (Bloom et al., 2002, p.28) with lax enforcement. JF recipients, by contrast, were required to participate in employment services targeted toward quick job placement unless they were parents caring for a child under age one.[8] On a related note, The JF

[7] The EITC and other taxes do not directly interact with cash and in-kind assistance because income from welfare and FS is not counted in the determination of taxes and tax credits.

[8] Regarding the AFDC work mandates, Bloom et al. (2002, p.11) state that "Connecticut, like many other states, did not strongly enforce the existing requirements for AFDC recipients to participate in employment-related activities (in fact there were waiting lists for services). Job Connection, the state's Job Opportunities and Basic Skills Training (JOBS) program, served a small proportion of the total welfare caseload in any month, and a large proportion of those who participated were in education and training activities." As to the JF work mandates, Bloom et al. (2002, p.12) state that "nearly all [non-exempted] JF participants were required to begin by looking for a job, either on their own or through Job Search Skills Training (JSST), a group activity that teaches job-seeking and job-holding skills. Education and training were generally reserved for recipients who were unable to find a job despite lengthy

reform stepped up sanctions for non-compliance with work requirements. JF recipients who failed to make good faith efforts to find work while receiving assistance could be sanctioned by having their welfare grant reduced or temporarily canceled. Under AFDC, sanctions involved removing the noncompliant adult from the grant calculation rather than closing the entire case.

Finally, under AFDC, women could remain on welfare indefinitely, provided that their children were of eligible age. By contrast, under JF, women were limited to twenty one months of assistance. However, exemptions and six month extensions from the time limit were possible. Survey evidence from Bloom et al. (2002, p.76) suggests that, in practice, a majority of the cases reaching the time limit were granted an extension and, during the first year after random assignment, nearly 20% of the JF units were exempt from time limits (p.35).

Other Changes

As mentioned above, the JF reform also entailed changes in related programs. As we explain next, these changes are likely to have been less important than the changes mentioned in previous sections.

First, under AFDC, recipients were eligible for twelve months of Transitional Child Care (TCC) subsidies if they left welfare for work. Under JF, households were eligible for TCC indefinitely if they left welfare for employment and as long as their income did not exceed 75% of the state median income. While this could create additional incentives to work, Bloom et al (2002) indicate that this component of the JF reform had minimal impact on actual access to child care subsidies because of existing means-tested child care programs provided by the State of Connecticut. Similarly, under AFDC, assistance units leaving welfare because of increased earnings were eligible for one year of Transitional Medicaid (TM). Under JF, units were eligible for two years of TM, which might again increase incentives to work. However, Bloom et al. (2002) indicate that this component of the JF reform had little impact on actual access to healthcare because of contemporaneous state level programs covering essentially the same population.[9]

Second, JF changed the treatment of income received in the form of child support (CS) transfers. Under AFDC, recipients received only the first $50 of CS collected each month through the Bureau of Child Support Enforcement (BCE) and the entire amount received was disregarded in

up-front job search activities."

[9]Regarding TCC, Bloom et al. (2002) write that "in practice, however, the difference between these two policies was minimal, because AFDC members who reached the end of their eligibility for TCC could move directly into the child care certificate program (that is, income-eligible child care) for low-income working parents.". Regarding TM, Bloom et al. (2002) write that "the magnitude of the treatment difference related to medical assistance has diminished over time, as Connecticut has expanded the availability of health coverage to low-income children and adults who do not receive welfare." In addition, they note that "the 1996 federal welfare law 'de-linked' eligibility for Medicaid from eligibility for welfare and created a new coverage category for families who are not on welfare but who meet the AFDC eligibility criteria that were in place in July 1996. These statewide expansions in health coverage for children and adults are available to both the JF group and the AFDC group." Taken together these observation suggests that the additional 12 months of TM available under JF are unlikely to have induced changes in the value of working off assistance.

computing the welfare transfer, corresponding to a $50 CS disregard. Instead, under JF, recipients received a check for the full amount of any CS collected by BCE and the first $100 were disregarded in computing the welfare transfer. These changes could induce income effects since women receiving between $50 and $100 of CS received an increased transfer under JF without adjusting their behavior. However, these income effects are likely to be minimal given that they only apply to women within this restricted range of CS payments – payments above $100 were deducted dollar for dollar from benefits – and since the amount of additional income per month is very small.

Prior Analyses

Between January 1996 and February 1997, MDRC collected a baseline sample of roughly 4,800 single parent AFDC recipients and applicants and randomly assigned them to either the new JF program or the old AFDC program with equal probability. To conduct the evaluation, administrative data on earnings and welfare participation were collected for several years prior to and following the date of random assignment and merged with a baseline survey conducted by MDRC.

Several prior analyses of this experiment find that the program encouraged work and had important effects on the distribution of both earned and unearned income (Bloom et al., 2002; BGH, 2006, 2014). In particular, BGH (2006) demonstrate that over the first seven quarters of the JF experiment – during which time none of the women were at risk of exhausting the time limits – the reform increased employment; raised quantiles of the earnings distribution corresponding to low, but positive, earnings levels; and lowered the top quantiles of earnings, with these negative effects being stronger among women with positive earnings prior to random assignment (BGH, 2014).

One interpretation of the negative impacts on top quantiles is that they reflect "opt-in" behavior – i.e. that some women reduced their earnings in order to qualify for welfare assistance.[10] While the opt-in interpretation is plausible, it remains to be seen whether these negative QTEs in fact reflect a decrease in earnings mass above the FPL, as a standard labor supply model would predict. Negative QTEs at top quantiles could, for example, reflect a shifting of mass between two points above (or below) the poverty line. To resolve this ambiguity, in Section 3 we extend the analyses of BGH (2006, 2014) by exploiting information on AU size in order to isolate how changes in the earnings distribution relate to the JF eligibility notch. We also develop a formal test for intensive margin responsiveness and a test for anticipatory behavior in response to time limits during the first seven quarters of the experiment. To set the stage for these tests, we next describe the data and the analysis sample.

[10] As BGH (2006) note, since the women in this evaluation had either received or applied for welfare by the date of randomization, the relevant "opt-in" response is, in fact, typically a failure to "opt-out" of the JF program by earning more than the federal poverty line.

2 Data and Descriptive Statistics

Our data come from the MDRC Jobs First Public Use Files. They contain a baseline survey of demographic and family composition variables merged with longitudinal administrative information on welfare participation, rounded welfare payments, family composition, and rounded earnings covered by the state unemployment insurance (UI) system from at least seven quarters prior to random assignment to at least sixteen quarters post random assignment.

There are a number of limitations to the Public Use Files. While welfare payments are measured monthly, UI earnings data are only available quarterly. To put them on a consistent time scale, we aggregate welfare participation to the quarterly level. Another difficulty is that the administrative measure of AU size is missing for most cases, which is problematic because the JF notch occurs at the FPL which varies with AU size. For the JF sample we are able to infer an AU size in most months from the grant amount while the women are on welfare; otherwise, we use the grant amount in other months to impute AU size. For the AFDC sample, the grant amount depends on many unobserved factors, preventing us from inferring the AU size from the administrative data. Thus, when computing treatment effects by AU size, we rely on a variable collected in the baseline survey named "kidcount." This variable records the number of children in the household at the time of random assignment. As might be expected, the kidcount variable tends to underestimate the true AU size as women may have additional children over the seven quarters following the baseline survey. To deal with this problem we inflate the kidcount based AU size by one in order to avoid understating the location of the poverty line for most AUs.[11] Additional details about variable construction are provided in the Appendix.

Baseline Characteristics of the Analysis Sample

Table 2 shows descriptive statistics for our analysis sample. We have 4,642 cases with complete pre-random assignment characteristics and non-missing values of the kidcount variable.[12] There are some mildly significant differences between the AFDC and JF groups in their baseline characteristics, however these differences are not jointly significant.[13] Following the analysis in BGH (2014), we also examine two subgroups defined by whether they had positive earnings seven quarters prior to random assignment (the two rightmost panels in Table 2). Because pre-assignment earnings proxy for tastes and earnings ability, the JF reform likely presented these groups with different

[11] Appendix Table A1 tabulates the kidcount variable against the administrative measure available in the JF sample. Our inflation scheme maps the kidcount measure to roughly its modal administrative value plus one. We have found that our results are robust to alternate codings including inflating the AU size by two and not inflating it at all.

[12] This yields essentially the same baseline sample as in BGH (2006). Relative to their analysis, we impose the additional restriction that the kidcount variable be non-missing. We also drop one AFDC case from our analysis with unrealistically high quarterly earnings that sometimes led to erratic results.

[13] We follow BGH (2006) in using propensity score re-weighting to adjust for these baseline differences. These techniques are described in the Appendix. After adjustment, the means of the AFDC and JF groups are very similar as evidenced by the "Adjusted Difference" column in Table 2.

incentives, which makes them useful for exploring treatment effect heterogeneity.

Bunching in the JF Sample

As noted by BGH (2006), many simple optimizing models predict bunching of earnings at the JF eligibility notch. However, they find no evidence of such bunching. We can corroborate their analysis by looking for bunching in the JF sample using an improved measure of AU size. Figure 3a provides a histogram of earned income rescaled relative to the FPL. Not only do we fail to detect a spike in the mass of observations located at the notch, the earnings density actually appears to be declining through this point. Moreover, this decline is relatively smooth through the notch which should bound, to its right, a dominated earnings region. Compared to women not on welfare in the quarter (Figure 3c), there is arguably an excess "mound" in the density of earnings below the notch for women on welfare throughout the quarter (Figure 3b).

Under-reporting of Earnings

A conspicuous feature of Figure 3b is that the distribution of earnings stretches well beyond the FPL, despite the fact that women with such earnings levels should be ineligible for welfare under JF. While it is possible that some of these observations are the result of measurement problems, under-reporting behavior is also undoubtedly at play here. The MDRC final report (Bloom et al., 2003, p. 38) provides some direct evidence on this point, noting that, in the AFDC group, the fraction of women with earnings in the UI system was about ten percentage points higher than the fraction reporting earnings to the welfare agency. In the JF group, the fraction reporting earnings to the welfare system was nearly identical to the fraction with UI earnings. However, this may simply be an artifact of the 100% JF earnings disregard which creates incentives to report an earnings amount below the poverty line rather than no earnings at all.[14]

3 Anticipation Effects and Intensive Margin Responses

The JF time limits may provide households with an incentive to conserve their welfare benefits for future use (Grogger and Michaelopoulos, 2003; Swann, 2005). In this Section, we test for anticipatory behavior in response to time limits during the first seven quarters of the JF experiment.

[14] Evidence on such partial under-reporting is provided in a related context by Hotz, Mullin, and Scholz (2003), who analyzed data from a welfare reform experiment in California. Comparing administrative earnings records from the California Unemployment Insurance system with earnings reported to welfare, they find that about a quarter of welfare cases report earning amounts to the welfare agency that are lower than the figures recorded in the state UI system. The average fraction of UI earnings under-reported varies from 64% to 84% depending on the year studied. They also find that cases having quarterly UI earnings above $2,500 are disproportionately more likely to under-report and under-report greater amounts on average. This threshold is close to the eligibility threshold of the California program.

Finding no evidence of such responses to the JF reform, we then implement a pair of tests designed to detect intensive margin responses to the static incentives of the JF reform.

A Test for Anticipation

The JF time limits create incentives for a risk averse woman to save months of welfare eligibility for later periods when her earnings may be lower (e.g. due to job loss). Thus, under some conditions, JF may actually make working on welfare less attractive, as this choice requires sacrificing the option value of using welfare an additional month in the future.

Following Grogger and Michaelopolous (2003), we conduct a simple test for whether the JF time limits yield anticipatory effects. Our test compares the impact of reform on the welfare use of women who at baseline had a youngest child age 16-17 (for whom the time limits were irrelevant) to impacts on the welfare use of women who had younger children. As shown in Table 3, we cannot reject the null hypothesis that the average impact of JF on monthly welfare take-up is the same for both groups of women. In fact, our point estimates suggest that the response of women with younger children to reform was actually slightly greater than the response of women with children ages 16-17, which is the opposite of what banking behavior would suggest. While this finding does not prove that the women in our sample were myopic, it does suggest that anticipatory responses to the time limits were probably small.[15]

Intensive Margin Responses and the Eligibility Notch

The JF reform provided a mix of positive and negative labor supply incentives. While the program encouraged women to work, it also potentially encouraged some women with earnings above the federal poverty line to reduce their earnings in order to receive welfare assistance. But under the null hypothesis that women are unable (or unwilling) to adjust their earnings, the program had only one effect: to encourage work. If this is true, then we should expect the distribution of earned

[15] Grogger and Michaelopolous (2003) rely on data from a randomized welfare reform where the experimental group was exposed to a twenty four month time limit (or a thirty six month limit if particulary disadvantaged). JF's more stringent twenty one month time limit might be expected to produce a larger anticipatory response than found by Grogger and Michaelopoulus. It does not. One possible explanation for this discrepancy is that, as remarked above, a large fraction of JF experimental units were exempted from time limits, and a large fraction of the non-exempted units were granted six month extensions. Bloom et al. (2003, p.59) report that "written material produced by the DSS explicitly stated that extensions would be possible." Also, "staff reported that many recipients were initially skeptical that the time limit would be implemented (in fact, many staff said that they themselves were skeptical)". Based on the Interim Client Survey, it appears that "from the beginning, most recipients understood that the time limit would not necessarily result in cancellation of their welfare grant." Finally, Bloom et al. (2003, p.60) write that "owing to the structure and generosity of the enhanced earned income disregard, staff would be unlikely to urge recipients to [...] 'save' or 'bank' their available months of benefits. In addition, [...] there was in theory no reason to bank months, because recipients could receive an extension either when they reached the time limit or at any point thereafter if they experienced an involuntary drop in income. On the 1997 staff survey, most [staff] workers said that they did not stress a banking message; staff were more likely to use the time limit to motivate recipients to cooperate with program rules or find a job."

income in the JF sample to stochastically dominate the distribution in the AFDC sample because the reform simply shifts mass from zero to positive earnings levels. [16]

Figure 4a provides reweighted empirical distribution functions (EDFs) of earnings in the AFDC and JF samples using quarterly earnings data for the seven quarters following random assignment, a horizon over which no case was in danger of reaching the limit. We rescale earnings relative to three times the monthly FPLs faced by the sample women: $3FPL_i$ is the maximum amount that a woman can earn in a quarter while maintaining welfare eligibility throughout the quarter. By rescaling earnings relative to the FPL, we can deduce whether mass is "missing" from the portion of the distribution predicted by the JF incentive scheme – namely, at points just above the eligibility notch. Significant opt-in behavior should lead earnings levels below the FPL to be more common in the JF sample than the AFDC sample.

A reweighted Kolmogorov-Smirnov test strongly rejects the null hypothesis that the two EDFs are identical. Clearly more quarters exhibit positive earnings in the JF sample than in the AFDC sample, indicating that JF successfully incentivized many women to work. The earnings EDF rises more quickly in the JF sample than under AFDC, signaling excess mass at low earnings levels. Also, the EDFs cross below the notch, leading the fraction earning less than $3FPL_i$ to be slightly greater for the JF sample than among the AFDC controls. A large increase in the fraction earning less than $3FPL_i$ would be suggestive evidence of an opt-in response, however the impact here is small and statistically insignificant. Using a variant of the formal testing procedure of Barrett and Donald (2003), we fail to reject the null hypothesis that the JF earnings distribution stochastically dominates the earnings distribution in the AFDC sample. Hence, we can cannot reject the null hypothesis that these impacts were generated by extensive margin responses alone.

However, these distributional effects conceal substantial heterogeneity across subgroups. Figures 4b-4c provide corresponding EDFs in two subsamples defined by their earnings in the seventh quarter prior to random assignment. These groups are of interest because pre-random assignment earnings are a strong predictor of post-random assignment earnings, hence they proxy for the relevant range of the budget set an agent would face under AFDC. Accordingly, units with positive pre-random assignment earnings should be most likely to exhibit an opt-in effect while units with zero earning should be more likely to be pushed into the labor force by JF. The figures confirm that the expected pattern of heterogeneity is in fact present: the positive earnings group experienced less of an impact on the fraction of quarters spent working and a significant impact on the fraction of quarters with earnings less than or equal to three times the monthly poverty line. The zero earnings group, by contrast, exhibits a large impact on the fraction of quarters working, but essentially no impact on the fraction of quarters with earnings less than or equal to three times the monthly

[16] First order stochastic dominance, of course, implies the absence of negative QTEs, and so BGH (2006)'s analysis already provides evidence against the extensive margin-only null hypothesis. However, focusing on particular QTEs that happen to be significant can generate a multiple testing problem, which is dealt with formally by procedures testing for stochastic dominance.

poverty line. First order stochastic dominance is rejected at the 5% level in the positive earnings sample, indicating that intensive margin responses are in fact present.

Appendix Table A2 quantifies the impacts of JF on the earnings distribution and provides standard errors generally confirming the visual impression of the prior figures. JF yielded a large (eight percentage point) increase in the fraction of quarters with positive earnings. In the positive pre-random assignment earnings subsample, we see a smaller (3.9pp) impact on the fraction with earnings, but a significant (3.4pp) increase in the fraction earning less than three times the poverty line, suggesting the presence of an opt-in effect. As expected, welfare participation grew sharply under JF (by 7.4pp in the overall sample) and that the fraction of quarters spent on welfare with no earnings fell (by 7.4pp). We also see that average earnings while on welfare grew (by $403 per quarter), which is arguably the result of opt-in to welfare by high earners and substitution effects by working welfare recipients.

4 Revealed Preference Restrictions

Having established the presence of both intensive and extensive margin labor supply responses to the JF reform, we now seek to infer the frequency of these responses. What fraction of women were induced to lower their earnings and take up welfare in response to the JF reform? What share of women were induced to work at earnings levels above the poverty line? How many women were induced to leave welfare? The fundamental challenge to answering such questions is that we cannot observe the choice each woman would have made under the policy regime to which she was not assigned. To make progress, we require additional structure on the set of possible responses that can occur.

We now develop an optimizing model that formalizes the incentives provided by the JF reform and places restrictions on the set of possible labor supply and program participation responses to the experiment. We depart from conventional structural modeling approaches (e.g., Moffitt, 1983; Keane and Moffitt, 1998; Hoynes, 1996; Swann, 2005; Keane and Wolpin, 2002, 2007, 2010; Chan, 2013) by allowing for a non-parametric specification of preferences that varies across women in an unrestricted fashion. To rationalize the absence of a spike in the earnings distribution at the JF eligibility notch, we allow for the possibility that women face constraints on their labor supply decisions (Altonji and Paxson, 1988; Chetty et al, 2011; Dickens and Lundberg, 1993). We also incorporate under-reporting behavior into the model, which provides an explanation for welfare participation among households with UI earnings above the eligibility notch. Our model is thus quite general. However, we also rely on a number of simplifying assumptions, which we briefly discuss here.

First, the model is static. In practice, women are likely to make choices taking into account both current and future payoffs. For our purposes, these motives are only of concern if they rationalize responses that do not emerge under myopic decision making. For this to be the case, alternative specific continuation values would need to differ across AFDC and JF in ways that undermine our static conclusions regarding which choices are made more or less attractive by the reform. The JF time limits are the most obvious culprit for such effects since they could make working while on welfare less attractive under JF than under AFDC. However, our adaptation of the Grogger and Michaelopoulus (2003) test failed to find evidence of anticipatory behavior, leading us to believe that the dynamic incentives of the reform are in fact weak in this sample.[17]

Second, the model ignores the TCC, TM, and CS components of the JF reform. We explained above why these features of the reform likely had minimal effects. Introducing them would substantially complicate our analysis and add little given that we lack data on participation in these programs.

Third, to simplify exposition, the model ignores FS and the federal tax system including payroll and medicare taxes and the EITC. We explain in Section 7 why extending the model to incorporate these policies has no effect on our identification arguments or our corresponding inferences about behavior.

Model

Women (indexed by i) have heterogeneous utility functions $U_i(E, C)$, defined over earnings E and a consumption equivalent C. As in Saez (2010), utility is increasing in consumption but decreasing in earnings which require effort to generate. In this framework, one can think of heterogeneity in the disutility of earnings as capturing both variation in labor market skills and preferences for leisure.

Each month, a woman chooses her level of earnings (E) and whether to participate in welfare assistance (denoted by the indicator $D \in \{0, 1\}$), in which case she also chooses a level of earnings to report to the welfare agency (E^r). She can under-report but not over-report her earnings so that $E^r \leq E$.[18] The welfare grant amount is determined based upon reported (as opposed to actual) earnings. Hence, the regime-specific transfer functions can be written:

$$\begin{aligned} G_i^a(E^r) &= \max\left\{\overline{G}_i - \mathbf{1}[E^r > \delta_i](E^r - \delta_i)\tau_i, 0\right\} \\ G_i^j(E^r) &= \mathbf{1}[E^r \leq FPL_i]\,\overline{G}_i. \end{aligned} \tag{2}$$

The consumption equivalent C incorporates a variety of psychic and monetary costs and takes

[17] Returns to labor market experience are a second culprit. Our model posits regime-invariant earning offer functions, which implies that the attractiveness of off-welfare alternatives is assumed to be the same under AFDC and JF. If JF induces more women to work, and if returns to labor market experience are substantial, this assumption is violated. However, the magnitude of experience effects in our sample is likely to be small. For example, after studying data from a similar welfare experiment – the Canadian Self Sufficiency Project (SSP) – Card and Hyslop (2005) conclude that "work experience attributable to SSP appears to have had no detectable effect on wage opportunities."

[18] Allowing over-reporting behavior would essentially nullify the JF work requirements. In practice, concocting a fictitious job was difficult as employment had to be verified by case workers.

the form:

$$C = E + \left(G_i^t\left(E^r\right) - \phi_i - \eta_i^t \mathbf{1}\left[E^r = 0\right] - \kappa_i \mathbf{1}\left[E^r < E\right]\right) D - \mu_i \mathbf{1}\left[E > 0\right]. \quad (3)$$

The parameter ϕ_i gives the dollar value of welfare stigma (Moffitt, 1983), which may vary across women. Stigma rationalizes the failure of eligible women to participate in welfare. To simplify our analysis in the next section, we assume $\phi_i > G_i^a\left(FPL_i\right)$. This assumption guarantees that women will not choose to report earnings above the federal poverty line while on AFDC. We show in section 7 that relaxing this assumption has essentially no effect on our results.

We also allow for a fixed cost of work μ_i which, for example, might capture the monthly cost of commuting to work. Fixed costs discourage work at low earnings levels and create the possibility that non-working women respond to marginal changes in work incentives by earning large amounts (Cogan, 1981). To capture the effects of work requirements, $\eta_i^t \geq 0$ gives the dollar value of the "hassle" a woman faces when not working and receiving benefits under regime t. In some cases these hassle costs may be pecuniary as women may be sanctioned if they fail to seek work. Because JF includes stronger work requirements and sanctions, we assume that $\eta_i^j \geq \eta_i^a \; \forall i$.

The parameter $\kappa_i > 0$ gives the costs of under-reporting, which may vary arbitrarily across women. One can think of κ_i as the expected psychic and pecuniary costs of concealing a job from the welfare agency.[19] Like stigma and hassle, under-reporting costs are assumed to enter as dollar equivalents in consumption. Note that women face hassle when they report zero earnings regardless of whether or not their actual earnings are zero. Hence, a woman concealing her earnings will choose to report positive earnings equal to or below the fixed disregard level δ_i under AFDC or below FPL_i under JF.

Finally, each month, a woman draws a pair of earnings offers $\left(O_i^1, O_i^2\right)$ from an unrestricted bivariate distribution $F_i\left(.\right)$ with support on the (strictly) positive orthant. Heterogeneity in offer distributions $F_i\left(.\right)$ reflects both variation in skills and differences in search strategies. A woman can choose between these offers or reject them both, in which case she earns nothing. The offers drawn are invariant to the policy regime t to which the woman is assigned. The presence of two offers provides the possibility of an intensive margin earnings response to the policy change. This response may or may not be constrained as the offers $\left(O_i^1, O_i^2\right)$ could coincide with the woman's unconstrained choices of E_i under the two policy regimes.[20]

With these elements in place, we can state the woman's objective, which is to:

$$\max_{E \in \left\{0, O_i^1, O_i^2\right\},\ D \in \{0,1\},\ E^r \in [0,E]} U_i\left(E, C\right) \text{ subject to (2) and (3)}.$$

[19]See Saez (2010) for a related analysis involving a fixed "moral" cost of mis-reporting income to tax authorities.

[20]An alternate approach, which would achieve the same result, is to treat the offers as independent draws from an unknown continuous univariate distribution, and to let the number of offers vary across women in an unrestricted fashion. This too would nest the unconstrained case, as the number of offers may approach infinity for each woman.

The next section discusses the empirical content of this optimization, which can be stated in terms of revealed preference restrictions.

We note in passing that the "structure" of this simple model is given by the joint distribution of $\left(\phi_i, \eta_i^a, \eta_i^j, \mu_i, \kappa_i, U_i(.), F_i(.)\right)$. Empirical modeling usually proceeds by placing parametric restrictions on this joint distribution so that its parameters are identified by the observed data. We depart from this standard practice by leaving this joint distribution unrestricted. Our interest centers not on the structural primitives themselves, but on the set of margins along which reform might induce women to adjust their behavior. This is a topic on which the theory speaks clearly, as we shall see next.

Response Margins

The above model is sufficiently general that it places no restrictions on the cross-sectional distribution of earnings and program participation choices under a given policy regime: there is a mix of preferences and earnings opportunities that can support any earnings and program participation choice. Hence, the right mix of preferences and offers across women can support any cross-sectional distribution of choices. However, the model does restrict how a woman may respond to policy variation. Specifically, it rules out certain combinations of earnings and program participation choices under the two policy regimes. These restrictions follow from simple revealed preference arguments.

In this subsection, we verbally describe these restrictions. We focus on coarse earnings categories (described next) in light of the fact that the JF reform made a broad range of positive earnings choices (those below the FPL) more attractive conditional on welfare participation, potentially reduced the attractiveness of not working while on welfare, and had no effect on the return to working off assistance. Because we have not parametrically structured utility, we cannot quantify exactly how much more attractive each choice within these broad ranges has become. However, we can deduce whether women will make different broad earnings and program participation choices in response to the JF reform. In Section 5 we formalize these restrictions and use them to test the model and form bounds on the fraction of women who respond to reform along each of the allowable response margins.

We begin by introducing some notation. The coarsened earnings variable $\widetilde{E}_i$ is defined by the relation:[21]

$$\widetilde{E}_i \equiv \begin{cases} 0 & \text{if } E_i = 0 \\ 1 & \text{if } E_i \leq FPL_i \\ 2 & \text{if } E_i > FPL_i \end{cases}.$$

That is, $\widetilde{E}_i$ indicates whether a woman works, and if so, whether she earns enough to be ineligible for benefits under JF. This choice of earnings categories is crucial as the model rules out many responses to reform involving changes across (but not within) these categories. Moreover, our assumptions so far imply that, under either policy regime, a woman with $\widetilde{E}_i = 2$ who participates in welfare must be under-reporting her earnings to the welfare agency.

Pairing these earning categories with the decision to participate in welfare and the under-reporting decision yields seven earning / participation / reporting choices allowed by the model, which we henceforth refer to as *states*. The set of possible states is given by:

$$\mathcal{S} \equiv \{0n, 1n, 2n, 0r, 1r, 1u, 2u\}.$$

The number associated with each state refers to the woman's earnings category while the letter describes her combined welfare participation and reporting decisions. Specifically, the letter n denotes welfare non-participation, r denotes participating in welfare while truthfully reporting earnings ($E^r = E$), and u denotes participating in welfare while under-reporting earnings ($E^r < E$). The state $0u$ is ruled out, as it is not meaningful to "under-report" zero earnings, and the state $2r$ is not allowed by either the JF eligibility rules or, given the lower bound imposed on stigma, the AFDC eligibility rules.

Table 4 catalogues the responses that are allowed and disallowed by the model. Responses proscribed by the model are denoted with a "–" entry. The other entries describe the allowed response in terms of three margins: welfare participation (welfare take up or exit), labor supply (extensive versus intensive labor supply response), and reporting of earnings to the welfare agency (truthful reporting versus under-reporting). We next describe the intuition behind which responses are allowed and which are not. A formal proof that the restrictions in Table 4 are exhaustive is provided in the Appendix.

Starting with the disallowed responses, a woman will not choose state $1u$ under JF because under-reporting is costly and earnings below the poverty line are fully disregarded. For this reason, the column of Table 4 corresponding to state $1u$ under JF (cells with a horizontally striped

[21] The structural labor supply literature often assumes labor supply choices are constrained to fall into a few data driven categories such as "part-time" and "full-time" work (e.g. Hoynes, 1996; Keane and Moffitt, 1998; Blundell et al, 2013). By contrast, we allow the choice set to vary across women in an unrestricted fashion by means of the individual-specific offer distribution function $F_i(.)$. Our focus on coarsened earnings categories is motivated not by the constraints women face but by the incentives the JF reform generates: the model restricts responses across (but not within) these earnings categories.

background) is populated with "–" entries. The remaining prohibited responses stem from revealed preference arguments. First, the JF reform makes choices in the set $\mathcal{C}^{\succeq} \equiv \{0n, 1n, 2n, 1r, 1u, 2u\}$ no less attractive and choices in the set $\mathcal{C}^{\preceq} \equiv \{0n, 1n, 2n, 0r, 1u, 2u\}$ no more attractive. Therefore, by revealed preference, a woman will not pair any of the choices in $\mathcal{C}^{\succeq}$ under AFDC with a (different) choice in $\mathcal{C}^{\preceq}$ under JF. This reasoning justifies the "–" entries in the cells with a greyed background. Finally, the choice of $0r$ under AFDC implies stigma is below the base grant amount. This, in turn, implies that state $1n$ is dominated by state $1r$ under JF, which justifies the "–" entries in the cells with a vertically striped background.

Proceeding now to responses that are allowed, consider first the extensive margin labor supply responses. The pairing of state $0n$ under AFDC with state $1r$ under JF, as well as the pairing of state $0r$ under AFDC with any of the states $1r$, $2n$, or $2u$ under JF, involves an extensive margin response. A woman who, under AFDC, chooses not to work or participate in welfare (state $0n$) must face high welfare stigma and/or hassle as she is willing to forgo the full grant amount $\overline{G}_i$ under AFDC. Under JF, she may choose to earn below the FPL on assistance (state $1r$), as this option entails higher consumption than under AFDC. Alternately, she may elect not to modify her behavior. Next, a woman who, under AFDC, would participate in welfare without working (state $0r$), may be incentivized by the JF rules to adjust in several ways. First, she may be induced to work while on welfare both by the reduction in implicit tax rates on earnings and the increased hassle associated with JF (state $1r$). If fixed costs are large enough, the additional hassle associated with not working under JF may induce her to leave welfare and earn more than the federal poverty line (state $2n$) or to remain on welfare and earn more than the federal poverty line (state $2u$). Alternatively, she may respond to the hassle by opting out of welfare without working (state $0n$) or to not respond at all and continue to stay on welfare and not work, in both cases no labor supply response occurs.

Consider next the allowed intensive margin labor supply responses. The pairing of either states $2n$ or $2u$ under AFDC with state $1r$ under JF corresponds to an intensive margin response: the reform induces the woman to reduce her earnings below the FPL. Pairing state $2n$ under AFDC with state $1r$ under JF is the traditional opt-in response considered in the literature. Pairing state $2u$ under AFDC with state $1r$ under JF is a variant of this response where the woman claims assistance under either regime.

The pairing of states in the set $\{1n, 1r, 1u\}$ under AFDC with the state $1r$ under JF can also entail intensive margin responses as a woman may adjust her earnings within region 1. A woman working on welfare under AFDC, and earning less than the FPL, will face a reduction in her implicit tax rate under JF. Like any uncompensated increase in the wage, this change could lead to increases or decreases in the amount of work undertaken, but in any case will lead her to continue working on welfare (state $1r$). If her substitution effect dominates her income effect, the woman will be expected to work more but not more than the federal poverty line as this level of earnings was in her choice set under AFDC. Likewise, a woman working off welfare under AFDC may choose to participate in JF which would offer an increase in income for the same amount of work (state $1r$). This may result in a reduction in earnings due to income effects. If the woman has high enough welfare stigma, she may not participate in welfare under either regime (pairing of state 1n with 1n).

Some of the above extensive and intensive margin labor supply responses are accompanied by an adjustment in reporting behavior. Specifically, the JF reform may induce a woman to start truthfully report her earnings (pairing of states $1u$ and $2u$ with state $1r$). Conversely, the JF reform may induce a woman to under-report her earnings (pairing of state $0r$ with state $2u$). Figure 5 illustrates the decision problem in earnings and consumption equivalent space for two women with substantial fixed costs of work and low costs of under-reporting. The effective budget sets are discontinuous at zero earnings due to the fixed costs of work μ and hassle costs. As depicted, the hassle costs η^j of not working under JF are larger than those under AFDC represented by η^a, but both are smaller than μ. In comparison with the fixed costs of work and hassle, the costs of under-reporting (κ) are depicted as being relatively small. The under-reporting line is the same under AFDC and JF because under either regime a woman can secure the base grant by concealing her earnings.

A woman with the configuration of psychic costs and preferences found in Figure 5a would work on welfare under AFDC but under-report her earnings (point A). However, under JF, she would truthfully report her earnings (point B), as the JF disregard reduces the return to under-reporting. Hence, reform may induce a reduction in under-reporting.

By contrast, Figure 5b shows a scenario where the hassle effects of JF are larger, the costs of under-reporting are smaller, and preferences over earnings are such that the disutility of work is lower. This woman would receive benefits without working (point A) under AFDC but, under JF, will choose to earn above the poverty line and under-report her earnings (point B) in order to maintain eligibility. This occurs because the JF work requirements remove point A from her budget set – such a woman has effectively been hassled off welfare into under-reporting. Thus, the JF reform may have mixed effects on reporting behavior.

5 Identification and Estimation of Response Margins

The above arguments catalogue the restrictions economic theory places on how a woman may respond to the JF reform. These restrictions are not directly testable because we cannot observe the same woman under two regimes at a given point in time.[22] However, as we show below, these

[22]Since preferences and constraints can change month to month, the panel features of our data will not aid in solving this problem without strong assumptions about how these factors evolve over time. The problem is illustrated in Appendix Table A3 which provides the distribution of states occupied in quarters 1 through 7 among the subsample of women assigned to AFDC who chose state $0p$ in the quarter prior to random assignment. Even in the first quarter after random assignment, many of these women have switched states, suggesting substantial drift in preferences and

theoretical restrictions do have empirical content. Specifically, the model places refutable inequality restrictions on the data that can be exploited to bound the frequency of adjustment along each allowable response margin.

The Identification Problem

Let S_i^a denote woman i's potential state under AFDC and S_i^j her potential state under JF. Our goal is to identify *response probabilities* of the form:

$$\pi_{s^a,s^j} \equiv P\left(S_i^j = s^j | S_i^a = s^a\right),$$

for $\left(s^a, s^j\right) \in \mathcal{S} \times \mathcal{S}$. These probabilities summarize the frequency of adjustment to the JF reform along specific labor supply and participation margins.[23] For example, $\pi_{2n,1r}$ gives the proportion of those women who would earn above the federal poverty line off assistance under AFDC that would work on welfare under JF – that is, the share of high earning women at risk of opting into welfare who do so.

Let T_i denote the treatment regime to which a woman is assigned and $S_i \equiv \mathbf{1}\left[T_i = j\right] S_i^j + \mathbf{1}\left[T_i = a\right] S_i^a$ her realized state. Random assignment ensures that her potential states are independent of the policy regime to which she is assigned. Formally,

$$T_i \perp \left(S_i^a, S_i^j\right), \tag{4}$$

where the symbol $\perp$ denotes independence. The above condition implies that, for every $s \in \mathcal{S}$ and $t \in \{a, j\}$, $P\left(S_i = s | T_i = t\right) = P\left(S_i^t = s\right) \equiv q_s^t$, which is the well-known result that experimental variation identifies the marginal distributions of potential outcomes.

Unfortunately, experimental variation is not sufficient to identify the response probabilities $\left\{\pi_{s^a,s^j}\right\}$. To see this, observe that by the law of total probability, the marginal distributions of potential outcomes are linked by the relation:

$$\mathbf{q}^j = \mathbf{\Pi}' \mathbf{q}^a. \tag{5}$$

where $\mathbf{q}^t \equiv \left[q_{0n}^t, q_{1n}^t, q_{2n}^t, q_{0p}^t, q_{1p}^t, q_{2p}^t\right]'$ for $t \in \{a, j\}$ and the 7×7 matrix $\mathbf{\Pi}$ is composed of unknown response probabilities. Supposing for the moment that we know the vectors $\left(\mathbf{q}^a, \mathbf{q}^j\right)$ with certainty, the system in (5) consists of 7 equations (one of which is redundant) and $7 \times 6 = 42$ unknown response probabilities. Clearly, the response probabilities are heavily under-identified. As we show below, the economic model developed in Section 4 implies that only 8 out of the 42 atheoretical response margins are allowed. Hence, the theory dramatically reduces the degree of

constraints.

[23] Note that these probabilities are functionals of the joint distribution of the model primitives $\left(\phi_i, \eta_i^a, \eta_i^j, \mu_i, \kappa_i, U_i\left(.\right), F_i\left(.\right)\right)$.

under-identification present. Yet even with the model restrictions, there are still more unknowns than equations, which necessitates a partial identification analysis. Moreover, because we do not directly observe under-reporting behavior, we cannot distinguish between states $1u$ and $1r$, making the vectors $(\mathbf{q}^a, \mathbf{q}^j)$ themselves under-identified. We address both of these concerns below.

Allowed Response Margins

The model of Section 4 implies the matrix $\mathbf{\Pi}$ of response probabilities takes the form:

State under AFDC	Earnings / Reporting State under JF						
	$0n$	$1n$	$2n$	$0r$	$1r$	$1u$	$2u$
$0n$	$1-\pi_{0n,1r}$	0	0	0	$\pi_{0n,1r}$	0	0
$1n$	0	$1-\pi_{1n,1r}$	0	0	$\pi_{1n,1r}$	0	0
$2n$	0	0	$1-\pi_{2n,1r}$	0	$\pi_{2n,1r}$	0	0
$0r$	$\pi_{0r,0n}$	0	$\pi_{0r,2n}$	$1-\pi_{0r,0n}-\pi_{0r,2n}$ $-\pi_{0r,1r}-\pi_{0r,2u}$	$\pi_{0r,1r}$	0	$\pi_{0r,2u}$
$1r$	0	0	0	0	1	0	0
$1u$	0	0	0	0	1	0	0
$2u$	0	0	0	0	$\pi_{2u,1r}$	0	$1-\pi_{2u,1r}$

The zero entries in the matrix indicate responses that the model says cannot occur: they correspond to the "–" entries in the cells of Table 4. There are also two "deterministic" responses that occur with probability one: all women occupying states $1u$ or $1r$ under AFDC must occupy state $1r$ under JF. The remaining elements of the matrix reflect the eight response margins allowed by the model whose logic was discussed in Section 4. Note that the response probabilities $(\pi_{0r,2n}, \pi_{0r,2u})$ involve pairing earnings category 0 under AFDC with category 2 under JF, while the probabilities $(\pi_{2n,1r}, \pi_{2u,1r})$ involve pairing earnings category 2 under AFDC with category 1 under JF. Therefore, the model allows for rank reversals in earnings.[24]

Observable States

Our data do not allow us to measure reporting decisions other than by contrasting a woman's administrative earnings with the eligible maximum. Hence, states $1u$ and $1r$ are not empirically distinguishable. Accordingly, we define a function $g: \mathcal{S} \rightarrow \widetilde{\mathcal{S}}$ that reduces the *latent* states $\mathcal{S}$ to

[24] Rank reversals may also occur within earning category 1. However, without further restrictions, we cannot infer the magnitude of any such adjustments.

observable states $\widetilde{\mathcal{S}}$ that can be measured in our data. Formally,

$$g(s) \equiv \begin{cases} s & \text{if } s \in \{0n, 1n, 2n\} \\ 0p & \text{if } s = 0r \\ 1p & \text{if } s \in \{1u, 1r\} \\ 2p & \text{if } s = 2u \end{cases}.$$

As before, the number of each state refers to the woman's earnings category and the letter n refers to welfare non-participation. The letter p denotes welfare participation, which is directly observable. Note that state $2p$ can only be occupied via under-reporting.

Let $\widetilde{S}_i^t$ denote the potential observable state of a woman whose latent potential state under policy regime t is S_i^t, that is, $\widetilde{S}_i^t \equiv g\left(S_i^t\right)$ for $t \in \{a, j\}$. Also, define the probability of occupying state $\widetilde{s} \in \widetilde{\mathcal{S}}$ under policy regime t as $p_{\widetilde{s}}^t \equiv P\left(\widetilde{S}_i^t = \widetilde{s}\right) = \sum_{s:\, \widetilde{s}=g(s)} q_s^t$. Finally, denote the vectors of *observable* state probabilities as $\mathbf{p}^t \equiv \left[p_{0n}^t, p_{1n}^t, p_{2n}^t, p_{0p}^t, p_{1p}^t, p_{2p}^t\right]'$ for $t \in \{a, j\}$. We are now ready to discuss identification of the eight response probabilities appearing in the matrix Π based on the regime specific state distributions $\mathbf{p}^a$ and $\mathbf{p}^j$.

Testable Implications and Bounds on Response Probabilities

A direct application of the law of total probability to system (5) yields a system of six equations, one of which is redundant given that state probabilities sum to one in each policy regime. The five non-redundant equations can be given an intuitive representation as:

$$\begin{aligned} p_{0n}^j - p_{0n}^a &= -p_{0n}^a \pi_{0n,1r} + p_{0p}^a \pi_{0r,0n} \\ p_{1n}^j - p_{1n}^a &= -p_{1n}^a \pi_{1n,1r} \\ p_{2n}^j - p_{2n}^a &= -p_{2n}^a \pi_{2n,1r} + p_{0p}^a \pi_{0r,2n} \\ p_{0p}^j - p_{0p}^a &= -p_{0p}^a \left(\pi_{0r,1r} + \pi_{0r,2u} + \pi_{0r,2n} + \pi_{0r,0n}\right) \\ p_{2p}^j - p_{2p}^a &= p_{0p}^a \pi_{0r,2u} - p_{2p}^a \pi_{2u,1r} \end{aligned} \tag{6}$$

The left hand side of (6) catalogues the experimental impacts of the JF reform on the observable state probabilities. The right hand side rationalizes these impacts in terms of flows into and out of each state as allowed by the labor supply model. The identifying power of the theory derives from the fact that only a handful of response probabilities appear in each equation. Despite these restrictions, the system in (6) is clearly under-determined, with eight unknown response probabilities and only five equations. Still, it is immediate to see that the second equation of (6) uniquely identifies the response probability $\pi_{1n,1r}$. The remaining four equations constrain (without uniquely determining) the remaining seven response probabilities.

Some of the restrictions embedded in (6) are testable. First, the model implies that the experiment cannot generate an increase in the frequency of states $1n$ or $0p$. Second, the increase in the proportion of women occupying state $1p$ must be at least as large as the decrease in the fraction of women occupying state $1n$. Formally, the testable restrictions are:

$$p^j_{0p} - p^a_{0p} \leq 0, p^j_{1n} - p^a_{1n} \leq 0, p^j_{1p} - p^a_{1p} \geq p^a_{1n} - p^j_{1n}. \tag{7}$$

Violation of any of these conditions would imply that our framework failed to allow a response actually present in the data.

Subject to the restrictions in (7) holding, we can use the system in (6) to bound the seven remaining response probabilities. The upper and lower bounds on each of the response probabilities can be represented as the solution to a pair of linear programming problems of the form

$$\max_{\pi} \lambda'\pi \text{ subject to (6) and } \pi \in [0,1]^7, \tag{8}$$

where $\pi \equiv [\pi_{0n,1r}, \pi_{0r,0n}, \pi_{2n,1r}, \pi_{0r,2n}, \pi_{0r,1r}, \pi_{0r,2u}, \pi_{2u,1r}]'$. For example, solving the above problem for $\lambda = [0,0,0,0,0,0,1]'$ yields the upper bound on $\pi_{2u,1r}$, while choosing $\lambda = [0,0,0,0,0,0,-1]'$ yields the lower bound.

We can also use this representation to derive bounds on linear combinations of the response probabilities. We consider four "composite" margins of adjustment: $\pi_{0r,n} \equiv \pi_{0r,0n} + \pi_{0r,2n}$, $\pi_{p,n} \equiv \frac{p^a_{0p}}{p^a_{2p}+p^a_{1p}+p^a_{0p}} (\pi_{0r,2n} + \pi_{0r,0n})$, $\pi_{n,p} \equiv \frac{p^a_{2n}\pi_{2n,1r}+p^a_{1n}\pi_{1n,1r}+p^a_{0n}\pi_{0n,1r}}{p^a_{2n}+p^a_{1n}+p^a_{0n}}$, and $\pi_{0,1+} \equiv \frac{p^a_{0p}(\pi_{0r,1r}+\pi_{0r,2n}+\pi_{0r,2u})+p^a_{0n}\pi_{0n,1r}}{p^a_{0p}+p^a_{0n}}$. The parameter $\pi_{0r,n}$ gives the fraction of women who would claim benefits without working under AFDC that are induced to get off welfare under JF. Upper and lower bounds for this response probability can be had by solving (8) with $\lambda = [0,1,0,1,0,0,0]$ and $[0,-1,0,-1,0,0,0]$ respectively. We also examine the fraction $\pi_{p,n}$ of all women who would participate in welfare under AFDC that are induced to leave welfare under JF, the fraction $\pi_{n,p}$ of women who are induced to take up welfare under JF, and the fraction $\pi_{0,1+}$ who are induced by JF to work. Because no woman who would work under AFDC will choose not to work under JF, this last fraction is point identified by the proportional reduction in the fraction of women not working under JF relative to AFDC.

It is useful to construct analytic expressions for the bounds as a function of the regime-specific marginal distributions $(\mathbf{p}^a, \mathbf{p}^j)$. We accomplished this by solving the relevant linear programming problems by hand (a straightforward though cumbersome process). The resulting expressions are listed in the Appendix. An example is given by the bounds on the opt-in probability $\pi_{2n,1r}$ which take the form:

$$\max\left\{0, \frac{p^a_{2n}-p^j_{2n}}{p^a_{2n}}\right\} \leq \pi_{2n,1r} \leq \min\left\{\begin{array}{c} 1, \\ \frac{p^a_{2n}-p^j_{2n}+p^a_{0p}-p^j_{0p}}{p^a_{2n}}, \\ \frac{p^a_{2n}-p^j_{2n}+p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}}{p^a_{2n}}, \\ \frac{p^a_{2n}-p^j_{2n}+p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}}{p^a_{2n}}, \\ \frac{p^a_{2n}-p^j_{2n}+p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}+p^a_{2p}-p^j_{2p}}{p^a_{2n}} \end{array}\right\}.$$

Note that there are two possible solutions for the lower bound, one of which is zero. This turns out to be a generic feature of the lower bounds for each of the seven set-identified response probabilities. The upper bound on $\pi_{2n,1r}$ admits five possible solutions. Other response probabilities can have fewer or more solutions.[25]

Estimation and Inference

Consistent estimators of the upper and lower bounds of interest can be had by using sample analogs of the marginal probabilities and computing the relevant $\min\{.\}$ and $\max\{.\}$ expressions. Inference is complicated by the fact that the limit distribution of the upper and lower bounds depends upon uncertainty in which of the constraints in (8) bind – i.e. in which of the bound solutions is relevant. As discussed by Andrews and Han (2009), bootstrapping the empirical $\min\{.\}$ and $\max\{.\}$ of the sample analogues of the bound solutions will fail to capture the sampling uncertainty in the bounds, particularly when several constraints are close to binding.

We report confidence intervals for the response probabilities based upon two inference procedures described in detail in the Appendix. The first procedure ignores the uncertainty in which constraints bind – that is, it assumes the bound solution that appears relevant given the sample analogues is the only possible solution. In such a case, results from Imbens and Manski (2002) imply a 95% confidence interval for the parameter in question can be constructed by extending the upper and lower bounds by $1.65\widehat{\sigma}$ where $\widehat{\sigma}$ is a standard bootstrap estimate of the standard error of the sample moment used to define the relevant bound. These "naive" confidence intervals will provide valid inferences if no other constraints are close to binding.

The second approach, which is also based on a bootstrap procedure, covers the parameter with asymptotic probability greater than or equal to 95% regardless of which constraints bind. Heuristically, the procedure assumes that all bound solutions are identical, in which case sampling uncertainty in all of the sample moments entering these solutions affects the composite bound. The lower limit of this "conservative" confidence interval coincides with that of the naive confidence

[25] The bounds for each parameter are functions of $(\mathbf{p}^a, \mathbf{p}^j)$, which leads to interesting patterns of dependence among them. For instance, among each pair of response probabilities ($\pi_{2n,1r}$,$\pi_{0r,2n}$), ($\pi_{0n,1r}$,$\pi_{0r,0n}$), and ($\pi_{2u,1r}$,$\pi_{0r,2u}$), only one probability may have an informative lower bound.

interval because sampling uncertainty only affects one of the bound solutions in the max $\{.\}$ operator. However, the upper limit of the "conservative" confidence interval generally exceeds that from the "naive" confidence interval, often by a substantial amount.

6 Results

Table 5 reports the estimated probabilities of occupying the six observable earnings and welfare participation states under each policy regime. Notably, the sign restrictions in (7) are satisfied by the point estimates. There is a small but statistically significant increase in the fraction of quarters on welfare with earnings above the quarterly poverty line indicating that, on net, JF induced more women to under-report earnings than it induced to truthfully report them.

Table 6 provides estimates of the response probabilities that rationalize the impacts in Table 5. The point identified response probability $\pi_{1n,1r}$ is computed by plugging in its sample analogue $\frac{\hat{p}^a_{1n}-\hat{p}^j_{1n}}{\hat{p}^a_{1n}}$. JF has a strong effect on entry into the program by the working poor. The bootstrap confidence intervals suggest between 31% and 46% of the women who would have worked off welfare under AFDC at earnings levels below the poverty line were induced to participate in JF at eligible earning levels.

There is a substantial opt-in response among women who would have worked off welfare at earning levels above the poverty line. The estimated bounds imply that $\pi_{2n,1r} \geq .28$. That is, at least 28% of those women with ineligible earnings under AFDC decided to work at eligible levels under JF and participate in welfare. Accounting for sampling uncertainty in the bounds extends this lower limit to 19%, which is still quite substantial. The upper bounds for this parameter are not informative leading us to conclude that the opt-in probability lies in the interval $[.19, 1]$ with 95% probability.

We also find suggestive evidence of a second opt-in effect from non-participation. The sample bounds imply $\pi_{0n,1r} \in [.06, .62]$. However, uncertainty in the bounds prevents us from rejecting the null that this response probability is actually zero. We also find a small but significant under-reporting response attributable to the hassle effects of JF. A conservative 95% confidence interval for $\pi_{0r,2u}$ is $[.02, .13]$. Thus, JF induced at least one subpopulation to under-report earnings, and in the process generate rank reversals in earnings.

The remaining response probabilities $(\pi_{0r,0n}, \pi_{0r,2n}, \pi_{0r,1r}, \pi_{2u,1r})$ each have zero lower bounds. However, we can reject the null that they are jointly zero. From (6) such a joint restriction implies $p^j_{0p} - p^a_{0p} = -\left(p^j_{2p} - p^a_{2p}\right)$, which is easily rejected by our data. Thus, at least some of these margins of adjustment are present. Among the probabilities in question, the candidate that seems most likely to be positive is $\pi_{0r,1r}$ which is the extensive margin response through which welfare reform has traditionally been assumed to operate. However, we cannot be sure that the abundance of women working at low earning levels under JF are in fact coming from state $0r$ rather than state

$2u$.

The last four rows of Table 6 report the estimated bounds, and corresponding confidence intervals, for the composite margins described in the previous section. First is the probability $\pi_{0,1+}$ that a woman responds along the extensive margin from non-work to work. A conservative 95% confidence interval for this probability is $[0.13, 0.21]$. Thus, JF induced a substantial fraction of women who would not have worked under AFDC to obtain employment under JF.

The confidence interval on the fraction $\pi_{n,p}$ of women induced to take up welfare by JF is relatively tight. Although JF unambiguously increased the fraction of women on welfare, our model suggests some women may also have been induced to leave welfare, breaking point identification of this margin. According to our conservative inference procedure, at least 19% (and at most 51%) of women off welfare under AFDC were induced to claim benefits under JF. Conversely, the fraction $\pi_{p,n}$ of women induced by JF to leave welfare is estimated to be at least zero and at most 17%.

Finally, we cannot reject the null hypothesis that JF failed to induce any of the women who would have not worked while claiming AFDC benefits to leave welfare under JF, as the lower bound for the response probability $\pi_{0r,n}$ is zero. We are however able to conclude that at most 24% of such women left welfare, which may limit concerns that the JF reforms pushed a large fraction of women potentially unable to work off assistance.

7 Robustness

Here we discuss potential extensions to our approach and issues which may affect the interpretation of our results. First, we examine the impact of relaxing our lower bound restriction on stigma. Second, we explain why incorporating Food Stamps and the Earned Income Tax Credit into the budget set has no effect on our results.

Stigma

Thus far, we have maintained the assumption of a lower bound on stigma ($\phi_i > G_i^a(FPL_i)$), which guarantees that women will not choose to truthfully report earnings above the FPL while on AFDC. Even without the stigma restriction, women claiming AFDC are unlikely to earn in this range since AFDC benefit exhaustion induces a non-convex kink in the budget set. Empirically, the number of observations in our sample for which this sort of behavior could be present is bounded from above by the number of quarters in the AFDC sample where women earn more than the FPL and receive a welfare transfer that is positive but no larger than $G_i^a(FPL_i)$. In our data, there are only 9 person-quarters (out of 44,352) meeting these criteria, implying that such behavior is extremely rare.[26]

[26] This estimate is constructed as follows: for each AFDC sample woman *and quarter*, we determine the welfare transfer she would receive if her earnings equaled the (AU size and quarter-specific) FPL and if she had access to the unreduced fixed and proportional disregards. We round this amount to the nearest \$50 and denote it by $G_i^{a*}(FPL_i)$.

Nevertheless, it is of some pedagogical interest to consider what additional responses might emerge if we do not rule out such choices a priori.[27] Appendix Table A4 displays the allowed and disallowed responses to the JF reform when we only assume $\phi_i \geq 0$, in which case state $2r$ can be occupied under the AFDC (but not JF) eligibility rules. The last row of Appendix Table A4 corresponds to the responses of a woman who under AFDC has earnings in the range $\left(FPL_i, \overline{E}_i\right]$, is on assistance, and truthfully reports her earnings to the welfare agency (state $2r$). Some of her responses are disallowed. Specifically, she will not choose any of the states $\{1u, 2r, 1n\}$ under JF. State $2r$ is proscribed by the JF eligibility rules while, by revealed preference, states $1u$ and $1n$ are dominated by state $1r$ under JF.

The remaining responses are all allowed and entail both extensive margin and intensive margin adjustments. In particular, a woman who occupies state $2r$ under AFDC may be induced by the reform to *stop* working (states $0n$ and $0r$ under JF). That is, dropping the nonzero lower bound on stigma enables the emergence of flows out of the labor force, which were absent in the model of Section 4. Earning constraints are essential to the emergence of these flows. Appendix Figure A1 illustrates this point. It portrays a woman whose two earning offers $\left(O_i^k, O_i^l\right)$ are both in range 2 and obey $O_i^k \in \left(FPL_i, \overline{E}_i\right]$. Her welfare stigma is zero. For convenience, her fixed cost of work is also zero and her cost of under-reporting is sufficiently large that under-reporting earnings to the welfare agency is always a dominated choice. Under AFDC, the woman earns O_i^k, is on assistance, and truthfully reports her earnings. Observe that she would make the same choice even if earning constraints were absent. Under JF, the woman does not work and is off assistance. However, if earning constraints were absent she would be better off by earning below the FPL on assistance and truthfully reporting her earnings.

Food Stamps, the EITC, and Payroll Taxes

In Section 4 we ignored a number of programs that are typically relevant for would-be welfare recipients, namely FS and the federal tax system, including payroll taxes and the EITC. Here we summarize why the inclusion of these programs does not change our conclusions about the theoretically allowable effects of the JF reform. A formal proof of these arguments is provided in the Online Appendix.

The Online Appendix develops an extended model where FS participation is introduced as an additional choice, so that a woman may be off assistance, on welfare only, on FS only, or on both welfare and FS. We allow separate stigma terms for each combination of FS and welfare assistance. Under-reporting costs also vary depending on the type of assistance. Filing for EITC is assumed

Then, we count the number of quarterly observations in the AFDC sample associated with UI earnings above the FPL and with quarterly welfare transfers no greater than $G_i^{a*}(FPL_i)$.

[27] We have estimated bounds allowing for these additional responses. The results are, not surprisingly, virtually indistinguishable from those reported in Table 6 under the assumption that $\phi_i > G_i^a(FPL_i)$.

invariant to the policy regime,[28] and payroll and Medicare taxes are levied on earnings under both regimes.

In this model we distinguish 16 states that a woman may occupy under either regime, that is, 16 combinations of coarsened earnings, welfare participation, FS participation, and respective earnings reporting choices. Appendix Table A5 catalogs the theoretically allowed and disallowed responses: revealed preference arguments constrain 201 out of the 16 x 15 = 240 atheoretically possible responses leaving us with 39 allowed responses. The disallowed responses imply restrictions on a corresponding 16 x 16 matrix of response probabilities. An important feature of this response matrix is that if we integrate out FS participation we obtain a matrix with exactly the same zero and unitary entries as the response matrix Π associated with the model of Section 4.

There are two reasons for this convenient result. First, as described in Section 1, under JF earnings up to the FPL were disregarded in full for the determination of the FS grant *only conditional on joint take up* of welfare. Thus, JF's impact on the FS program effectively amplifies the notch at the FPL (recall Figure 2) and leaves the attractiveness of the *non-welfare* assistance states unaffected. Second, when deriving restrictions from the extended model we use the same coarsened earnings categories employed in conjunction with the model of Section 4: zero earnings (range 0), positive earnings and below the FPL (range 1), and positive earnings above the FPL (range 2). While FS can generate additional predictions about behavior within these earnings categories, it does nothing to alter predictions about transitions between them.

8 Conclusion

Our analysis of the Jobs First experiment suggests that women responded to the policy incentives of welfare reform along several margins, some of which are intensive and some of which are extensive. This finding is in accord with BGH's original interpretation of the JF experiment and with recent evidence from Blundell, Bozio, and Laroque (2011a,b) who find that secular trends in aggregate hours worked appear to be driven by both intensive and extensive margin adjustments. Our conclusions are also qualitatively consistent with recent studies relying on dynamic parametrically structured labor supply models (e.g., Blundell et al., 2012; Blundell et al., 2013).

An important question is the extent to which our finding of intensive margin responsiveness might generalize to other transfer programs that lack sharp budget notches but still involve phase-out regions that should discourage work. It seems plausible that the JF notch would yield larger disincentive effects than, say, the budget kink induced by the EITC phase-out region. However, BGH (2008) show that experimental responses to a Canadian reform inducing such a gradual benefit phaseout generated a pattern of earnings QTEs similar to that found in the JF experiment. More conclusive evidence on this question may be had via an application of the methods developed here

[28] The decision as to whether to file is not explicitly modeled but the model's implications are robust to whether a woman files or does not file as long as if she files under AFDC she also files under JF and vice versa.

to other policy reforms.

Though we studied a randomized experiment, our approach is easily generalized to quasi-experimental settings. Estimates of the relevant counterfactual choice probabilities can be formed using one's research design of choice (e.g., a difference in differences design), subject to the usual caveat that different designs may identify counterfactuals for different treated subpopulations.[29] With the two sets of marginal choice probabilities, bounds on response probabilities can then be had by a direct application of the methods developed in this paper.

As with most methods designed for the study of treatment effects, we cannot, without additional assumptions, predict the responses likely to arise from new interventions outside the range of observed policy variation. In cases where data are available on many different sorts of policy interventions, one can fit a curve summarizing how the bounds on response probabilities vary with policy parameters and attempt a statistical extrapolation. Otherwise, restrictions on model primitives will be necessary for prediction. A natural approach would be to parameterize features of utility and/or the process governing the labor supply constraints (e.g. as in Chetty et al., 2011), in which case bounds can be developed on finite dimensional structural parameters rather than response probabilities. A challenge to such approaches is establishing consensus on functional forms, as inappropriate parametric restrictions tend to overstate, rather than simply approximate, what is known in partially identified settings (Ponomareva and Tamer, 2010; Kline and Santos, 2013). We leave the development of such semi-parametric methods to future work.

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[29] For example, if one uses an instrumental variables design, counterfactuals are, under weak assumptions, identified only for the subpopulation of "compliers" (Imbens and Rubin, 1997).

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Table 1: Summary of Policy Differences Between AFDC and Jobs First

	Jobs First	AFDC
Welfare:		
Eligibility	Earnings Below Poverty Line	Earnings level at which benefits are exhausted (see disregard parameters below)
Earnings disregard	• Fixed Diregard: n.a. • Proportional Disregard: 100%	• Fixed Diregard: $120 (first 12 months of work), $90 (after 12 months) • Proportional Disregard: 51% (first 4 months of work), 27% (after month 4)
Time Limit	21 months	None
Work requirements	Mandatory work first employment services (exempt if child <1)	Education / training (exempt if child < 2)
Other	•Sanctions (3 month grant reduction due to infraction: 20% (1st), 35% (2nd), 100% (3rd); moderate enforcement) •Asset limit $3,000 •Family cap $50 •Two years transitional Medicaid •Transitional Child Care Assistance indefinitely provided as long as income is <75% of state median •Child support: $100 disregarded; full pass-through	•Sanctions (grant reduction corresponding to removal of adult from AU; rarely enforced) •Asset limit $1,000 •Family cap $100 •One year transitional Medicaid •Transitional Child Care Assistance for one year as long as income is <75% of state median •Child support: $50 disregarded; $50 maximum pass-through
Food Stamps (if joint with welfare):		
Earning Disregard	• Fixed Diregard: n.a. • Proportional Disregard: 100% of earnings up to FPL	• Fixed Diregard: n.a. • Proportional Disregard: 76% of earnings up to the eligibility threshold

Sources: Bloom et al. (2002) and Bitler, Gelbach, and Hoynes (2005), Connecticut Department of Social Services Uniform Policy and Procedure Manual (various dates).

Notes: This table describes the "AFDC-family group" variant of AFDC considered in the JF experiment. Categorical eligibility for both AFDC and JF requires the presence of children below the age of 18 (19 if enrolled in high school) or of a pregnant woman. CT's implementation of AFDC reflected the "fill-the-gap" provision whereby the effective implicit tax rate on earnings is always less than 100%. Specifically, "fill-the-gap" budgeting lowers the implicit AFDC tax rate on earnings by a factor of .73. For example, in the first four months of employment while on AFDC the usual tax rate would be 2/3rds (as part of the so called "30$ + 1/3 policy") but in CT it is .73 × (1-1/3) × 100=49%, hence a proportional disregard of 51% ensues. From the 5th month forward the usual tax rate would be 100% but in CT it is .73 × (1-0) × 100=73%, hence a proportional disregard of 27% ensues. Certain families, such as those in which the parent is incapacitated, are exempt from the JF time limits. In addition, JF recipients who reach the 21 month time limit may receive renewable six-month extensions of their benefits if they have made a good-faith effort to find employment. Both AFDC and JF impose work requirements. Unless they are exempt, JF recipients are required to look for a job, either on their own or through Job Search Skills Training (JSST) courses that teach job-seeking and job-holding skills. Education and training are generally restricted to those who were unable to find a job despite lengthy up-front job search activities. Job Connection, the state's Job Opportunities and Basic Skills Training (JOBS) program under AFDC, served a small proportion of the total welfare caseload in any month, and a large proportion of those who participated were in education and training activities. Under both AFDC and JF, sanctions are imposed for failure to comply with employment-related mandates (work-requirements). Sanctions entail grant reductions that become more severe as the recipient accumulates instances of non-compliance. During the study period, a JF recipient's cash grant was reduced by 20 percent for three months in response to the first instance of noncompliance and by 35 percent for three months in response to the second instance. A third instance resulted in cancellation of the entire grant for three months. Under AFDC, a sanction removed the noncompliant individual from the grant. "Full pass-through" of child support means that under JF all child support collected on behalf of children receiving assistance is given directly to the custodial parent. Under AFDC, when child support was collected, the welfare recipient received a check for the first $50 that was collected each month (or less than $50 if less was collected), in addition to her regular welfare check. A "family cap" is a cap on the benefit increase for children conceived while the mother receives welfare. "Transitional Medicaid assistance" is Medicaid assistance for families leaving welfare for work. "Transitional child care assistance" is child care assistance (subsidies) for families leaving welfare for work. AFDC and JF differ in the duration of the assistance, not in its nature or generosity. Because cash assistance recipients are categorically eligible for Food Stamps (FS), the asset and earned income rules effectively apply to FS eligibility while a family receives welfare. In particular, JF enhanced earning disregard applies to the FS grant calculation – so that all earnings are disregarded as long as recipients are earning below the FPL. When JF recipients lose their

Table 2: Mean Sample Characteristics

	Overall Sample				Zero Earnings Q7 pre-RA				Positive Earnings Q7 pre-RA			
	Jobs First	AFDC	Difference	Difference (adjusted)	Jobs First	AFDC	Difference	Difference (adjusted)	Jobs First	AFDC	Difference	Difference (adjusted)
Demographic Characteristics												
White	0.374	0.360	0.014	0.001	0.340	0.331	0.009	-0.001	0.453	0.421	0.032	0.003
Black	0.380	0.384	-0.004	0.000	0.370	0.360	0.010	0.001	0.404	0.435	-0.031	-0.002
Hispanic	0.214	0.224	-0.010	-0.001	0.258	0.275	-0.017	0.000	0.110	0.117	-0.007	-0.002
Never married	0.654	0.661	-0.007	0.000	0.658	0.654	0.003	0.000	0.645	0.674	-0.029	0.000
Div/wid/sep/living apart	0.332	0.327	0.005	0.000	0.327	0.334	-0.007	0.000	0.345	0.312	0.032	0.000
HS dropout	0.350	0.334	0.017	0.000	0.390	0.394	-0.004	0.000	0.257	0.209	0.048	0.000
HS diploma/GED	0.583	0.604	-0.021	0.000	0.550	0.555	-0.005	-0.001	0.661	0.706	-0.045	0.001
More than HS diploma	0.066	0.062	0.004	0.000	0.060	0.051	0.009	0.000	0.082	0.085	-0.003	-0.001
More than 2 Children	0.235	0.214	0.021	0.000	0.260	0.250	0.010	0.000	0.176	0.139	0.037	0.001
Mother younger than 25	0.287	0.298	-0.011	-0.003	0.287	0.268	0.019	-0.001	0.288	0.361	-0.074	0.000
Mother age 25-34	0.412	0.414	-0.003	0.005	0.410	0.419	-0.009	0.000	0.416	0.405	0.010	0.000
Mother older than 34	0.301	0.287	0.014	-0.002	0.303	0.313	-0.010	0.001	0.297	0.233	0.063	0.000
Average quarterly pretreatment values												
Earnings	673	750	-76*	4	174	185	-11	2	1856	1935	-79	11
	[1306]	[1379]	(40)	(6)	[465]	[479]	(17)	(4)	[1802]	[1828]	(99)	(21)
Cash welfare	903	845	58**	1	1050	1022	28	0	555	475	80**	-4
	[805]	[784]	(23)	(2)	[811]	[799]	(28)	(3)	[679]	[602]	(35)	(7)
Food stamps	356	344	12	0	399	398	1	1	253	230	23	-2
	[320]	[304]	(9)	(1)	[326]	[310]	(11)	(1)	[281]	[256]	(15)	(4)
Fraction of pretreatment quarters with												
Any earnings	0.319	0.347	-0.029***	0.000	0.137	0.143	-0.007	0.000	0.751	0.776	-0.025*	0.000
	[0.362]	[0.370]	(0.011)	(0.001)	[0.211]	[0.215]	(0.008)	(0.001)	[0.262]	[0.238]	(0.014)	(0.002)
Any welfare assistance	0.581	0.551	0.030*	-0.001	0.650	0.636	0.014	0.000	0.418	0.373	0.045*	-0.002
	[0.451]	[0.450]	(0.013)	(0.001)	[0.439]	[0.439]	(0.015)	(0.001)	[0.438]	[0.416]	(0.023)	(0.004)
Any Food Stamp assistance	0.613	0.605	0.008	0.000	0.670	0.674	-0.004	0.001	0.480	0.460	0.020	-0.003
	[0.437]	[0.431]	(0.012)	(0.001)	[0.427]	[0.421]	(0.015)	(0.001)	[0.433]	[0.418]	(0.023)	(0.004)
# of cases	2,318	2,324			1,630	1,574			688	750		

Notes: Sample units missing baseline data on number of children (kidcount) are excluded. Adjusted differences are computed via propensity score reweighting. Numbers in brackets are standard deviations and numbers in parentheses are standard errors calculated via 1,000 block bootstrap replications (resampling at case level). ***, **, and * indicate statistical significance at the 1-percent, 5-percent, and 10-percent levels, respectively (significance indicators provided only for difference estimates).

Table 3: Fraction of Months on Welfare by Experimental Status and Age of Youngest Child

Age of Youngest Child at Baseline:	16 or 17	15 or less
AFDC	0.441	0.651
	(0.038)	(0.008)
JF	0.508	0.740
	(0.039)	(0.007)
Impact	0.089	0.066
	(0.010)	(0.055)
Difference in Impacts	**-0.022**	
	(0.056)	

Notes: Sample consists of 87,717 person-months: 21 months of data on each of 4,177 cases with non-missing baseline information on age of youngest child. Table gives reweighted fraction of person-months that women participated in welfare by experimental status and age of youngest child at baseline. Standard errors computed using 1,000 block bootstrap replications (resampling at case level).

Table 4: Allowed and Disallowed Responses

State under AFDC	State under Jobs First: 0n	1n	2n	0r	1r	1u	2u
0n	No Response	—	—	—	Extensive LS (+) Take Up Welfare	—	—
1n	—	No Response	—	—	Intensive LS (+/0/-) Take Up Welfare	—	—
2n	—	—	No Response	—	Intensive LS (-) Take Up Welfare	—	—
0r	No LS Response Exit Welfare	—	Extensive LS (+) Exit Welfare	No Response	Extensive LS (+)	—	Extensive LS (+) Under-reporting (Figure 5 (b))
1r	—	—	—	—	Intensive LS (+/0/-)	—	—
1u	—	—	—	—	Intensive LS (+/0/-) Truthful Reporting	—	—
2u	—	—	—	—	Intensive LS (-) Truthful Reporting (Figure 5 (a))	—	No Response

Notes: This table catalogues the theoretically allowed response margins given the states that a woman may occupy under AFDC and Jobs First. A state is a pair of coarsened earnings (0 stands for zero earnings, 1 for positive earnings at or below the FPL, and 2 for earnings strictly above the FPL), and participation status in the relevant welfare assistance program along with an earnings reporting decision (n stands for "not on assistance", r for "on assistance and truthfully reporting earnings", and u for "on assistance and under-reporting earnings"). The cells containing a "—" represent responses that are not allowed based on revealed preference arguments derived from the nonparametric model of Section 4. Specifically, (a) a woman will not leave a state at least as attractive under JF as under AFDC for a state that is no more attractive under JF than under AFDC ("—" in cells with a solid greyed-out background fill), (b) state 1u is unpopulated under JF ("—" in cells with a horizontally striped background fill), and (c) a woman will not pair state 0r under AFDC with state 1n under JF ("—" in cells with a vertically striped background fill). The remaining cells represent responses that are allowed by the model. Their content summarizes the three possible sorts of responses: (a) the labor supply "LS" response (intensive versus extensive and its sign: "+" for increase, "0" for no change, and "-" for decrease), (b) the program participation response (take up of versus exit from welfare assistance), and (c) the reporting of earnings to the welfare agency margin (to truthfully report versus to under-report). When the state that a woman occupies under AFDC and Jobs First is the same, no response occurs along any of these three margins. See Appendix for proof.

Table 5: Probability of Earnings / Participation States

	Overall			Overall - Adjusted		
	Jobs First	AFDC	Difference	Jobs First	AFDC	Difference
Pr(State=0n)	0.127	0.136	-0.009	0.128	0.135	**-0.007**
				(0.006)	(0.006)	**(0.008)**
Pr(State=1n)	0.076	0.130	-0.055	0.078	0.126	**-0.048**
				(0.004)	(0.005)	**(0.006)**
Pr(State=2n)	0.068	0.099	-0.031	0.069	0.096	**-0.027**
				(0.004)	(0.005)	**(0.006)**
Pr(State=0p)	0.366	0.440	-0.074	0.359	0.449	**-0.090**
				(0.008)	(0.008)	**(0.012)**
Pr(State=1p)	0.342	0.185	0.157	0.343	0.184	**0.159**
				(0.008)	(0.006)	**(0.009)**
Pr(State=2p)	0.022	0.009	0.013	0.023	0.009	**0.014**
				(0.002)	(0.001)	**(0.002)**
# of quarterly observations	16,226	16,268		16,226	16,268	

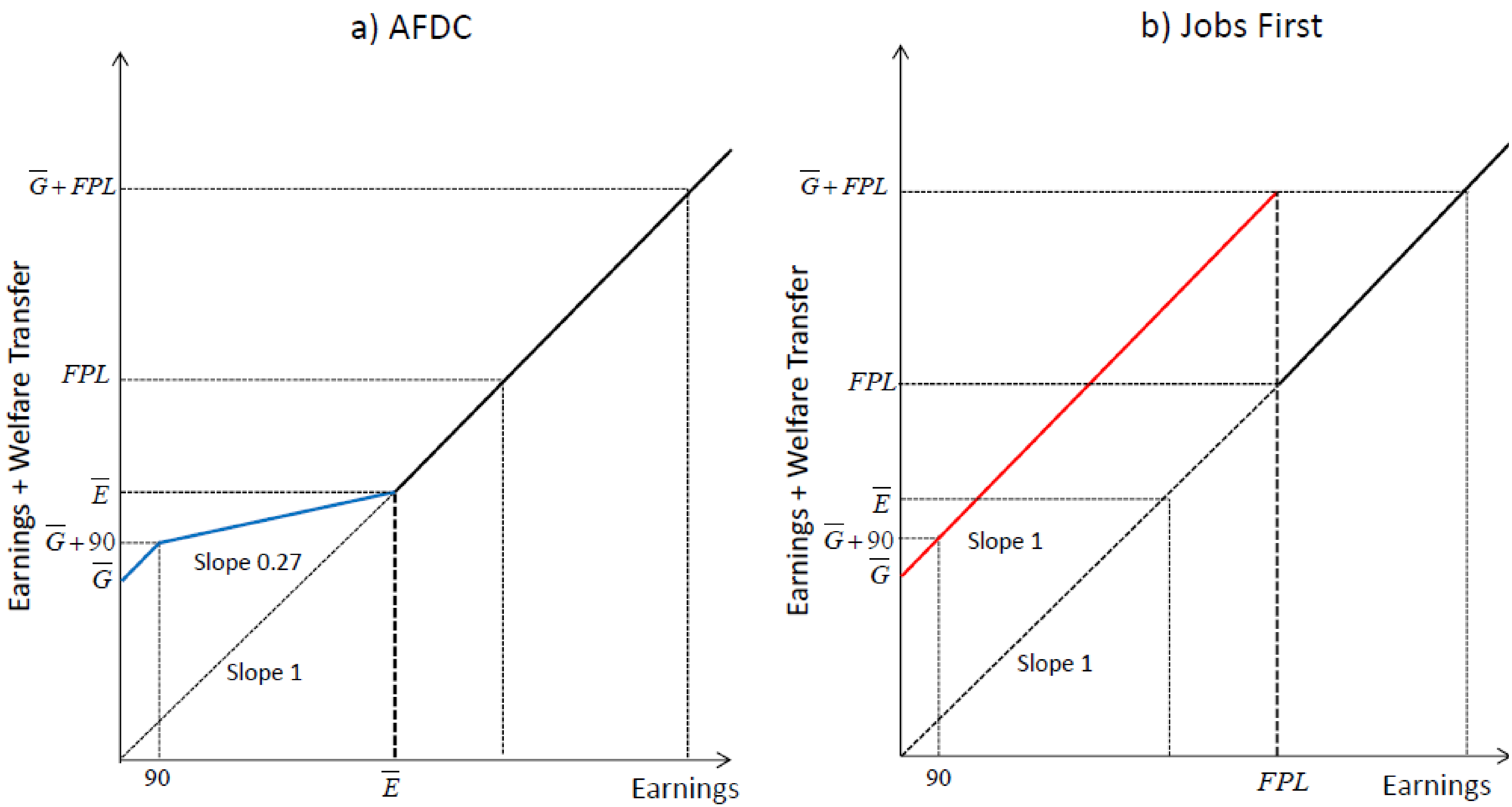
Notes: Sample covers quarters 1-7 post-random assignment during which individual is either always on or always off welfare. Sample units with kidcount missing are excluded. Number of state refers to earnings level, with 0 indicating no earnings, 1 indicating earnings below 3 times the monthly FPL, and 2 indicating earnings above 3FPL. The letter n indicates welfare nonparticipation throughout the quarter while the letter p indicates welfare participation throughout the quarter. Poverty line computed under assumption AU size is one greater than amount implied by baseline kidcount variable. Adjusted probabilities are adjusted via the propensity score reweighting algorithm described in the Appendix. Standard errors computed using 1,000 block bootstrap replications (resampling at case level).

Table 6: Point and Set-identified Response Margins

	Estimate	95% CI (naive)	95% CI (conservative)
Point-identified Margins			
Off welfare, low earnings → On welfare, low earnings ($\pi_{1n,1r}$)	0.381	[0.306, 0.455]	[0.306, 0.455]
Set-identified Margins			
On welfare, not working → Off welfare, not working ($\pi_{0r,0n}$)	{0.000, 0.169}	[0.000, 0.210]	[0.000, 0.245]
On welfare, not working → On welfare, low earnings ($\pi_{0r,1r}$)	{0.000, 0.169}	[0.000, 0.210]	[0.000, 0.250]
On welfare, not working → Off welfare, high earnings ($\pi_{0r,2n}$)	{0.000, 0.154}	[0.000, 0.170]	[0.000, 0.302]
On welfare, not working → On welfare, high earnings ($\pi_{0r,2u}$)	{0.031, 0.051}	[0.022, 0.059]	[0.022, 0.131]
Off welfare, not working → On welfare, low earnings ($\pi_{0n,1r}$)	{0.059, 0.618}	[0.000, 0.755]	[0.000, 0.875]
Off welfare, high earnings → On welfare, low earnings ($\pi_{2n,1r}$)	{0.281, 1.000}	[0.193, 1.000]	[0.193, 1.000]
On welfare, high earnings → On welfare, low earnings ($\pi_{2u,1r}$)	{0.000, 1.000}	[0.000, 1.000]	[0.000, 1.000]
Composite Margins			
Not working → Working ($\pi_{0,1+}$)	0.168	[0.129, 0.206]	[0.129, 0.206]
Off welfare → On welfare ($\pi_{n,p}$)	{0.232, 0.444}	[0.188, 0.486]	[0.188, 0.509]
On welfare → Off welfare ($\pi_{p,n}$)	{0.000, 0.118}	[0.000, 0.147]	[0.000, 0.173]
On welfare, not working → Off welfare ($\pi_{0r,n}$)	{0.000, 0.169}	[0.000, 0.210]	[0.000, 0.244]

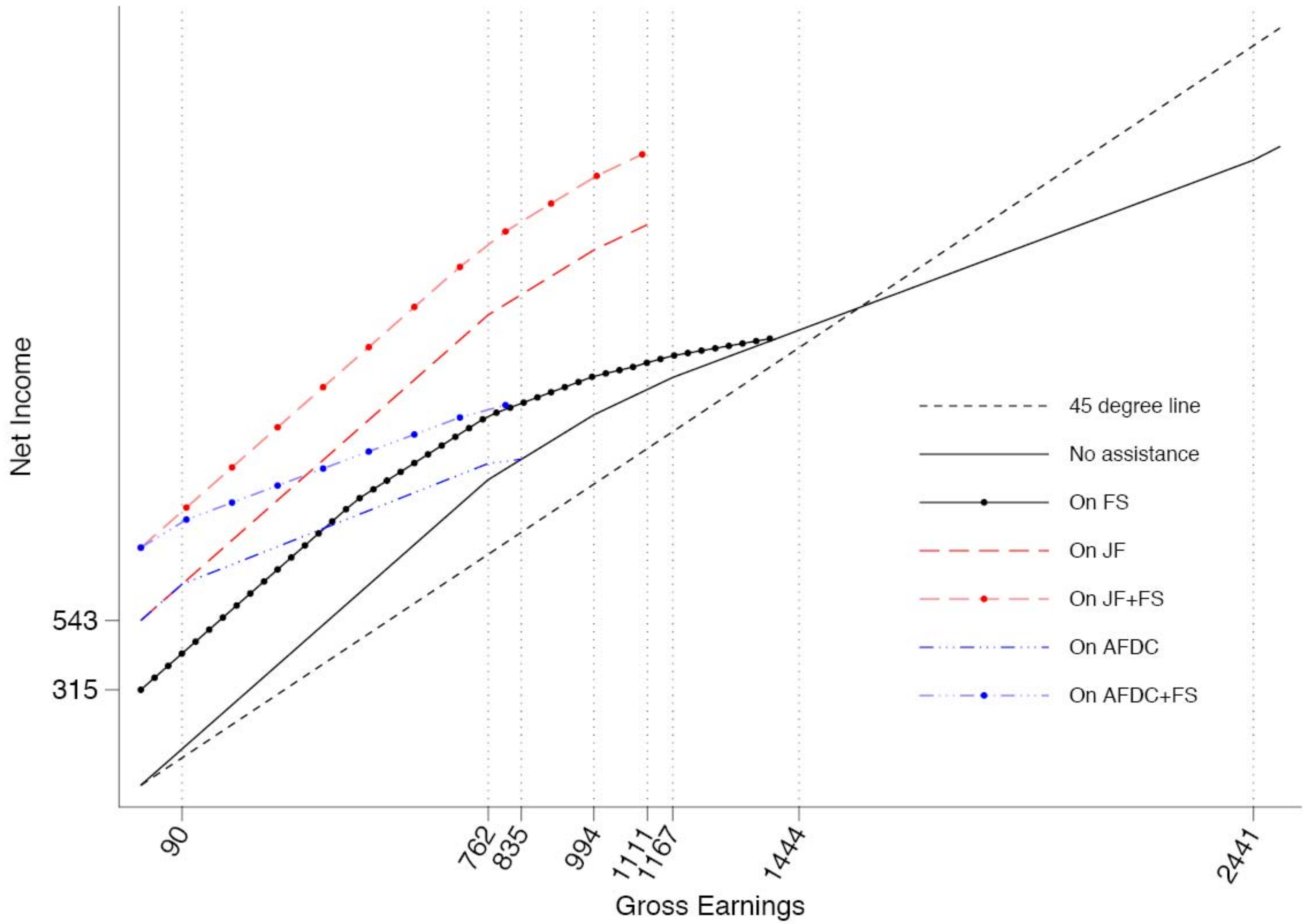
Notes: Estimates refer to the probability of occupying the state to the right of the arrow under JF rules among women who would occupy the state to the left of the arrow under AFDC rules. Estimates inferred from probabilities in Table 5, see text for formulas. Low earnings refers to quarterly earnings less than or equal to three times the monthly federal poverty line (E=1), high earnings refer to quarterly earnings above three times the monthly federal poverty line (E=2). Numbers in braces are estimated upper and lower bounds, numbers in brackets are 95% confidence intervals. "Naive" 95% confidence interval ignores uncertainty in which moment inequalities bind. "Conservative" 95% confidence interval assumes all constraints bind. See Appendix for details.

Figure 1: Monthly Earnings plus Welfare Transfer under AFDC and Jobs First



Notes: The figures (not drawn to scale) depict the sum of monthly earnings and welfare transfer for a woman with 2 children under AFDC (panel a)) and Jobs First (panel b)) policy rules as of 1997. FPL refers to federal poverty line ($1,111) and $\overline{G}$ is the base grant amount ($543). The illustration assumes that the woman only has access to the fixed $90 disregard under AFDC which implies that the AFDC transfer is exhausted at earnings level $\overline{E}$ corresponding to $\overline{G}/0.73+90$ ($835). The JF welfare transfers falls to zero at earnings level FPL, that is, JF extends the segment of the budget line that under AFDC has slope 1 from $90 to FPL. Under JF, a woman who earns between FPL ($1,111) and $FPL+\overline{G}$ ($1,654) can increase the sum of earnings and welfare transfers by taking up welfare assistance and working less.

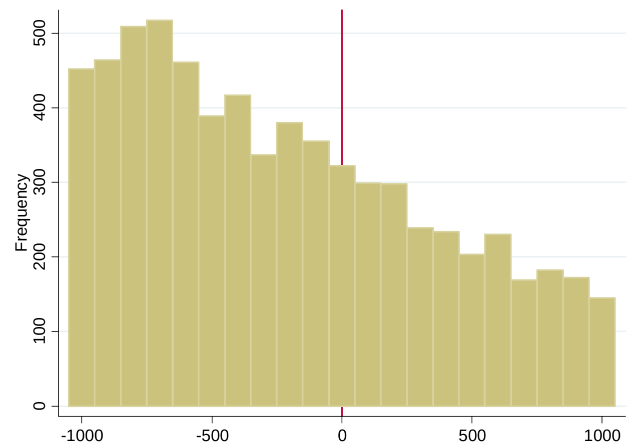
Figure 2: Hypothetical Budget Sets under AFDC and Jobs First, Accounting for Food Stamps and Taxes



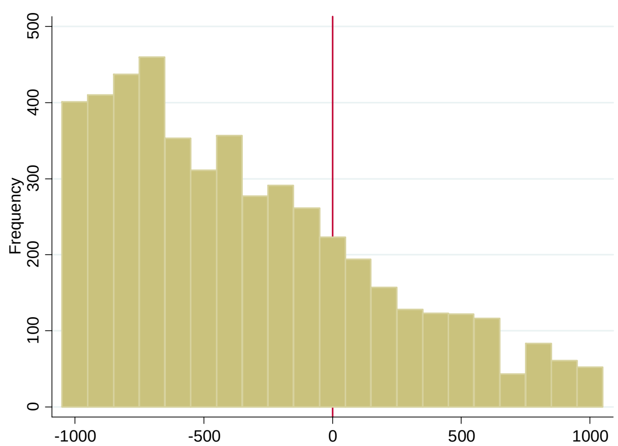
Notes: Figure depicts hypothetical budget set faced by assistance unit of size 3 under AFDC and JF policy rules. Illustration assumes household only has access to fixed $90 disregard under AFDC and faces $366 in monthly rental expenses. Net income is earnings net of federal taxes and inclusive of EITC and transfers (given participation). No assistance corresponds to earnings net of payroll taxes and federal income taxes and inclusive of EITC. *Vertical lines*: at the AFDC fixed earning disregard and break-even level ($90 and $835), at the end of the EITC phase-in and start and end of the phase-out regions ($762, $994 and $2,441), at the minimum taxable earnings ($1,167), at the FPL ($1,111), and at 1.3FPL ($1,444) which is a FS eligibility threshold under AFDC. *Horizontal ticks*: at maximum FS and welfare grants.

Figure 3: Distribution of Quarterly Earnings Centered at 3 x Monthly Federal Poverty Line

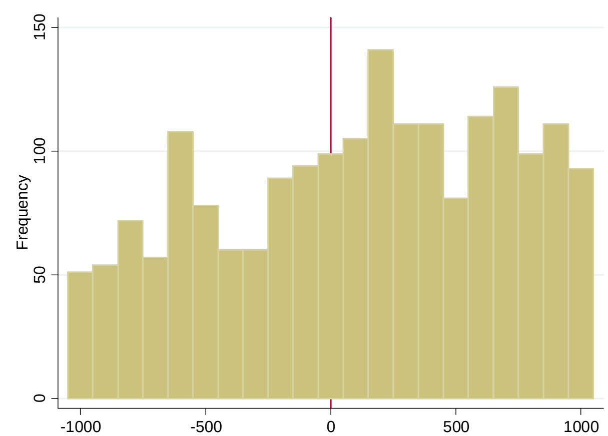
a) Unconditional



b) On Assistance all 3 Months of the Quarter



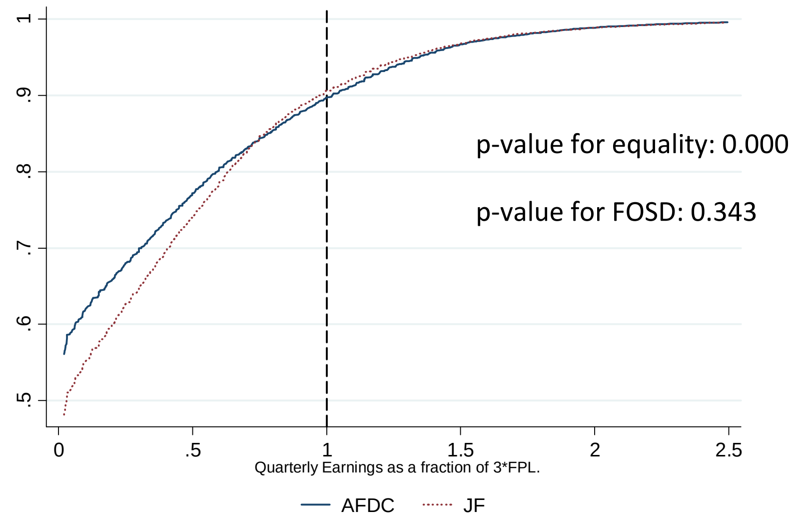
c) Off Assistance all 3 Months of the Quarter



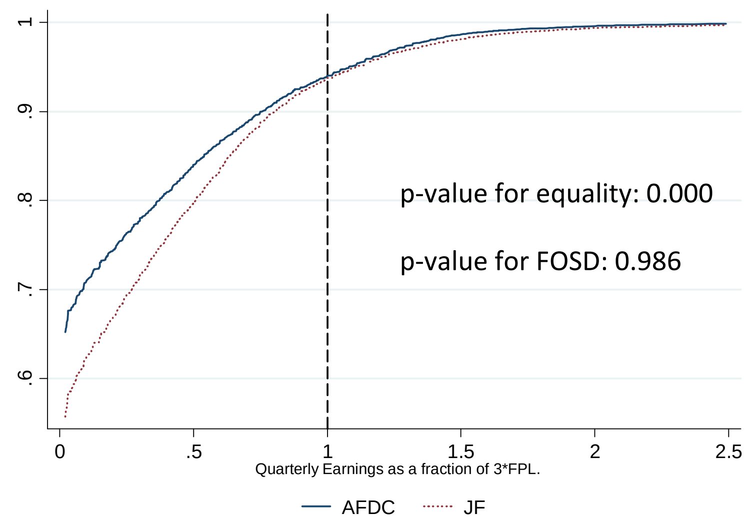
Notes: Restricted to Jobs First sample quarters 1-7 post random assignment. Assistance unit (AU) size has been inferred from monthly aid payment. AU sizes above 8 have been excluded. The bins in the histograms are $100 wide with bin 0 containing three times the monthly federal poverty line corresponding to the size and the calendar year of the quarterly observation. Vertical line indicates Jobs First eligibility threshold at three times the monthly federal poverty line.

Figure 4: CDFs of Quarterly Earnings Relative to 3 x Federal Poverty Line

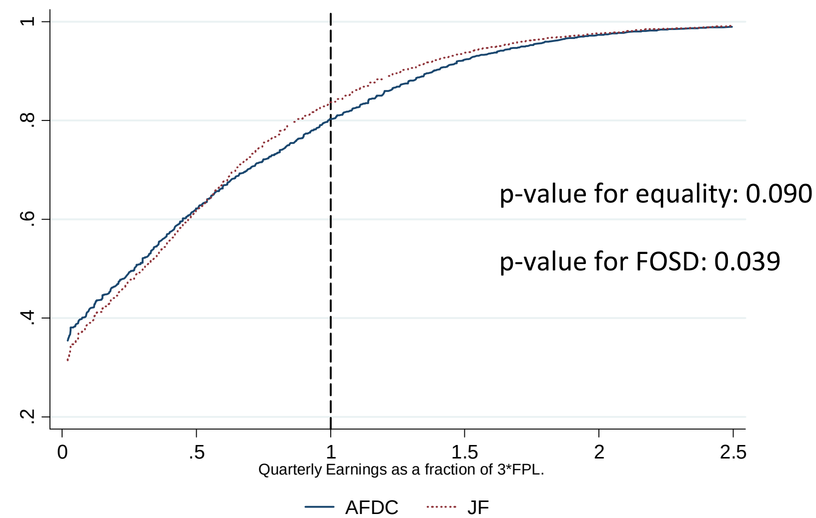
a) Unconditional



b) Zero Earnings Prior to Random Assignment

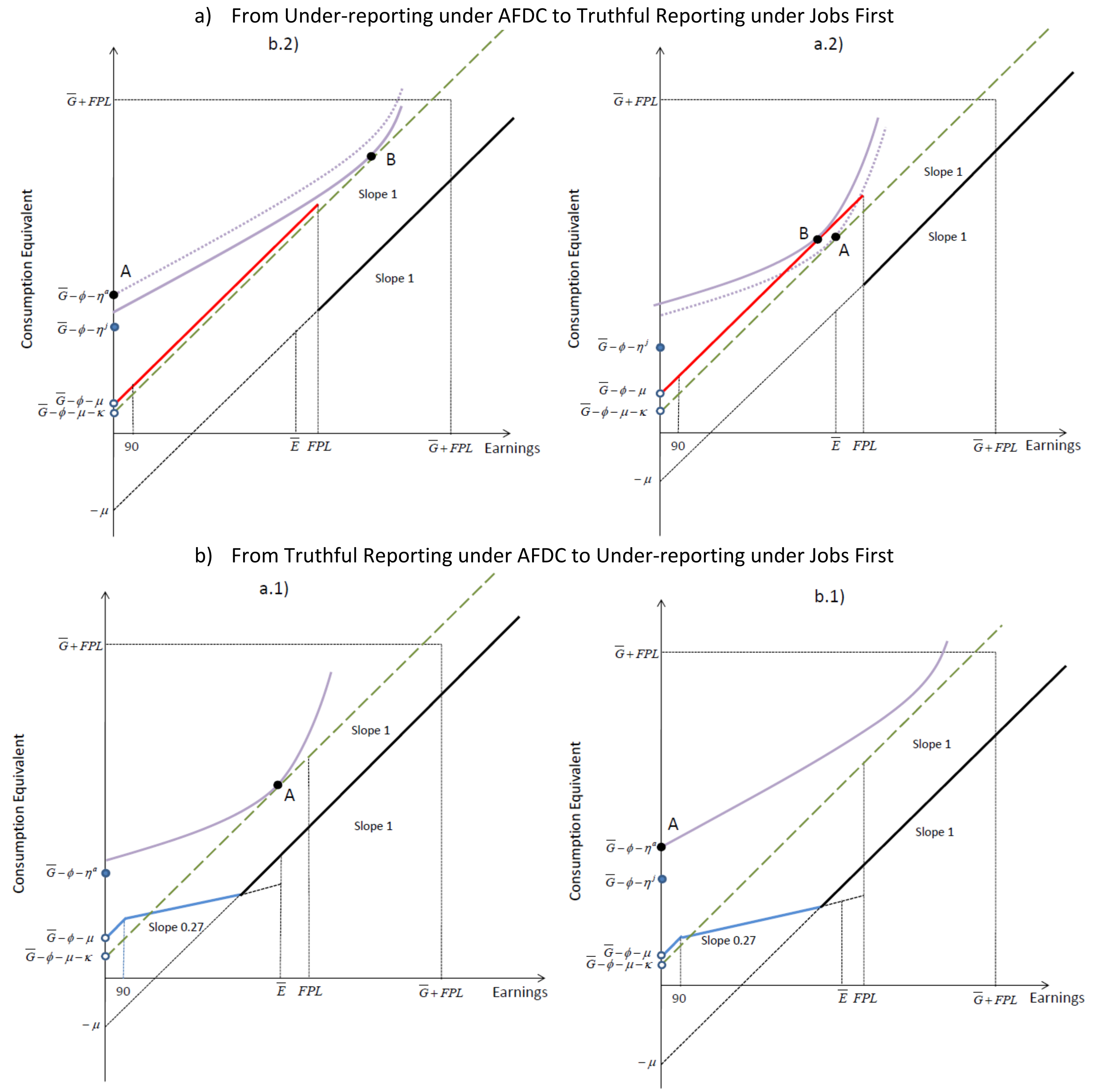


c) Positive Earnings Prior to Random Assignment



Notes: Figures give reweighted CDFs of quarterly UI earnings (in quarters 1-7 post-RA) in JF and AFDC samples relative to three times the monthly federal poverty line associated with year and AU size. Panel (b) refers to women with zero earnings in the 7^{th} quarter prior to random assignment, while panel (c) refers to women with positive earnings in that quarter. AU size determined by baseline survey variable "kidcount." To deal with increases in family size since random assignment, we use one plus the AU size directly implied by kidcount. The "p-value for equality" refers to a Kolmogorov-Smirnov test of equality of the two distributions, while "p-value for FOSD" refers to a Barrett-Donald test for first order stochastic dominance of the JF distribution over the AFDC distribution (both based on 1,000 bootstrap replications, see Appendix for details).

Figure 5: Earnings and Participation Choices with Under-reporting



Notes: Panels (a) through (b) are drawn in the earnings (horizontal axis) and equivalent consumption (vertical axis) plane. Equivalent consumption equals earnings plus transfer income from welfare (if any) net of monetized hassle, stigma, work, and under-reporting costs (if any, see text for details). At each level of earnings, the bold lines correspond to equivalent consumption either off welfare or on welfare with truthful reporting of earnings to the welfare agency. At each level of earnings, the dashed lines correspond to equivalent consumption on welfare with under-reporting. The horizontal axis displays the same selected earnings levels appearing in Figure 1: the fixed earning disregard under AFDC ($90), the earnings level at which welfare assistance is exhausted under AFDC ($\overline{E}$) and the FPL. For clarity, the graphs assume away earnings constraints. Panels (a.1) and (a.2) depict a scenario where the JF reform induces a woman who would participate in welfare, work, and under-report her earnings under AFDC (point A in panel (a.1)) to work and truthfully report her earnings under JF (point B panel (a.2)) thanks to the 100% earning disregard under JF. Panels (b.1) and (b.2) depict a scenario where the JF reform induces a woman who would participate in welfare without work under AFDC (point A in panel (b.1)) to work and under-report her earnings under JF (point B panel (b.2)) to avoid the hassle cost under JF.

Online Appendix to Kline and Tartari (2014)

Outline

- Section 1 provides additional details about the data and variable construction.
- Section 2 describes the propensity score re-weighting method used to adjust for chance imbalances in baseline characteristics.
- Section 3 explains how we construct the tests for equality and first order stochastic dominance whose p-values are reported in Figure 4.
- Section 4 proves that the response matrix Π takes the form described in Section 5 of the paper. We start by introducing definitions and restating the assumptions made in the paper. We then prove a few intermediate lemmas which are used to prove the main propositions.
  - Lemma 1 establishes that no woman will truthfully report earnings above the federal poverty level while on assistance.
  - Lemma 2 establishes that no woman will under-report earnings that are below the federal poverty line under JF.
  - Lemma 3 provides the main revealed preference argument regarding pairing of choices under JF and AFDC.
  - Propositions 1 and 2 formally establish that the matrix Π incorporates all the restrictions implied by the model.
- Section 5 lists the analytical expressions for the bounds on the response probabilities and explain how they were derived.
- Section 6 describes the construction of the 95% confidence intervals reported in Table 6.
- Section 7 relaxes the lower bound on stigma assumed in the paper.
  - Proposition 3 establishes the effect of this relaxation on the response matrix.
  - Corollary 1 shows that earning constraints enable exit from the labor force in response to the JF reform
- Section 8 develops an extended model that allows for participation in the FS program and accounts for taxes (including the EITC).
  - Propositions 4 and 5 establish the form of the response matrix.
  - Proposition 6 and the subsequent remark demonstrate that integrating out FS yields a response matrix with the same zero and unitary entries as Π.
- Appendix Figures and Tables are provided at the end along with references.

1 Data

From Monthly to Quarterly Data

The public use files do not report the month of randomization. However, we were able to infer it by contrasting monthly assistance payments with an MDRC constructed variable providing quarterly assistance payments. For each case, we found that a unique month of randomization leads the aggregation of the monthly payments to match the quarterly measure to within rounding error.

Measures of AU Size

The administrative measure of AU size is missing for most cases, which is problematic because the JF notch occurs at the FPL which varies with AU size. For the Jobs First sample we are able to infer an AU size in most months from the grant amount while the women are on welfare. However if AU size changes while off welfare we are not able to detect this change.[1] Moreover, in some cases the grant amount does not match any of the base grant amounts. This can result when a woman reports some unearned income or because of sanctions. In both of these situations, we use the grant amount in other months to impute AU size. For the AFDC sample, the grant amount depends on many unobserved factors, preventing us from inferring the AU size from the administrative data.

The kidcount variable described in the text records the number of children in the household at the time of random assignment and is top-coded at three children. Appendix Table A1 gives a cross-tabulation, in the JF sample, of kidcount with our more reliable AU size measure inferred from grant amounts. The tabulation suggests the kidcount variable is a reasonably accurate measure of AU size over the first 7 quarters post-random assignment conditional on the number of children at baseline being less than three. As might be expected, the kidcount variable tends to underestimate the true AU size as women may have additional children over the 7 quarters following the baseline survey. To deal with this problem we inflate the kidcount based AU size by one in order to avoid understating the location of the poverty line for most assistance units. That is, we use the following mapping from kidcount to AU size: $0 \rightarrow 3$, $1 \rightarrow 3$, $2 \rightarrow 4$, $3 \rightarrow 5$, which maps each kidcount value to the modal inferred AU size in Appendix Table A1 plus one. This mapping is conservative in ensuring that earnings levels below the FPL are indeed below it.

2 Propensity Score Reweighting

We use propensity score reweighting methods to adjust for the chance imbalances in baseline characteristics between the AFDC and JF groups. Following BGH (2006) we estimate a logit of the JF assignment dummy on: quarterly earnings in each of the 8 pre-assignment quarters, separate variables representing quarterly AFDC and quarterly food stamps payments in each of the 7 pre-assignment quarters, dummies indicating whether each of these 22 variables is nonzero, and dummies indicating whether the woman was employed at all or on welfare at all in the year preceding random assignment or in the applicant sample. We also include dummies indicating each of the following baseline demographic characteristics: being white, black, or Hispanic; being never married or separated; having a high-school diploma/GED or more than a high-school education;

[1] Changes in AU size are typically due to a birth or to the fact that a child becomes categorically ineligible for welfare. Under AFDC, the AU size also changes when the adult is removed from the unit due to sanctions for failure to comply with employment-related mandates. Empirically this source of time variation in AU size seems quantitatively minor. Bloom et al. (2002) report that 5 percent of AFDC group members had their benefits reduced owing to a sanction within four years after random assignment.

having more than two children; being younger than 25 or age 25-34; and dummies indicating whether baseline information is missing for education, number of children, or marital status.

Denote the predicted values from this model by $\widehat{p}_i$. The propensity score weights used to adjust the moments of interest are given by:

$$\omega_i = \frac{\frac{\mathbf{1}[T_i=j]}{\widehat{p}_i}}{\sum_{n=1}^{N}\frac{\mathbf{1}[T_n=j]}{\widehat{p}_n}} + \frac{\frac{1-\mathbf{1}[T_i=j]}{1-\widehat{p}_i}}{\sum_{n=1}^{N}\frac{1-\mathbf{1}[T_n=j]}{1-\widehat{p}_n}}.$$

where N is the number of cases. These are inverse probability weights, re-normalized to sum to one within policy group. When examining subgroups we always recompute a new set of propensity score weights and re-normalize them.

3 Distributional Tests

Kolmogorov-Smirnov test for equality of distributions

We use a bootstrap procedure to compute the p-values for our reweighted Kolmogorov-Smirnov (K-S) tests for equality of distribution functions across treatment groups. Let $F_n^t(e)$ be the propensity score reweighted EDF of earnings in treatment group t. That is,

$$F_n^t(e) \equiv \sum_i \omega_i \mathbf{1}\left[E_i \le e, T_i = t\right].$$

Define the corresponding bootstrap EDF as:

$$F_n^{t*}(e) \equiv \sum_i \omega_i^* \mathbf{1}\left[E_i^* \le e, T_i^* = t\right].$$

where stars refer to resampled values (we resampled at the case level in order to preserve serial correlation in the data). The K-S test statistic is given by:

$$\widehat{KS} \equiv \sup_e |F_n^j(e) - F_n^a(e)|.$$

To obtain a critical value for this statistic, we compute the bootstrap distribution of the *recentered* K-S statistic:

$$KS^* \equiv \sup_e |F_n^{j*}(e) - F_n^{a*}(e) - \left(F_n^j(e) - F_n^a(e)\right)|.$$

Recentering is necessary to impose the correct null hypothesis on the bootstrap DGP (Giné and Zinn, 1990). We compute an estimated p-value $\widehat{\alpha}_{KS}$ for the null hypothesis that the two distributions are equal as:

$$\widehat{\alpha}_{KS} \equiv \frac{1}{1000}\sum_{b=1}^{1000}\mathbf{1}\left[KS^{*(b)} > \widehat{KS}\right],$$

where b indexes the bootstrap replication.

Barrett-Donald test for stochastic dominance

Our test statistic for detecting violations of the null hypothesis that the JF distribution of earnings stochastically dominates the AFDC distribution is given by:

$$\widehat{BD} \equiv \sup_{e} F_n^j(e) - F_n^a(e).$$

As suggested by Barrett and Donald (2003), we bootstrap the recentered version of this statistic given by:

$$BD^* \equiv \sup_{e} \left[F_n^{j*}(e) - F_n^{a*}(e) - \left(F_n^j(e) - F_n^a(e)\right)\right].$$

We compute an estimated p-value $\widehat{\alpha}_{BD}$ as:

$$\widehat{\alpha}_{BD} \equiv \frac{1}{1000} \sum_{b=1}^{1000} \mathbf{1}\left[BD^{*(b)} > \widehat{BD}\right].$$

4 Derivation of Response Matrix

Notation, Definitions, and Assumptions

Notation: Throughout, we use a to refer to AFDC and j to refer to JF. The policy regime is denoted by $t \in \{a, j\}$.

Definition 1. Earnings range 0 refers to zero earnings. Earnings range 1 refers to the interval $(0, FPL_i]$ where FPL_i is woman i's federal poverty line. Earnings range 2 refers to the interval (FPL_i, ∞).

Definition 2. The regime dependent transfer functions are $G_i^a(E^r) \equiv \max\left\{\overline{G}_i - \mathbf{1}[E^r > \delta_i](E^r - \delta_i)\tau_i, 0\right\}$ and $G_i^j(E^r) \equiv \mathbf{1}[E^r \leq FPL_i]\overline{G}_i$. The parameter $\delta_i \in \{90, 120\}$ gives woman i's fixed disregard and the parameter $\tau_i \in \{.49, .73\}$ governs her proportional disregard. $\overline{G}_i$,$FPL_i > 0$ vary across women due to differences in AU size.

Definition 3. Define woman i's regime dependent consumption equivalent as $C_i^t(E, D, E^r) \equiv E - \mu_i 1\{E > 0\} + D\left(G_i^t(E^r) - \phi_i - \eta_i^t 1\{E^r = 0\} - \kappa_i 1\{E^r < E\}\right)$.

Definition 4. Woman i's "state" is defined by the following function:

$$s_i(E, D, E^r) \equiv \begin{cases} 0n & \text{if } E = 0,\ D = 0 \\ 1n & \text{if } E \text{ in range } 1,\ D = 0 \\ 2n & \text{if } E \text{ in range } 2,\ D = 0 \\ 0r & \text{if } E = 0,\ D = 1 \\ 1r & \text{if } E \text{ in range } 1,\ D = 1,\ E^r = E \\ 1u & \text{if } E \text{ in range } 1,\ D = 1,\ E^r < E \\ 2u & \text{if } E \text{ in range } 2,\ D = 1,\ E^r < E \\ 2r & \text{if } E \text{ in range } 2,\ D = 1,\ E^r = E \end{cases}$$

Definition 5. An allocation is an earnings and consumption equivalent pair (E, C). For simplicity, we refer to C as consumption.

Definition 6. We say that an allocation (E, C) is compatible with state s under regime t for woman i if there exists a pair $(D, E^r) \in \{0, 1\} \times [0, E]$ such that $s = s_i(E, D, E^r)$ and $C = C_i^t(E, D, E^r)$.

Definition 7. Unless specified otherwise, we denote earnings offers by O_i^k or O_i^l. It is implicit that $O_i^k, O_i^l \in \{O_i^1, O_i^2\}$, where (O_i^1, O_i^2) are woman i's two earning offers drawn from the bivariate distribution $F_i(.)$ with support on the strictly positive orthant. The statement $\forall O_i^k$ is shorthand for $\forall O_i^k \in \{O_i^1, O_i^2\}$.

Definition 8. We say that an allocation (E, C) is available and compatible with state s under regime t for woman i if it is compatible with state s under regime t and E corresponds to an earning draw O_i^k or $E = 0$.

Definition 9. We say that a state s is unpopulated under regime t if no available allocation compatible with s under regime t is chosen by any woman.

Definition 10. We say that a state s is no better (worse) under JF than under AFDC if, for any woman i, and any (E, D, E^r) such that $s = s_i(E, D, E^r)$, $U_i\left(E, C_i^j(E, D, E^r)\right) \leq (\geq) U_i(E, C_i^a(E, D, E^r))$. We say that a state s is equally attractive under JF and AFDC if, for any woman i, and any (E, D, E^r) such that $s = s_i(E, D, E^r)$, $U_i\left(E, C_i^j(E, D, E^r)\right) = U_i(E, C_i^a(E, D, E^r))$.

Definition 11. Define $\mathcal{S} \equiv \{0n, 1n, 2n, 0r, 1r, 1u, 2u\}$, $\mathcal{C}_+ \equiv \{1r\}$, $\mathcal{C}_- \equiv \{0r\}$ and $\mathcal{C}_0 \equiv \{0n, 1n, 2n, 1u, 2u\}$.

Definition 12. Consider those women who under AFDC choose a triplet (E, D, E^r) such that $s^a = s_i(E, D, E^r)$. We denote by π_{s^a, s^j} the fraction of them who under JF choose a triplet $(E', D', E^{r\prime})$ such that $s^j = s_i(E', D', E^{r\prime})$.

Assumption 1. *Woman i's utility function $U_i(.,.)$ is decreasing in its first argument (earnings) and increasing in its second argument (consumption)*

Assumption 2. *For each woman i, $\left(\mu_i, \eta_i^a, \eta_i^j\right)$ are non-negative, $\eta_i^j \geq \eta_i^a$, $\kappa_i > 0$, and $\phi_i > \underline{\phi}_i \equiv G_i^a(FPL_i)$.*

Assumption 3. *Under regime t, woman i makes choices by solving the optimization problem:*

$$\max_{E \in \{0, O_i^1, O_i^2\}, D \in \{0,1\}, E^r \in [0,E]} U_i\left(E, C_i^t(E, D, E^r)\right).$$

Assumption 4. *Women break indifference in favor of the same allocation irrespective of the regime.*

Intermediate Lemmas

Lemma 1. *Given Assumptions 1,2, and 3, state $2r$ is unpopulated.*

Proof. State $2r$ is unpopulated under regime j because $\phi_i > 0$ for all women (Assumptions 2) and the JF grant amount is zero whenever a woman reports earnings above FPL_i (Assumptions 1 and 3). We next show that state $2r$ is also unpopulated under regime a. Define woman i's break-even earnings level under a as $\overline{E}_i \equiv \frac{\overline{G}_i}{\tau_i} + \delta_i$, this is the level at which benefits are exhausted. If $\overline{E}_i \leq FPL_i$, she will not choose to truthfully report earnings above FPL_i (range 2) because $\phi_i > 0$ (Assumptions 2) and the AFDC grant amount is zero whenever she reports earnings above $\overline{E}_i$ (Assumptions 1 and 3). We now prove by contradiction that even when $\overline{E}_i > FPL_i$ a woman will not choose to truthfully report earnings above FPL_i (range 2). Suppose that woman i chooses an allocation that entails earnings $O_i^k \in (FPL_i, \overline{E}_i]$ and reports these earnings truthfully. By Assumption 3, her choice reveals that $U_i\left(O_i^k, O_i^k - \mu_i + G_i^a\left(O_i^k\right) - \phi_i\right) \geq U_i\left(O_i^k, O_i^k - \mu_i\right)$ which, because consumption is a good (Assumption 1), bounds her stigma from above, namely, $G_i^a\left(O_i^k\right) \geq$

ϕ_i. We thus have $G_i^a\left(O_k^i\right) \geq \phi_i > \underline{\phi}_i = G_i^a\left(FPL_i\right)$ because ϕ_i is bounded from below by $\underline{\phi}_i$ (Assumption 2). This yields a contradiction because $G_i^a\left(O_k^i\right) < G_i^a\left(FPL_i\right)$ for any $O_i^k > FPL_i$. Finally, suppose that under a woman i chooses an allocation that entails earnings $O_i^k > \overline{E}_i$ and reports these earnings truthfully. We again have a contradiction because $\phi_i > 0$ for all women (Assumption 2) and the AFDC grant amount is zero whenever she reports earnings above $\overline{E}_i$ (Assumptions 1 and 3). □

Lemma 2. *Given Assumptions 1 - 4: a) the optimal reporting rule, while on assistance, entails either truthful reporting or reporting an amount in the range $[0, FPL_i]$ under JF or in the range $[0, \delta_i]$ under AFDC, b) when earnings are positive, reporting zero earnings is only optimal if hassle $\left(\eta^t\right)$ under the relevant regime is zero, and c) state $1u$ is unpopulated under JF.*

Proof. Let E and E^r denote the actual and reported earnings corresponding to an optimal allocation so that $E = O_i^k$ for some earning draw or $E = 0$. Consider first regime j and focus on three alternative optimal allocations: an allocation with E equal zero, an allocation with E in range 1, and an allocation with E in range 2. We now show that, by their optimality, each of these allocations entails either $E^r = E$ or $E^r \in [0, FPL_i]$. Women cannot over-report earnings (Assumption 3). Thus, truthful reporting is trivially optimal for a non-working woman. When E is in range 1, consumption while on welfare depends on reported earnings as follows:

$$C_i^j\left(E,1,E^r\right) = \begin{cases} E - \mu_i + \overline{G}_i - \phi_i - \kappa_i - \eta_i^j & \text{if } E^r = 0,\ E \text{ in range 1} \\ E - \mu_i + \overline{G}_i - \phi_i - \kappa_i & \text{if } 0 < E^r < E,\ E \text{ in range 1} \\ E - \mu_i + \overline{G}_i - \phi_i & \text{if } E^r = E,\ E \text{ in range 1} \end{cases}.$$

Thus, truthful reporting maximizes consumption since $\kappa_i > 0, \eta_i^j \geq 0$ (Assumption 2). Hence, by Assumptions 1 and 3, truthful reporting must be optimal. When E is in range 2, consumption while on welfare depends on reported earnings as follows:

$$C_i^j\left(E,1,E^r\right) = \begin{cases} E - \mu_i + \overline{G}_i - \phi_i - \kappa_i - \eta_i^j & \text{if } E^r = 0,\ E \text{ in range 2} \\ E - \mu_i + \overline{G}_i - \phi_i - \kappa_i & \text{if } E^r \text{ in range 1},\ E \text{ in range 2} \end{cases}.$$

When $\eta_i^j > 0$, reports in range 1 maximize consumption (and therefore utility). Since the grant amount is unaffected by earnings in this range, she may report any earnings in the range $(0, FPL_i]$. If $\eta_i^j = 0$, the woman is indifferent between reporting zero and amounts in the range $[0, FPL_i]$. This establishes parts a) and b) of the Lemma under regime j.

Consider next regime a and focus on four alternative optimal allocations: an allocation with $E = 0$, an allocation with $0 < E \leq \delta_i$ (by construction in range 1), an allocation with $E > \delta_i$ in range 1, and an allocation with E in range 2. We now show that, by optimality, each of these allocations entails either $E^r = E$ or $E^r \in (0, \delta_i]$. First, $E^r = E$ when $E = 0$ (Assumption 3). Thus, truthful reporting is optimal for a non-working woman. When $0 < E \leq \delta_i$ consumption while on welfare depends on reported earnings as follows:

$$C_i^a\left(E,1,E^r\right) = \begin{cases} E - \mu_i + \overline{G}_i - \phi_i - \kappa_i - \eta_i^a & \text{if } E^r = 0,\ E \in (0, \delta_i] \\ E - \mu_i + \overline{G}_i - \phi_i - \kappa_i & \text{if } 0 < E^r < E,\ E \in (0, \delta_i] \\ E - \mu_i + \overline{G}_i - \phi_i & \text{if } E^r = E,\ E \in (0, \delta_i] \end{cases}.$$

Thus, truthful reporting maximizes consumption (and hence utility) because $\kappa_i > 0, \eta_i^a \geq 0$. When $E > \delta_i$ and is in range 1, consumption while on welfare depends on reported earnings as follows:

$$C_i^a\left(E,1,E^r\right) = \begin{cases} E - \mu_i + \overline{G}_i - \phi_i - \kappa_i - \eta_i^a & \text{if } E^r = 0,\ E \in (\delta_i, FPL_i] \\ E - \mu_i + \overline{G}_i - \phi_i - \kappa_i & \text{if } 0 < E^r \leq \delta_i,\ E \in (\delta_i, FPL_i] \\ E - \mu_i + G_i^a\left(E^r\right) - \phi_i - \kappa_i & \text{if } \delta_i < E^r < E,\ E \in (\delta_i, FPL_i] \\ E - \mu_i + G_i^a\left(E^r\right) - \phi_i & \text{if } E^r = E,\ E \in (\delta_i, FPL_i] \end{cases}.$$

Thus, only truthful reports or under-reports in $[0,\delta_i]$ are optimal since $G_i^a(.)$ is a decreasing function and $\kappa_i > 0, \eta_i^a \geq 0$ (Assumption 2). When $\eta_i^a > 0$ such a woman is indifferent among the reports in the interval $(0,\delta_i]$. When $\eta_i^a = 0$ she is indifferent among the reports in the interval $[0,\delta_i]$. When E is in range 2, women must be under-reporting (Lemma 1), hence consumption while on welfare depends on reported earnings as follows:

$$C_i^a(E,1,E^r) = \begin{cases} E - \mu_i + \overline{G}_i - \phi_i - \kappa_i - \eta_i^a & \text{if } E^r = 0,\ E \text{ in range 2} \\ E - \mu_i + \overline{G}_i - \phi_i - \kappa_i & \text{if } 0 < E^r \leq \delta_i,\ E \text{ in range 2} \\ E - \mu_i + G_i^a(E^r) - \phi_i - \kappa_i & \text{if } \delta_i < E^r < E,\ E \text{ in range 2} \end{cases} .$$

Thus, reports below δ_i maximize consumption since $G_i^a(.)$ is a decreasing function and $\kappa_i \geq 0, \eta_i^a \geq 0$. If $\eta_i^a > 0$, reports in the interval $(0,\delta_i]$ are optimal, while if $\eta_i^a = 0$ reports in the interval $[0,\delta_i]$ are optimal. This establishes parts a) and b) of the Lemma under a.

It is straightforward to verify that, for any woman i, the consumption associated with optimally under-reporting is $E - \mu_i + \overline{G}_i - \phi_i - \kappa_i$ under either regime. Hence, a woman will only under-report if $E - \mu_i + \overline{G}_i - \phi_i - \kappa_i \geq C_i^t(E,1,E)$ which occurs only when $\kappa_i \leq \overline{G}_i - G_i^t(E)$. Because $\overline{G}_i - G_i^j(E) = 0$ for any E in range 1, women will never choose state $1u$ under j. □

Lemma 3. *Consider any pair of states (s^a, s^j) obeying: I) $s^j \neq s^a$; II) state s^a is no worse under JF than under AFDC; III) state s^j is no better under JF than under AFDC. Then, if Assumptions 3 and 4 hold, the response probability π_{s^a,s^j} equals zero.*

Proof. The proof is by contradiction. Suppose that $\pi_{s^a,s^j} > 0$ for some pair of states (s^a, s^j) satisfying properties I)-III). Then, there exists a woman i who chooses a triple (E,D,E^r) under a obeying $s_i(E,D,E^r) = s^a$ and a triple $(E',D',E^{r\prime})$ under j obeying $s_i(E',D',E^{r\prime}) = s^j$. By Property II) $U_i\left(E, C_i^j(E,D,E^r)\right) \geq U_i(E, C_i^a(E,D,E^r))$. The choice of state s_a under a reveals that $U_i(E, C_i^a(E,D,E^r)) \geq U_i(E', C_i^a(E',D',E^{r\prime}))$ (Assumption 3). By Property III) $U_i(E', C_i^a(E',D',E^{r\prime})) \geq U_i\left(E', C_i^j(E',D',E^{r\prime})\right)$. Combining these inequalities we have:

$$U_i\left(E, C_i^j(E,D,E^r)\right) \geq U_i(E, C_i^a(E,D,E^r)) \geq U_i\left(E', C_i^a\left(E',D',E^{r\prime}\right)\right) \geq U_i\left(E', C_i^j\left(E',D',E^{r\prime}\right)\right).$$

If any of the inequalities is strict, optimality of choice $(E',D',E^{r\prime})$ under j is contradicted. If no inequality is strict, woman i is indifferent between the two allocations $\left(E, C_i^j(E,D,E^r)\right)$ and $(E', C_i^a(E',D',E^{r\prime}))$ which contradicts her choosing the first allocation under a and the second under j (Assumption 4 and Property I). □

Lemma 4. *Given Assumptions 1-4, the states in $\mathcal{C}_+$ are no worse under JF than under AFDC, the states in $\mathcal{C}_-$ are no better under JF than under AFDC, and the states in $\mathcal{C}_0$ are equally attractive under JF and AFDC.*

Proof. From Assumption 1, it is sufficient to verify that $C_i^j(E,D,E^r) \geq C_i^a(E,D,E^r)$ for all (E,D,E^r) such that $s_i(E,D,E^r) \in \mathcal{C}_+$, that $C_i^j(E,D,E^r) \leq C_i^a(E,D,E^r)$ for all (E,D,E^r) such that $s_i(E,D,E^r) \in \mathcal{C}_-$, and that $C_i^j(E,D,E^r) = C_i^a(E,D,E^r)$ for all (E,D,E^r) such that $s_i(E,D,E^r) \in \mathcal{C}_0$.

Start with a triple (E,D,E^r) obeying $s_i(E,D,E^r) \in \mathcal{C}_+$. Since $\mathcal{C}_+$ consists of state $1r$, this means that E is in range 1, $D = 1$, and $E^r = E$. Because $G_i^a(E) < \overline{G}_i$ for all E in range 1,

$$C_i^j(E,1,E) = E - \mu_i + \overline{G}_i - \phi_i \geq E - \mu_i + G_i^a(E) - \phi_i = C_i^j(E,1,E),$$

which verifies the desired inequality. Consider next a triple (E, D, E^r) obeying $s_i(E, D, E^r) \in \mathcal{C}_-$. Since $\mathcal{C}_-$ consists of state $0r$, this means that $E = E^r = 0$ and $D = 1$. Because $\eta_i^j \geq \eta_i^a$ (Assumption 2),

$$C_i^j(0,1,0) = \overline{G}_i - \phi_i - \eta_i^j \leq \overline{G}_i - \phi_i - \eta_i^a = C_i^a(0,1,0),$$

which verifies the desired inequality. Finally, consider a triple (E, D, E^r) obeying $s_i(E, D, E^r) \in \mathcal{C}_0$. If $s_i(E, D, E^r) \in \{0n, 1n, 2n\}$, consumption is unaffected by the regime (Assumption 3): it is either zero, when $s_i(E, D, E^r) = 0n$, or $E - \mu_i$, when $s_i(E, D, E^r) \in \{1n, 2n\}$. If $s_i(E, D, E^r) \in \{1u, 2u\}$, consumption is unaffected by the regime because optimal under-reporting yields a transfer of $\overline{G}_i$ under either regime (Lemma 2). Specifically, consumption is $E - \mu_i + \overline{G}_i - \phi_i - \kappa_i$ under either regime. □

Main Propositions

For convenience we reproduce here the matrix Π:

State under AFDC	Earnings / Reporting State under JF						
	$0n$	$1n$	$2n$	$0r$	$1r$	$1u$	$2u$
$0n$	$1-\pi_{0n,1r}$	0	0	0	$\pi_{0n,1r}$	0	0
$1n$	0	$1-\pi_{1n,1r}$	0	0	$\pi_{1n,1r}$	0	0
$2n$	0	0	$1-\pi_{2n,1r}$	0	$\pi_{2n,1r}$	0	0
$0r$	$\pi_{0r,0n}$	0	$\pi_{0r,2n}$	$1-\pi_{0r,0n}-\pi_{0r,2n}$ $-\pi_{0r,1r}-\pi_{0r,2u}$	$\pi_{0r,1r}$	0	$\pi_{0r,2u}$
$1r$	0	0	0	0	1	0	0
$1u$	0	0	0	0	1	0	0
$2u$	0	0	0	0	$\pi_{2u,1r}$	0	$1-\pi_{2u,1r}$

.

Proposition 1. *Given Assumptions 1-4, the responses corresponding to the zero entries of matrix* Π *cannot occur and the responses corresponding to unitary entries of the matrix must occur.*

Proof. We begin with the zeros. State $1u$ is unpopulated under j (Lemma 2). Therefore $\pi_{s^a,1u} = 0$ for any $s^a \in \mathcal{S}$. Next, by Lemmas 3 and 4, the response probability π_{s^a,s^j} equals zero for all (s^a, s^j) in the collection:

$$\left\{(s^a, s^j) : s^a \in \mathcal{C}_0 \cup \mathcal{C}_+, s^j \in \mathcal{C}_0 \cup \mathcal{C}_-, s^a \neq s^j\right\}. \tag{1}$$

It suffices to show that properties I)-III) of Lemma 3 are met. Property I) holds trivially and properties II) and III) hold by Lemma 4. Therefore, the responses in (1) have probability zero.

We now show that $\pi_{0r,1n} = 0$. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $0r$ under a and selects an allocation compatible with state $1n$ under j, entailing earnings O_k^i. By Assumption 3, her choice under a reveals that $U_i(0, \overline{G}_i - \phi_i - \eta_i^a) \geq U_i(0,0)$ which implies $\overline{G}_i - \phi_i \geq \eta_i^a$. Her choice under j reveals that $U_i(O_i^k, O_i^k - \mu_i) \geq U_i(O_i^k, O_i^k - \mu_i + \overline{G}_i - \phi_i)$ which implies $\overline{G}_i - \phi_i \leq 0$. Thus, $0 \leq \eta_i^a \leq \overline{G}_i - \phi_i \leq 0$ (Assumption 1). If $\eta_i^a > 0$ or $\eta_i^a = 0$ and $\overline{G}_i \neq \phi_i$, a contradiction ensues. If $\eta_i^a = 0$ and $\overline{G}_i = \phi_i$, the woman must be indifferent between the allocation compatible with state $0r$ and that compatible with $0n$ under a which means $U_i(0,0) \geq U_i(O_i^l, O_i^l - \mu_i)$ for any O_i^l in range 1 including O_i^k. The choice of the allocation compatible with state $1n$ under j reveals that $U_i(O_i^k, O_i^k - \mu_i) \geq U_i(0,0)$. If this last inequality is strict a contradiction ensues. Otherwise, the woman must be indifferent under a among the allocation compatible with state $0n$, the allocation compatible with state $0r$, and the allocation entailing earnings O_i^k while off assistance. If however she did not choose O_i^k over $0r$ under a then she will make the same choice under j (Assumption 4), which implies a contradiction. Therefore $\pi_{0r,1n} = 0$. This concludes the proof of the zero entries in the matrix.

Turning to the unitary entries, by Lemma 1, the allowable states are given by $\mathcal{S} \equiv \{0n, 1n, 2n, 0r, 1r, 1u, 2u\}$. Hence, each row of matrix Π must sum to one. Therefore $\pi_{1r,1r} = 1$ and $\pi_{1u,1r} = 1$. □

Proposition 2. *Given Assumptions 1-4, the "free" response probabilities in matrix* Π *given by* π_{s^a,s^j} *for all* $\left(s^a, s^j\right)$ *in the two collections:*

$$\{(s^a, 1r) : s^a \in \{0n, 1n, 2n, 2u\}\}, \tag{2}$$

$$\left\{\left(0r, s^j\right) : s^j \in \{0n, 2n, 1r, 2u\}\right\}, \tag{3}$$

are unrestricted, meaning they need not equal zero or one.

Proof. We start by considering the collection of state pairs in (2). The common feature of the states in $\{0n, 1n, 2n, 2u\}$ is that they are equally attractive under AFDC and JF. Instead, state $1r$ is no worse under AFDC than under JF. In light of Proposition 1, to prove that the response probabilities corresponding to the pairs of states in collection (2) need not equal zero or one it suffices to provide examples where two women occupy the same state $s^a \in \{0n, 1n, 2n, 2u\}$ under AFDC, but the first woman occupies state $s^j = s^a$ and the second woman occupies state $s_j = 1r$ under JF. We then turn to the collection of state pairs in (3). The common feature of the states in $\{0n, 2n, 1r, 2u\}$ is that they are no worse under AFDC than under JF. Instead, state $0r$ is no better under AFDC than under JF. To prove that the response probabilities corresponding to the pairs of states in collection (3) need not equal zero it suffices to provide examples of a woman who occupies state $0r$ under AFDC and state $s^j \in \{0n, 2n, 1r, 2u\}$ under JF. This also proves that the response probabilities corresponding to the pairs of states in (3) need not equal one because the rows of matrix Π sum to one, hence $\sum_{s\in\mathcal{S}} \pi_{0r,s} = 1$ and $\pi_{0r,s} > 0$ for any s implies $\pi_{0r,s'} < 1$ for all $s \neq s'$.

$\pi_{0n,1r}$ **is not restricted to zero or one**

Consider two women i' and i'' who both choose an allocation compatible with state $0n$ under a. Assume that each woman draws both earnings offers from range 1. Let woman i' have a non-positive net of stigma reward from assistance so that:

$$\overline{G}_{i'} - \phi_{i'} \leq 0. \tag{4}$$

Woman i'', by contrast, has a positive net of stigma reward from assistance obeying:

$$0 < \overline{G}_{i''} - \phi_{i''} \leq \eta^a_{i''}. \tag{5}$$

We now show that woman i' chooses an allocation compatible with state $0n$ under j while woman i'' may select an available allocation compatible with state $1r$ under j. For both women, the choice of the allocation compatible with state $0n$ under a reveals (Assumption 3) that this allocation yields as much utility as the available allocations compatible with states $\{0r, 1r, 1u, 1n\}$. Thus, for $i \in \{i', i''\}$:

$$U_i(0,0) \geq U_i\left(0, \overline{G}_i - \phi_i - \eta^a_i\right), \tag{6}$$

$$U_i(0,0) \geq U_i\left(O_i^k, O_i^k - \mu_i + G_i^a\left(O_i^k\right) - \phi_i\right)\ \forall O_i^k, \tag{7}$$

$$U_i(0,0) \geq U_i\left(O_i^k, O_i^k - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right)\ \forall O_i^k, \tag{8}$$

$$U_i(0,0) \geq U_i\left(O_i^k, O_i^k - \mu_i\right)\ \forall O_i^k. \tag{9}$$

Observe that (6) explicitly bounds from above the net of stigma reward from assistance:

$$\overline{G}_i - \phi_i \leq \eta_i^a, \tag{10}$$

which agrees with both (4) and (5). Both women prefer state $0n$ under j to the available allocations compatible with states $\{1n, 0r, 1u\}$ (Proposition 1). Also, condition (4), (9) and Assumptions 1, 3, and 4 imply that woman i' prefers state $0n$ to the available allocations compatible with state $1r$ under j. Thus, woman i' occupies the same state under both regimes which proves that $\pi_{0n,1r}$ need not equal zero.

If woman i'' has an earnings draw $O_{i''}^l$ obeying:

$$U_{i''}(0,0) < U_{i''}\left(O_{i''}^l, O_{i''}^l - \mu_{i''} + \overline{G}_{i''} - \phi_{i''}\right), \tag{11}$$

she would have selected an allocation compatible with state $1r$ had the grant formula under regime a fully disregarded earnings (but not otherwise, as per (7)). As evidenced by (6)-(9), inequality (11) is enabled by (5) and $\overline{G}_{i''} \geq G_{i''}^a(E)\,\forall E$.[2] Condition (11) allows us to conclude that, under j, woman i'' prefers the available allocations compatible with $1r$ to those compatible with all other states. Thus, woman i'' occupies a different state under the two regimes which proves that $\pi_{0n,1r}$ need not equal one. Hence, $\pi_{0n,1r}$ is unrestricted.

$\pi_{1n,1r}$ **is not restricted to zero or one**

Consider two women i' and i'' who both choose an allocation compatible with state $1n$ under a. Assume that each woman draws both earnings offers from range 1. Let $O_{i'}^k$ and $O_{i''}^k$ denote the earnings offers chosen under a by woman i' and i'' respectively. Let woman i' have a non-positive net of stigma reward from assistance so that:

$$\overline{G}_{i'} - \phi_{i'} \leq 0. \tag{12}$$

Woman i'', by contrast, has a positive net of stigma reward from assistance obeying:

$$0 < \overline{G}_{i''} - \phi_{i''} \leq \min\left\{\overline{G}_{i''} - G_{i''}^a\left(O_{i''}^k\right), \kappa_{i''}\right\}. \tag{13}$$

We now show that woman i' chooses an allocation compatible with state $1n$ under j while woman i'' may select an available allocation compatible with state $1r$ under j. For both women, the choice of the allocation compatible with state $1n$ under a reveals (Assumption 3) that this allocation yields as much utility as the available allocations compatible with states $\{0n, 0r, 1r, 1u\}$ as well as the other available allocations compatible with state $1n$. Formally, for $i \in \{i', i''\}$:

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i(0,0), \tag{14}$$

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(0, \overline{G}_i - \phi_i - \eta_i^a\right), \tag{15}$$

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(O_i^l, O_i^l - \mu_i\right) \forall O_i^l, \tag{16}$$

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(O_i^l, O_i^l - \mu_i + G_i^a\left(O_l^i\right) - \phi_i\right) \;\forall O_i^l, \tag{17}$$

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(O_i^l, O_i^l - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right) \;\forall O_i^l. \tag{18}$$

[2]Suppose, for example, that $U_{i''}(E,C) = C - E$ and that $G_{i''}^a\left(O_{i''}^k\right) - \phi_{i''} \leq \mu_{i''} < \overline{G}_{i''} - \phi_{i''} \leq \min\{\mu_{i''} + \kappa_{i''}, \eta_{i''}^a\}\,\forall O_{i''}^k$ which is enabled by $\overline{G}_{i''} \geq G_{i''}^a(E)\,\forall E > 0$ and $\kappa_{i''} > 0$ (Assumption 1). It is easy to check that for this woman the conditions in (6)-(9), associated with occupying state $0n$ under a, and condition (11), associated with occupying state $1r$ under j, hold.

Observe that (17) and (18) evaluated at $O_i^l = O_i^k$ explicitly bound from above the net of stigma reward from assistance (Assumption 1):

$$\overline{G}_i - \phi_i \leq \kappa_i,\ G_i^a\left(O_i^k\right) - \phi_i \leq 0, \tag{19}$$

which agrees with (12) and (13). Both women still prefer earning O_i^k off assistance (state $1n$) under j to the available allocations compatible with states $\{0r, 0n, 1u\}$ (Proposition 1) as well as to the other available allocation compatible with state $1n$. Condition (12) and (16), and Assumptions 1, 3, and 4, imply that woman i' also still prefers state $1n$ under j to the available allocations compatible with state $1r$. Thus, woman i' occupies the same state under both regimes which proves that $\pi_{1n,1r}$ need not equal zero. If woman i'''s utility function is strictly increasing in consumption, and by condition (13) and Assumptions 1, 3, and 4, woman i'' prefers earning $O_{i''}^k$ on assistance to earning the same amount off assistance under j. Hence, the available allocation entailing earnings $O_{i''}^k$ on assistance is preferred under j to the available allocations compatible with all states but $1r$. Thus, woman i'' occupies different states under the two regimes which proves that $\pi_{1n,1r}$ need not equal one. Hence, $\pi_{1n,1r}$ is unrestricted.

$\pi_{2n,1r}$ **is not restricted to zero or one**

Consider two women i' and i'' who both choose an allocation compatible with state $2n$ under a. Assume that each woman draws an earnings offer in range 1 and another offer in range 2. Let $O_{i'}^k$ and $O_{i''}^k$ denote the earnings offer in range 2 drawn by woman i' and i'' respectively. Likewise, denote woman i' and i'''s earnings draw in range 1 by $O_{i'}^m$ and $O_{i''}^m$ respectively. Let woman i' have a non-positive net of stigma reward from assistance so that:

$$\overline{G}_{i'} - \phi_{i'} \leq 0. \tag{20}$$

Woman i'', by contrast, has a positive net of stigma reward from assistance obeying:

$$0 < \overline{G}_{i''} - \phi_{i''} \leq \kappa_{i''}. \tag{21}$$

We now show that woman i' chooses an allocation compatible with state $2n$ under j while woman i'' may select an available allocation compatible with state $1r$ under j. For both women, the choice of the allocation compatible with state $2n$ under a reveals (Assumption 3) that this allocation yields as much utility as the available allocations compatible with states $\{0n, 0r, 1n, 1r, 1u, 2u\}$. Formally, for $i \in \{i', i''\}$:

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(0, 0\right), \tag{22}$$

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(0, \overline{G}_i - \phi_i - \eta_i^a\right), \tag{23}$$

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(O_i^m, O_i^m - \mu_i\right), \tag{24}$$

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(O_i^m, O_i^m - \mu_i + G_i^a\left(O_i^m\right) - \phi_i\right), \tag{25}$$

$$U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(O_i^l, O_i^l - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right)\ \forall O_i^l. \tag{26}$$

Observe that (26) explicitly bounds from above the net of stigma rewards from assistance:

$$\overline{G}_i - \phi_i \leq \kappa_i, \tag{27}$$

which agrees with (20) and (21). Under j both women still prefer earning O_i^k off assistance (state $2n$) to the available allocations compatible with states $\{0r, 2u, 0n, 1n, 1u\}$ (Proposition 1). This fact, (20), (24) and Assumptions 1, 3, and 4 imply that woman i' still prefers the allocation compatible with state $2n$ to the available allocation compatible with state $1r$. Thus, woman i' occupies the same state under both regimes which proves that $\pi_{2n,1r}$ need not equal zero. If woman i'''s earnings offer in range 1 obeys:

$$U_{i''}\left(O_{i''}^m, O_{i''}^m - \mu_{i''} + \overline{G}_{i''} - \phi_{i''}\right) > U_{i''}\left(O_{i''}^k, O_{i''}^k - \mu_{i''}\right). \tag{28}$$

she would have selected the allocation compatible with state $1r$ had the grant formula under regime a fully disregarded earnings (but not otherwise, as per (25)). As evidenced by (24)-(26), inequality (28) may hold because of (21) and $\overline{G}_{i''} \geq G_{i''}^a(E)\,\forall E$ in range 1.[3] Together with (22)-(26), (28) allows us to conclude that under j woman i'' prefers the available allocation entailing truthfully reporting earning $O_{i''}^m$ on assistance to the available allocations compatible with all states. Thus, woman i'' occupies a different state under the two regimes which proves that $\pi_{2n,1r}$ need not equal one. Hence, $\pi_{2n,1r}$ is unrestricted.

$\pi_{2u,1r}$ **is not restricted to zero or one**

Consider two women i' and i'' who both choose an allocation compatible with state $2u$ under a. Assume that each woman draws an earning offer in range 1 and another offer in range 2. Let $O_{i'}^k$ and $O_{i''}^k$ denote the earnings offer in range 2 drawn by woman i' and i'' respectively. Likewise, denote woman i' and i'''s earnings offer in range 1 by $O_{i'}^m$ and $O_{i''}^m$ respectively. Let woman i' have a positive net of stigma reward from assistance obeying:

$$\kappa_{i'} \leq \overline{G}_{i'} - \phi_{i'} < \mu_{i'} - FPL_{i'}. \tag{29}$$

Woman i'' also has a positive net of stigma reward from assistance obeying:

$$\max\{\kappa_{i''}, \mu_{i''} - FPL_{i''}\} \leq \overline{G}_{i''} - \phi_{i''}. \tag{30}$$

We now show that woman i' may select an allocation compatible with state $2u$ under j while woman i'' may select an available allocation compatible with state $1r$ under j. For both women, the choice of the allocation compatible with state $2u$ under a reveals (Assumption 3) that this allocation yields as much utility as the available allocations compatible with states $\{0n, 0r, 1n, 2n, 1r, 1u\}$. Formally, for $i \in \{i', i''\}$:

$$U_i\left(O_i^k, O_i^k - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right) \geq U_i(0,0), \tag{31}$$

$$U_i\left(O_i^k, O_i^k - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right) \geq U_i\left(0, \overline{G}_i - \phi_i - \eta_i^a\right), \tag{32}$$

$$U_i\left(O_i^k, O_i^k - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right) \geq U_i\left(O_i^l, O_i^l - \mu_i\right)\ \forall O_i^l, \tag{33}$$

$$U_i\left(O_i^k, O_i^k - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right) \geq U_i\left(O_i^m, O_i^m - \mu_i + G_i^a(O_i^m) - \phi_i\right), \tag{34}$$

$$U_i\left(O_i^k, O_i^k - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right) \geq U_i\left(O_i^m, O_i^m - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right). \tag{35}$$

Observe that (33) explicitly bounds from below the net of stigma reward from assistance, namely,

$$\kappa_i \leq \overline{G}_i - \phi_i, \tag{36}$$

[3]Suppose, for example, that $U_{i''}(E,C) = C - E$, $\mu_{i''} = 0$, $\eta_{i''}^a > 0$, and $G_{i''}^a(O_{i''}^m) - \phi_{i''} \leq 0 < \overline{G}_{i''} - \phi_{i''} \leq \min\{\kappa_{i''}, \eta_{i''}^a\}$ which may hold because $\overline{G}_{i''} \geq G_{i''}^a(E)\,\forall E$ in range 1. It is easy to check that condition (28), associated with occupying state $1r$ under j, and the conditions in (22)-(26), associated with occupying state $2n$ under a, all hold.

which agrees with both (29) and (30). Both women still prefer state $2u$ under j to the available allocations compatible with states $\{0r, 0n, 1n, 2n, 1u\}$ (Proposition 1). Condition (29) implies that $\overline{G}_{i'} - \phi_{i'} < \mu_{i'} - FPL_{i'} \leq \mu_{i'} - O^m_{i'}$ because $O^m_{i'}$ is in range 1, hence $O^m_{i'} - \mu_{i'} + \overline{G}_{i'} - \phi_{i'} < 0$. Assumption 1 then implies that woman i' prefers the allocation compatible with state $0n$ to the available allocation compatible with state $1r$. By (31), this means that she still prefers the allocation compatible with state $2u$ to the available allocation compatible with state $1r$. Hence she prefers state $2u$ under j to the allocations available and compatible with all other states. Thus, woman i' occupies the same state under both regimes which proves that $\pi_{2u,2u}$ need not equal zero. If woman i'''s earnings offer in range 1 obeys:

$$U_{i''}\left(O^m_{i''}, O^m_{i''} - \mu_{i''} + \overline{G}_{i''} - \phi_{i''}\right) > U_{i''}\left(O^k_{i''}, O^k_{i''} - \mu_{i''} + \overline{G}_{i''} - \phi_{i''} - \kappa_{i''}\right), \tag{37}$$

she would have selected the allocation compatible with state $1r$ had the grant formula under regime a fully disregarded earnings (but not otherwise, as per (34)). As evidenced by (35), inequality (37) is enabled by $\kappa_{i''} > 0$ (Assumption 3) and it can agree with (34) because $\overline{G}_{i''} \geq G^a_{i''}(E)\,\forall E$ in range 1.[4] In such a case, under j woman i'' prefers the available allocation entailing truthfully reporting earning $O^m_{i''}$ on assistance to the available allocations compatible with all states. Thus, woman i'' occupies a different state under the two regimes which proves that $\pi_{2u,1r}$ need not equal one. Hence, $\pi_{2u,1r}$ is unrestricted.

$(\pi_{0r,0r}, \pi_{0r,1r}, \pi_{0r,0n}, \pi_{0r,2n}, \pi_{0r,2u})$ **are not restricted to zero or one**

Consider five women $i', i'', i^{III}, i^{IV}, i^V$ who all choose an allocation compatible with state $0r$ under a. Assume that each woman draws an earnings offer in range 1 and another in range 2. Let women i' and i'' have identical hassle from not working on assistance under both regimes, $\eta^a_i = \eta^j_i$, and a sufficiently large net of stigma reward from assistance obeying:

$$\eta^a_i \leq \overline{G}_i - \phi_i. \tag{38}$$

Women $i = \{i^{III}, i^{IV}, i^V\}$, by constrast, have strictly larger hassle from not working on assistance under j than a, $\eta^a_i < \eta^j_i$, and a net of stigma reward from assistance obeying:

$$\eta^a_{i^{III}} \leq \overline{G}_{i^{III}} - \phi_{i^{III}} \leq \min\left\{\kappa_{i^{III}}, \eta^j_{i^{III}}\right\}, \tag{39}$$

$$\eta^j_{i^{IV}} \leq \overline{G}_{i^{IV}} - \phi_{i^{IV}} \leq \kappa_{i^{IV}}, \tag{40}$$

$$\max\left\{\kappa_{i^V}, \eta^j_{i^V}\right\} \leq \overline{G}_{i^V} - \phi_{i^V}. \tag{41}$$

We now show that woman i' may select an allocation compatible with state $0r$ under j, woman i'' may select an available allocation compatible with state $1r$ under j, woman i^{III} may select an available allocation compatible with state $0n$ under j, woman i^{IV} may select an available allocation compatible with state $2n$ under j, and woman i^V may select an available allocation compatible with state $2u$ under j. For all women, the choice of the allocation compatible with state $0r$ under a reveals that such allocation yields as much utility as the available allocations compatible with all

[4] Suppose, for example, that $U_{i''}(E, C) = C - E$. Then (37) always holds since it requires $\kappa_{i''} > 0$ (Assumption 2).

the other states, namely $\{0n, 1n, 2n, 1r, 1u, 2u\}$. Formally, for $i \in \{i', i'', i^{III}, i^{IV}, i^{V}\}$:

$$U_i\left(0, \overline{G}_i - \phi_i - \eta_i^a\right) \geq U_i\left(0,0\right), \tag{42}$$

$$U_i\left(0, \overline{G}_i - \phi_i - \eta_i^a\right) \geq U_i\left(O_i^k, O_i^k - \mu_i\right) \ \forall O_i^k, \tag{43}$$

$$U_i\left(0, \overline{G}_i - \phi_i - \eta_i^a\right) \geq U_i\left(O_i^k, O_i^k - \mu_i + G_i^a\left(O_i^k\right) - \phi_i\right) \text{ for } O_i^k \text{ in range 1}, \tag{44}$$

$$U_i\left(0, \overline{G}_i - \phi_i - \eta_i^a\right) \geq U_i\left(O_i^k, O_i^k - \mu_i + \overline{G}_i - \phi_i - \kappa_i\right) \ \forall O_i^k. \tag{45}$$

Inequality (42) explicilty bounds from below the net of stigma reward from assistance, namely,

$$\eta_i^a \leq \overline{G}_i - \phi_i, \tag{46}$$

which can agree with (38), (39), (40), and (41). In such a case, because $\eta_i^a = \eta_i^j$ for $i = i', i''$, state $0r$ has the same utility value under both regimes hence both women still prefer $0r$ under j to the available allocations compatible with states $\{0n, 1n, 2n, 1u, 2u\}$ (Lemma 4). If woman i' satisfies the additional requirement that:

$$U_{i'}\left(0, \overline{G}_{i'} - \phi_{i'} - \eta_{i'}^a\right) \geq U_i\left(O_{i'}^k, O_{i'}^k - \mu_{i'} + \overline{G}_{i'} - \phi_{i'}\right) \text{ for } O_{i'}^k \text{ in range 1}, \tag{47}$$

which implies (44) because $G_{i'}^a(E) \leq \overline{G}_{i'}$ for all E in range 1.[5] In such a case woman i' still prefers $0r$ under j to the available allocation compatible with state $1r$, this proves that $\pi_{0r,0r}$ need not equal zero. If woman i'' has an earnings draw $O_{i''}^k$ in range 1 such that:

$$U_{i''}\left(O_{i''}^k, O_{i''}^k - \mu_{i''} + \overline{G}_{i''} - \phi_{i''}\right)\{1r, 2n\}\, under j. > U_{i''}\left(0, \overline{G}_{i''} - \phi_{i''} - \eta_{i''}^a\right), \tag{48}$$

which can agree with (44) because $G_{i''}^a(E) \leq \overline{G}_{i''}$ for all E in range 1.[6] In such a case, woman i'' prefers earning $O_{i''}^k$ compatible with state $1r$ under j to state $0r$, this proves that $\pi_{0r,1r}$ need not equal zero.

Consider now women i^{III}, i^{IV}, i^{V}. By Proposition 1, none of these women will occupy states $\{1n, 1u\}$ under j. Let woman i^{III} prefer non-employment off assistance to the available allocations compatible with states $\{1r, 2n\}$ under j. Formally,

$$U_{i^{III}}\left(0,0\right) \geq U_{i^{III}}\left(O_{i^{III}}^k, O_{i^{III}}^k - \mu_{i^{III}} + \overline{G}_{i^{III}} - \phi_{i^{III}}\right) \text{ for } O_{i^{III}}^k \text{ in range 1}, \tag{49}$$

$$U_{i^{III}}\left(0,0\right) \geq U_{i^{III}}\left(O_{i^{III}}^k, O_{i^{III}}^k - \mu_{i^{III}}\right) \text{ for } O_{i^{III}}^k \text{ in range 2}. \tag{50}$$

Then, by the upper bound $\overline{G}_{i^{III}} - \phi_{i^{III}} \leq \eta_{i^{III}}^j$ in (39), woman i^{III} also prefers non-employment off assistance to state $0r$ under j (which, thanks to $\eta_{i^{III}}^j > \eta_{i^{III}}^a$, is compatible with (42) hence with the optimality of $0r$ under a).[7] By the upper bound $\overline{G}_{i^{III}} - \phi_{i^{III}} \leq \kappa_{i^{III}}$ in (39) and (50), woman i^{III} also prefers non-employment off assistance to the allocations compatible with state $2u$ under j. In summary, woman i^{III} prefers an allocation compatible with state $0n$ under j to the allocations compatible with all the other states. This shows that $\pi_{0r,0n}$ need not equal zero.

[5] Suppose, for example, that $U_{i'}(E,C) = C - E$. Then (47) requires $\eta_{i'}^a < \mu_{i'}$ which agrees with the condition for optimality of $0r$ under a, namely (42)-(45).

[6] Suppose, for example, that $U_{i''}(E,C) = C - E$. Then (48) requires $\eta_{i'}^a > \mu_{i'}$ which agrees with the conditions for optimality of $0r$ under a, namely (42)-(45).

[7] Suppose, for example, that $U_{i^{III}}(E,C) = C - E$. Then (49)-(50) require $\mu_{i^{III}} \geq \overline{G}_{i^{III}} - \phi_{i^{III}}$ which agrees with the condition for optimality of $0r$ under a, namely (42)-(45) since $\overline{G}_{i^{III}} - \phi_{i^{III}} \geq \eta_{i^{III}}^a$ by our characterization of woman i^{III} in (39).

Let woman i^{IV} have an earnings draw $O^k_{i^{IV}}$ in range 2 such that under j she prefers earning $O^k_{i^{IV}}$ off assistance to the available allocations compatible with states $\{0r, 1r\}$. Formally,

$$U_{i^{IV}}\left(O^k_{i^{IV}}, O^k_{i^{IV}} - \mu_{i^{IV}}\right) > U_{i^{IV}}\left(0, \overline{G}_{i^{IV}} - \phi_{i^{IV}} - \eta^j_{i^{IV}}\right), \tag{51}$$

$$U_{i^{IV}}\left(O^k_{i^{IV}}, O^k_{i^{IV}} - \mu_{i^{IV}}\right) \geq U_{i^{IV}}\left(O^l_{i^{IV}}, O^l_{i^{IV}} - \mu_{i^{IV}} + \overline{G}_{i^{IV}} - \phi_{i^{IV}}\right) \text{ for } O^l_{i^{IV}} \text{ in range 1}, \tag{52}$$

where, because $\eta^j_{i^{IV}} > \eta^a_{i^{IV}}$, (51) is compatible with (42), and hence with the optimality of $0r$ under a.[8] Then, under j, by the lower bound $\overline{G}_{i^{IV}} - \phi_{i^{IV}} > \eta^j_{i^{IV}}$ in (40) and (51), woman i^{IV} also prefers $O^k_{i^{IV}}$ off assistance to state $0n$. By the lower bound $\overline{G}_{i^{IV}} - \phi_{i^{IV}} > 0$ implicit in (40) and (52), woman i^{IV} also prefers $O^k_{i^{IV}}$ off assistance to the allocation compatible with state $1n$ under j. By the upper bound $\overline{G}_{i^{IV}} - \phi_{i^{IV}} \leq \kappa_{i^{IV}}$ in (40), woman i^{IV} also prefers $O^k_{i^{IV}}$ off assistance to the allocation compatible with state $2u$ under j. In summary, woman i^{IV} prefers $O^k_{i^{IV}}$ off assistance under j to the allocations compatible with all the other states. This shows that $\pi_{0r,2n}$ need not equal zero.

Let woman i^V have an earnings draw $O^k_{i^V}$ in range 2 such that under j she prefers earning and misreporting $O^k_{i^V}$ to the available allocations compatible with states $\{0r, 1r\}$. Formally,

$$U_{i^V}\left(O^k_{i^V}, O^k_{i^V} - \mu_{i^V} + \overline{G}_{i^V} - \phi_{i^V} - \kappa_{i^V}\right) > U_{i^V}\left(0, \overline{G}_{i^V} - \phi_{i^V} - \eta^j_{i^V}\right), \tag{53}$$

$$U_{i^V}\left(O^k_{i^V}, O^k_{i^V} - \mu_{i^V} + \overline{G}_{i^V} - \phi_{i^V} - \kappa_{i^V}\right) \geq U_{i^V}\left(O^l_{i^V}, O^l_{i^V} - \mu_{i^V} + \overline{G}_{i^V} - \phi_{i^V}\right) \text{ for } O^l_{i^V} \text{ in range 1.} \tag{54}$$

where, because $\eta^j_{i^V} > \eta^a_{i^V}$, (53) is compatible with (42), and hence with the optimality of $0r$ under a.[9] In such a case, under j, by the lower bound $\overline{G}_{i^V} - \phi_{i^V} \geq \eta^j_{i^V}$ in (41) and (53), woman i^V also prefers misreporting $O^k_{i^V}$ to state $0n$. By the lower bound $\overline{G}_{i^V} - \phi_{i^V} \geq 0$ implicit in (41) and (54), woman i^{IV} also prefers misreporting $O^k_{i^V}$ to the available allocation compatible with state $1n$. By the lower bound $\overline{G}_{i^V} - \phi_{i^V} \geq \kappa_{i^V}$ in (41) woman i^V also prefers misreporting $O^k_{i^V}$ to the allocation compatible with state $2n$. In summary, woman i^V prefers misreporting $O^k_{i^V}$ under j to the allocations compatible with all the other states. This shows that $\pi_{0r,2u}$ need not equal zero. □

[8] Suppose, for example, that $U_{i^{iv}}(E,C) = C - \beta_{i^{iv}} E$ with $\beta_{i^{iv}} \in (0,1)$. Then (51)-(52) bound from above the net of stigma reward from assistance: $O^k_{i^{IV}}(1-\beta_{i^{iv}}) - \mu_{i^{IV}} + \eta^j_{i^{IV}} > \overline{G}_{i^{IV}} - \phi_{i^{IV}}$ and $\left(O^k_{i^{IV}} - O^l_{i^{IV}}\right)(1-\beta_{i^{iv}}) \geq \overline{G}_{i^{IV}} - \phi_{i^{IV}}$ for $O^k_{i^{IV}}$ in range 2 and $O^l_{i^{IV}}$ in range 1. Given our characterization of woman i^{IV}, namely, $\eta^j_{i^{IV}} \leq \overline{G}_{i^{IV}} - \phi_{i^{IV}}$ from (40), this requires $O^k_{i^{IV}}(1-\beta_{i^{iv}}) - \mu_{i^{IV}} \leq 0$ and $\left(O^k_{i^{IV}} - O^l_{i^{IV}}\right)(1-\beta_{i^{iv}}) \geq \eta^j_{i^{IV}}$ which agree with the conditions for optimality of $0r$ under a, namely (42)-(45).

[9] Suppose, for example, that $U_{i^v}(E,C) = C - \beta_{i^v} E$ with $\beta_{i^v} \in (0,1)$. Then (53)-(54) bound from above the cost of under-reporting: $O^k_{i^V}(1-\beta_{i^v}) - \mu_{i^{IV}} + \eta^j_{i^V} > \kappa_{i^V}$ and $\left(O^k_{i^V} - O^l_{i^V}\right)(1-\beta_{i^v}) > \kappa_{i^V}$ for $O^k_{i^V}$ in range 2 and $O^l_{i^V}$ in range 1. These bounds agree with the conditions for optimality of $0r$ under a, namely (42)-(45).

5 Bounds on the Response Probabilities

List of Bounds

The analytical expressions for the bounds on the response probabilities are:

$$\pi_{2n,1r} \geq \max\left\{0, \frac{p^a_{2n} - p^j_{2n}}{p^a_{2n}}\right\},$$

$$\pi_{2n,1r} \leq \min\left\{\begin{array}{c} 1, \frac{p^a_{2n}-p^j_{2n}+p^a_{0p}-p^j_{0p}}{p^a_{2n}}, \frac{p^a_{2n}-p^j_{2n}+p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}}{p^a_{2n}}, \\ \frac{p^a_{2n}-p^j_{2n}+p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}}{p^a_{2n}}, \frac{p^a_{2n}-p^j_{2n}+p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}+p^a_{2p}-p^j_{2p}}{p^a_{2n}} \end{array}\right\},$$

$$\pi_{0n,1r} \geq \max\left\{0, \frac{p^a_{0n} - p^j_{0n}}{p^a_{0n}}\right\},$$

$$\pi_{0n,1r} \leq \min\left\{\begin{array}{c} 1, \frac{p^a_{0n}-p^j_{0n}+p^a_{0p}-p^j_{0p}}{p^a_{0n}}, \frac{p^a_{0n}-p^j_{0n}+p^a_{0p}-p^j_{0p}+p^a_{2n}-p^j_{2n}}{p^a_{0n}}, \\ \frac{p^a_{0n}-p^j_{0n}+p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}}{p^a_{0n}}, \frac{p^a_{0n}-p^j_{0n}+p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}+p^a_{2n}-p^j_{2n}}{p^a_{0n}} \end{array}\right\},$$

$$\pi_{2u,1r} \geq \max\left\{0, \frac{p^a_{2p} - p^j_{2p}}{p^a_{2p}}\right\},$$

$$\pi_{2u,1r} \leq \min\left\{\begin{array}{c} 1, \frac{p^a_{2p}-p^j_{2p}+p^a_{0p}-p^j_{0p}}{p^a_{2p}}, \frac{p^a_{2p}-p^j_{2p}+p^a_{0p}-p^j_{0p}+p^a_{2n}-p^j_{2n}}{p^a_{2p}}, \\ \frac{p^a_{2p}-p^j_{2p}}{p^a_{2p}} + \frac{p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}}{p^a_{2p}}, \frac{p^a_{2p}-p^j_{2p}+p^a_{0p}-p^j_{0p}+p^a_{2n}-p^j_{2n}+p^a_{0n}-p^j_{0n}}{p^a_{2p}} \end{array}\right\},$$

$$\pi_{0r,1r} \geq \max\left\{0, \frac{p^a_{0p} - p^j_{0p} - p^j_{0n} - p^j_{2n} - p^j_{2p}}{p^a_{0p}}\right\},$$

$$\pi_{0r,1r} \leq \min\left\{\begin{array}{c} \frac{p^a_{0p}-p^j_{0p}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{2n}-p^j_{2n}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}}{p^a_{0p}}, \\ \frac{p^a_{0p}-p^j_{0p}+p^a_{2n}-p^j_{2n}+p^a_{2p}-p^j_{2p}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}+p^a_{2n}-p^j_{2n}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}+p^a_{0n}-p^j_{0n}}{p^a_{0p}}, \\ \frac{p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}+p^a_{2n}-p^j_{2n}+p^a_{2p}-p^j_{2p}}{p^a_{0p}} \end{array}\right\},$$

$$\pi_{0r,2n} \geq \max\left\{0, \frac{-\left(p^a_{2n} - p^j_{2n}\right)}{p^a_{0p}}\right\},$$

$$\pi_{0r,2n} \leq \min\left\{\begin{array}{c} \frac{p^j_{2n}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}}{p^a_{0p}}, \\ \frac{p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}+p^a_{0n}-p^j_{0n}}{p^a_{0p}} \end{array}\right\},$$

$$\pi_{0r,2u} \geq \max\left\{0, \frac{-\left(p^a_{2p} - p^j_{2p}\right)}{p^a_{0p}}\right\},$$

$$\pi_{0r,2u} \leq \min\left\{\begin{array}{c} \frac{p^j_{2p}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{2n}-p^j_{2n}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{0n}-p^j_{0n}}{p^a_{0p}}, \\ \frac{p^a_{0p}-p^j_{0p}+p^a_{2n}-p^j_{2n}+p^a_{0n}-p^j_{0n}}{p^a_{0p}} \end{array}\right\},$$

$$\pi_{0r,0n} \geq \max\left\{0, \frac{-\left(p^a_{0n} - p^j_{0n}\right)}{p^a_{0p}}\right\},$$

$$\pi_{0r,0n} \leq \min\left\{\begin{array}{c} \frac{p^j_{0n}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}}{p^a_{0p}}, \frac{p^a_{0p}-p^j_{0p}+p^a_{2n}-p^j_{2n}}{p^a_{0p}}, \\ \frac{p^a_{0p}-p^j_{0p}+p^a_{2p}-p^j_{2p}+p^a_{2n}-p^j_{2n}}{p^a_{0p}} \end{array}\right\}.$$

Derivation of Bounds

A solution to any linear programming problem has to occur at one of the vertices of the problem's constraint space (see Murty, 1983). Recall that the linear constraints are:

$$\begin{aligned} p^j_{0n} - p^a_{0n} &= -p^a_{0n}\pi_{0n,1r} + p^a_{0p}\pi_{0r,0n} \\ p^j_{1n} - p^a_{1n} &= -p^a_{1n}\pi_{1n,1r} \\ p^j_{2n} - p^a_{2n} &= -p^a_{2n}\pi_{2n,1r} + p^a_{0p}\pi_{0r,2n} \\ p^j_{0p} - p^a_{0p} &= -p^a_{0p}\left(\pi_{0r,1r} + \pi_{0r,2u} + \pi_{0r,2n} + \pi_{0r,0n}\right) \\ p^j_{2p} - p^a_{2p} &= p^a_{0p}\pi_{0r,2u} - p^a_{2p}\pi_{2u,1r} \end{aligned} \tag{55}$$

To obtain the set of possible solutions to the linear programming problem

$$\max_{\pi} \lambda'\pi \text{ subject to (55) and } \pi \in [0,1]^7,$$

we enumerated all vertices of the convex polytope defined by the intersection of the hyperplane defined by the equations in (55) with the hypercube defined by the unit constraints on the parameters. In practice, this amounted to setting all possible choices of three of the seven parameters in (55) to 0 or 1 and solving for the remaining four parameters. There were $\binom{7}{3} = 35$ different possible choices of three parameters and $2^3 = 8$ different binary arrangements those parameters could take, yielding 280 possible vertices. However we were able to use the structure of our problem to rule out the existence of solutions at certain vertices – e.g., $\pi_{2n,1r}$ and $\pi_{0r,2n}$ cannot both be set arbitrarily because this would lead to a violation of the second equation in (55). Such restrictions reduced the problem to solving the system at 160 vertices. We then enumerated the set of minima and maxima each parameter could achieve across the 160 relevant solutions. After eliminating dominated solutions, we arrived at the stated bounds.

6 Inference on Bounds

We begin with a description of the upper limit of our confidence interval. For each response probability π we have a set of possible upper bound solutions $\{ub_1, ub_2, ..., ub_K\}$. We know that:

$$\begin{aligned} \pi \leq \overline{\pi} &\equiv \min\{\underline{ub}, 1\} \\ \underline{ub} &\equiv \min\{ub_1, ub_2, ..., ub_K\}. \end{aligned}$$

A consistent estimate of the least upper bound $\underline{ub}$ can be had by plugging in consistent sample moments $\widehat{ub}_k \xrightarrow{p} ub_k$ and using $\underline{\widehat{ub}} \equiv min\left\{\widehat{ub}_1, \widehat{ub}_2, ..., \widehat{ub}_K\right\}$ as an estimate of $\underline{ub}$. This estimator is consistent by continuity of probability limits. We can then form a corresponding consistent estimator $\widehat{\overline{\pi}} \equiv \min\left\{\widehat{\underline{ub}}, 1\right\}$ of $\overline{\pi}$.

To conduct inference on π, we seek a critical value r such that:

$$P\left(\underline{ub} \leq \widehat{\underline{ub}} + r\right) = 0.95, \tag{56}$$

as such an r implies

$$\begin{aligned}
P\left(\pi \leq \min\left\{\widehat{\underline{ub}} + r, 1\right\}\right) &\geq P\left(\overline{\pi} \leq \min\left\{\widehat{\underline{ub}} + r, 1\right\}\right) \\
&\geq P\left(\underline{ub} \leq \min\left\{\widehat{\underline{ub}} + r, 1\right\}\right) \\
&= P\left(\underline{ub} \leq \widehat{\underline{ub}} + r\right) \mathbf{1}\left[\widehat{\underline{ub}} + r < 1\right] + \mathbf{1}\left[\widehat{\underline{ub}} + r \geq 1\right] \\
&= 0.95 \times \mathbf{1}\left[\widehat{\underline{ub}} + r < 1\right] + \mathbf{1}\left[\widehat{\underline{ub}} + r \geq 1\right] \\
&\geq 0.95,
\end{aligned}$$

with the first inequality binding when $\pi = \overline{\pi}$ and the second when $\underline{ub} < \overline{\pi}$.

We can rewrite (56) as:

$$P\left(-\min\left\{\widehat{ub}_1 - \underline{ub}, \widehat{ub}_2 - \underline{ub}, ..., \widehat{ub}_K - \underline{ub}\right\} \leq r\right) = 0.95,$$

or equivalently

$$P\left(\max\left\{\underline{ub} - \widehat{ub}_1, \underline{ub} - \widehat{ub}_2, ..., \underline{ub} - \widehat{ub}_K\right\} \leq r\right) = 0.95.$$

It is well known that the limiting distribution of $\max\left\{\underline{ub} - \widehat{ub}_1, \underline{ub} - \widehat{ub}_2, ..., \underline{ub} - \widehat{ub}_K\right\}$ depends on which and how many of the upper bound constraints bind. Several approaches to this problem have been proposed which involve conducting pre-tests for which constraints are binding (e.g. Andrews and Barwick, 2012).

We take an alternative approach to inference that is simple to implement and consistent regardless of the constraints that bind. Our approach is predicated on the observation that:

$$P\left(\max\left\{ub_1 - \widehat{ub}_1, ..., ub_K - \widehat{ub}_K\right\} \leq r\right) \leq P\left(\max\left\{\underline{ub} - \widehat{ub}_1, ..., \underline{ub} - \widehat{ub}_K\right\} \leq r\right), \tag{57}$$

with equality holding in the case where all of the upper bound solutions are identical. We seek an r' such that:

$$P\left(\max\left\{ub_1 - \widehat{ub}_1, ..., ub_K - \widehat{ub}_K\right\} \leq r'\right) = .95. \tag{58}$$

From (57),

$$P\left(\max\left\{\underline{ub} - \widehat{ub}_1, ..., \underline{ub} - \widehat{ub}_K\right\} \leq r'\right) \geq .95,$$

with equality holding when all bounds are identical.

A bootstrap estimate $r^* \xrightarrow{p} r'$ of the necessary critical value can be had by considering the bootstrap analog of condition (58) (see Proposition 10.7 of Kosorok, 2008). That is, by computing the 95th percentile of:

$$\max\left\{\widehat{ub}_1 - \widehat{ub}_1^*, ..., \widehat{ub}_K - \widehat{ub}_K^*\right\}$$

across bootstrap replications, where stars refer to bootstrap quantities. An upper limit U of the confidence region for π can then be formed as:

$$U = \min\left\{\widehat{\underline{ub}} + r^*, 1\right\}.$$

Note that this procedure is essentially an unstudentized version of the inference method of Chernozhukov et al. (2013) where the set of relevant upper bounds ($\mathcal{V}_0$ in their notation) is taken here to be the set of all upper bounds, thus yielding conservative inference.

We turn now to the lower limit of our confidence interval. Our greatest lower bounds are all of the form:

$$\pi \geq \underline{\pi} \equiv \max\{lb, 0\}.$$

We have the plugin lower bound estimator $\widehat{lb} \xrightarrow{p} lb$. By the same arguments as above we want to search for an r'' such that

$$P\left(lb \geq \widehat{lb} - r''\right) = 0.95.$$

Since $\widehat{lb}$ is just a scalar sample mean, we can choose $r'' = 1.65\sigma_{lb}$ where σ_{lb} is the asymptotic standard error of $\widehat{lb}$ in order to guarantee the above condition holds asymptotically. To account for the propensity score reweighting, we use a bootstrap standard error estimator $\widehat{\sigma}_{lb}$ of σ_{lb} which is consistent via the usual arguments. Thus, our "conservative" 95% confidence interval for π is:

$$\left[\max\left\{0, \widehat{lb} - 1.65\widehat{\sigma}_{lb}\right\}, \min\left\{\underline{\widehat{ub}} + r^*, 1\right\}\right].$$

This confidence interval covers the parameter π with asymptotic probability of at least 95%.

7 Relaxation of Zero Lower Bound on Stigma

We relax the restriction $\phi_i > G_i^a(FPL_i)$ in Assumption 2 to $\phi_i \geq 0$. We replace $\mathcal{S}$ in Definition 11 with $\mathcal{S} \equiv \{0n, 1n, 2n, 0r, 1r, 1u, 2r, 2u\}$. For convenience we reproduce here the matrix Π of response probabilities that is referenced below in Proposition 3:

	Earnings / Program Participation State under JF							
AFDC	0n	1n	2n	0r	1r	1u	2u	2r
0n	$1-\pi_{0n,1r}$	0	0	0	$\pi_{0n,1r}$	0	0	0
1n	0	$1-\pi_{1n,1r}$	0	0	$\pi_{1n,1r}$	0	0	0
2n	0	0	$1-\pi_{0n,1r}$	0	$\pi_{2n,1r}$	0	0	0
0r	$\pi_{0r,0n}$	0	$\pi_{0r,2n}$	$1-\pi_{0r,0n}-\pi_{0r,2n}$ $-\pi_{0r,1r}-\pi_{0r,2u}$	$\pi_{0r,1r}$	0	$\pi_{0r,2u}$	0
1r	0	0	0	0	1	0	0	0
1u	0	0	0	0	1	0	0	0
2u	0	0	0	0	$\pi_{2u,1r}$	0	$1-\pi_{2u,1r}$	0
2r	$\pi_{2r,0n}$	0	$\pi_{2r,2n}$	$\pi_{2r,0r}$	$\pi_{2r,1r}$	0	$1-\pi_{2r,0n}-\pi_{2r,2n}$ $-\pi_{2r,1r}-\pi_{2r,0r}$	0

Proposition 3. *Given Assumptions 1-4, the responses corresponding to the zero entries of matrix* Π *cannot occur and the responses corresponding to unitary entries of the matrix must occur. Under the same assumptions, the "free" response probabilities in matrix* Π *are unrestricted, meaning they need not equal zero or one.*

Proof. The zero and unitary entries in the first 7 rows and 7 columns of matrix Π were proven in Proposition 1. The non zero and non unitary entries in the first 7 rows and 7 columns of matrix Π were proven in Proposition 2. We are left to prove the zero entries and the "free responses" in row 8 and column 8 of matrix Π. $\pi_{2r,1u} = 0$ because $1u$ is dominated by $1r$ under j. $\pi_{2r,2r} = 0$ because $2r$ is not defined under j. We now show that $\pi_{2r,1n} = 0$. The proof is by contradiction. Suppose that woman i chooses an allocation that entails earnings $O_i^k \in \left(FPL_i, \overline{E}_i\right]$ and reports these earnings truthfully when applying for welfare under a. Her choice reveals that $U_i\left(O_i^k, O_i^k - \mu_i + G_i^a\left(O_i^k\right) - \phi_i\right) \geq U_i\left(O_i^k, O_i^k - \mu_i\right)$, which, because consumption is a good, bounds her stigma from above, namely, $G_i^a\left(O_i^k\right) \geq \phi_i$. Her choice under j reveals that $U_i\left(O_i^k, O_i^k - \mu_i\right) \geq U_i\left(O_i^k, O_i^k - \mu_i + \overline{G}_i - \phi_i\right)$, which, because consumption is a good, bounds her stigma from below, namely, $\overline{G}_i \leq \phi_i$. Thus, $G_i^a\left(O_i^k\right) \geq \phi_i \geq \overline{G}_i$ which is a contradiction because $G_i^a\left(O_i^k\right) < \overline{G}_i$. This completes the proof of the zero entries in column 8 and row 8. The other pairings appearing in column 8 and row 8 are "free". To see why $(\pi_{2r,0n}, \pi_{2r,0r}, \pi_{2r,2n}, \pi_{2r,2u})$ need not be zero we just need to consider four women, i', i'', i^{III}, i^{IV}, who all choose an allocation compatible with state $2r$ under a and such that each woman's two earnings offers $\left(O_i^k, O_i^l\right)$ are in range 2 with $O_i^k \in \left(FPL_i, \overline{E}_i\right]$ and $O_i^l > \overline{E}_i$. Let woman i' have a sufficiently large hassle cost from assistance under j, a sufficiently large cost of under-reporting, and a sufficiently small stigma cost, obeying: $\overline{G}_{i'} - max\left\{\eta_{i'}^j, \kappa_{i'}\right\} < \phi_{i'} \leq G_{i'}^a\left(O_{i'}^k\right)$. Also, let woman i' have a fixed cost of work sufficiently large that $U_{i'}(0,0) \geq U_{i'}\left(O_{i'}^k, O_{i'}^k - \mu_{i'}\right)$ and $U_{i'}(0,0) \geq U_{i'}\left(O_{i'}^l, O_{i'}^l - \mu_{i'}\right)$. The restriction $\overline{G}_{i'} - max\left\{\eta_{i'}^j, \kappa_{i'}\right\} < \phi_{i'}$ implies that the woman prefers earning $O_{i'}^k$ (respectively $O_{i'}^l$) to under-reporting on assistance. Her choice under a reveals that $U_{i'}\left(O_{i'}^k, O_{i'}^k - \mu_{i'} + G_{i'}^a\left(O_{i'}^k\right) - \phi_{i'}\right) \geq U_i\left(O_i^k, O_i^k - \mu_i\right)$ which is compatible with the restriction $\phi_{i'} \leq G_{i'}^a\left(O_{i'}^k\right)$. Her choice under a also reveals that $U_{i'}\left(O_{i'}^k, O_{i'}^k - \mu_{i'} + G_{i'}^a\left(O_{i'}^k\right) - \phi_{i'}\right) \geq U_{i'}(0,0)$. However, the restriction $\overline{G}_{i'} - max\left\{\eta_{i'}^j, \kappa_{i'}\right\} < \phi_{i'}$ implies that under j she prefers be be off assistance if not working. The restrictions $U_{i'}(0,0) \geq U_{i'}\left(O_{i'}^k, O_{i'}^k - \mu_{i'}\right)$ and $U_{i'}(0,0) \geq U_{i'}\left(O_{i'}^l, O_{i'}^l - \mu_{i'}\right)$ further imply that under j she prefers not to work if off assistance. Thus, woman i' prefers $0n$ under j to all other available allocations. Similar arguments can be developed to show that $(\pi_{2r,0r}, \pi_{2r,2n}, \pi_{2r,2u})$ need not be zero. □

Corollary 1. *Suppose that there are no earnings constraints in (3), that is, replace constraint* $E \in \left\{0, O_i^k, O_i^l\right\}$ *with* $E \geq 0$ *. Then, given Assumptions 1-4,* $\pi_{2r,0n} = 0$ *and* $\pi_{2r,0r} = 0$ *in matrix* Π.

Proof. We first show that $\pi_{2r,0n} = 0$. The proof is by contradiction. Suppose that there is a woman i who selects an allocation compatible with state $2r$ under a, entailing earnings $O_i^k \in \left(FPL_i, \overline{E}_i\right]$, and selects an allocation compatible with state $0n$ under j. By Assumption 3, her choice under a reveals that $U\left(O_i^k, O_i^k - \mu_i + G_i^a\left(O_i^k\right) - \phi_i\right) \geq U(0,0)$. Because there are no earnings constraints, and because the program rules are such that $\overline{E}_i < FPL + \overline{G}_i$, there exists an earnings level in range 1, say E, such that $E + \overline{G}_i = O_i^k + G_i^a\left(O_i^k\right)$. This implies that $E - \mu_i + \overline{G}_i - \phi_i = O_i^k - \mu_i + G_i^a\left(O_i^k\right) - \phi_i$. Which in turns implies that $U\left(E, E - \mu_i + \overline{G}_i - \phi_i\right) \geq U\left(O_i^k, O_i^k - \mu_i + G_i^a\left(O_i^k\right) - \phi_i\right)$ because for given consumption (equalized across the two allocations), higher earnings are a bad and, by construction, $E < O_i^k$. This means that $U\left(E, E - \mu_i + \overline{G}_i - \phi_i\right) \geq U(0,0)$. If this weak inequality holds strictly, a contradiction ensues because this shows that no allocation compatible with state $0n$ can be optimal under j. Consider the possibility that the weak inequality hold as an equality. This means that $U\left(E, E - \mu_i + \overline{G}_i - \phi_i\right) = U\left(O_i^k, O_i^k - \mu_i + G_i^a\left(O_i^k\right) - \phi_i\right) = U(0,0)$. That is, the woman is indifferent between earning (and truthfully reporting) $O_i^k \in \left(FPL_i, \overline{E}_i\right]$ and not working off assistance under a. By Assumption 4, if the woman resolved an indifference situation against not working off assistance under a, she will also resolve an indifference situation against not working off assistance under j. This contradicts her selecting not to work off assistance over earning (and truthfully reporting) E in range 1 on assistance under j. The proof that $\pi_{2r,0r} = 0$ is similar. □

8 Extended Model with FS and Taxes

We begin with some additional notation and definitions which supersede those from the baseline model.

Notation, Definitions, and Assumptions

Notation: Throughout, we use a to refer to the JF reform's control welfare and FS policy and j to refer to the JF reform's experimental welfare and FS policy. The policy regime is denoted by $t \in \{a, j\}$. The assistance program mix is denoted by $k \in \{w, f, wf\}$ where w refers to welfare only, f refers to FS only, and wf refers to welfare joint with FS.

Definition 13. For any reported earning level E^r, the regime-dependent welfare transfer functions are

$$G_i^a(E^r) = \max\left\{\overline{G}_i - \mathbf{1}[E^r > \delta_i](E^r - \delta_i)\tau_i^w, 0\right\}, \tag{59}$$

$$G_i^j(E^r) = \mathbf{1}[E^r \leq FPL_i]\overline{G}_i. \tag{60}$$

The parameter $\delta_i \in \{90, 120\}$ gives woman i's fixed disregard and the parameter $\tau_i^w \in \{.49, .73\}$ governs her proportional disregard. $\overline{G}_i$ and FPL_i vary across women due to differences in AU size.

For any reported earning level E^r, the regime-dependent FS transfer functions are:

$$F_i^a(E^r) = F_i(E^r, 0), \tag{61}$$

$$F_i^j(E^r) = F_i(E^r, 0), \tag{62}$$

$$F_i^{a,wf}(E^r) = F_i(E^r, G_i^a(E^r))\mathbf{1}[G_i^a(E^r) > 0], \tag{63}$$

$$F_i^{j,wf}(E^r) = F_i\left(0, \overline{G}_i\right)\mathbf{1}[E^r \leq FPL_i], \tag{64}$$

where $F_i(\cdot, \cdot)$ is the standard FS formula, as described next. To simplify notation, let $F_i\left(\overline{G}_i\right) \equiv F_i\left(0, \overline{G}_i\right)$. Let $\mathbf{1}[elig_i]$ denote the eligibility for FS. Then, for any pair of reported earnings and welfare transfer, denoted (E, G) for simplicity, the FS transfer is:

$$F_i(E, G) = \max\left\{\overline{F}_i - \tau_1^f \chi_i(E, G), 0\right\}\mathbf{1}[elig_i], \tag{65}$$

with

$$\chi_i(E, G) \equiv \max\left\{E + G - \tau_2^f \min\{E, FPL_i\} - \beta_{1i}^f - \beta_{2i}^f(E + G), 0\right\},$$

where $\overline{F}_i$ is the maximum FS transfer, $\tau_1^f \chi_i(E, G)$ is a the net income deduction, τ_2^f is the earned income deduction rate, β_{1i}^f is the sum of the per unit standard deduction, the medical deduction, the child support deduction, and the dependent care deduction, and $\beta_{2i}^f(E + G)$ is the excess shelter deduction. The variation in $\left(\beta_{1i}^f, \beta_{2i}^f\right)$ across women with the same earnings and welfare is due to differences in actual medical, shelter, and child care expenses. The variation in $\overline{F}_i$ across women is due to differences in AU size. The eligibility indicator $\mathbf{1}[elig_i]$ reflects categorical eligibility, when FS is taken up jointly with welfare, or the FS's gross and net income tests, when FS is taken up alone:

$$\mathbf{1}[elig_i] = \begin{cases} 1 & \text{if } G > 0 \\ \mathbf{1}\left[E \leq \tau_3^f FPL_i\right]\mathbf{1}\left[E - \tau_2^f \min\{E, FPL_i\} - \beta_{1i}^f - \beta_{2i}^f(E + G) \leq FPL_i\right] & \text{if } G = 0 \end{cases}, \tag{66}$$

where τ_3^f is a multiplier factor. The parameters $\left(\tau_1^f, \tau_2^f, \tau_3^f\right)$ take values $(0.30, 0.20, 1.3)$.[10]

For any earning level E, earnings inclusive of one-twelfh of the total annual EITC credit, net of federal (gross) income taxes (with head of household filing status) and net of payroll and medicare taxes:

$$T_i(E) \equiv E - I_i(E) - EITC_i(E) - \left(\tau^l + \tau^m\right) E.$$

The parameters $\left(\tau^l, \tau^m\right)$ take values $(0.062, 0.0145)$. The earned income tax function $EITC_i(\cdot)$ is given by[11]

$$\begin{aligned} EITC_i(E) &= \tau_{1i}^e E \mathbf{1}\left[0 < E \leq \overline{E}_{1i}^e\right] + \tau_{1i}^e \overline{E}_{1i}^e \mathbf{1}\left[\overline{E}_{1i}^e < E \leq \overline{E}_{2i}^e\right] + \\ & \quad \left(\tau_{1i}^e \overline{E}_{1i}^e - \tau_{2i}^e\left(E - \overline{E}_{2i}^e\right)\right) \mathbf{1}\left[\overline{E}_{2i}^e < E \leq \overline{E}_{2i}^e + \frac{\tau_{1i}^e}{\tau_{2i}^e} \overline{E}_{1i}^e\right]. \end{aligned}$$

The parameters $(\tau_{1i}^e, \tau_{2i}^e)$ give a woman i's phase-in and phase-out rates. The parameters $\left(\overline{E}_{1i}^e, \overline{E}_{2i}^e\right)$ give a woman i's earning thresholds defining the earnings region yielding maximum credit. Both sets of parameters vary across women due to differences in the number of children. The (gross) federal income tax function $I_i(\cdot)$ is given by[12]

$$I_i(E) = \sum_{k=1}^{5} \tau_k^I \max\left\{\min\left\{Y_i^I - y_{k-1}^I, y_k^I - y_{k-1}^I\right\}, 0\right\},$$

where Y_i^I is the woman's taxable income which is given by her earnings net of the personal exempion and of the standard deduction: $Y_i^I = E - D_{1i}^I - D_2^I$. The personal exemption D_{1i}^I varies across women due to differences in the number of children. The parameters $\left(\tau_1^I, \tau_2^I, \tau_3^I, \tau_4^I, \tau_5^I\right)$ give the marginal tax rates and the parameters $\left(y_0^I, y_1^I, y_2^I, y_3^I, y_4^I, y_5^I\right)$ give the tax brackets with $y_0^I \equiv 0$ and $y_5^I \equiv \infty$.

Definition 14. Let D^f, D^w, and D^{wf} be indicators for the woman participating in, respectively, FS only, welfare only, and both FS and welfare; D^f, D^w, and D^{wf} take values in $\{0,1\}$. These program participation alternatives are mutually exclusive: $D^f + D^w + D^{wf} \in \{0,1\}$. Let $\left(E^{r,f}, E^{r,w}, E^{r,wf}\right)$ denote earnings reported to the welfare agency[13] when, respectively, only on FS, only on welfare, and on both FS and welfare. Let $\mathbf{D} \equiv \left(D^w, D^f, D^{wf}\right)$ and $\mathbf{E}^r \equiv \left(E^{r,w}, E^{r,f}, E^{r,wf}\right)$

Definition 15. Woman i's regime dependent consumption equivalent is

$$\begin{aligned} C_i^t(E, \mathbf{D}, \mathbf{E}^r) \equiv\ & T_i(E) - \mu_i \mathbf{1}[E > 0] \\ & + \left(G_i^t\left(E^{r,wf}\right) + F_i^{t,wf}\left(E^{r,wf}\right) - \varsigma_i - \eta_i^t \mathbf{1}\left[E^{r,wf} = 0\right] - \gamma_i \mathbf{1}\left[E < E^{r,wf}\right]\right) D^{wf} \\ & + \left(F_i^t\left(E^{r,f}\right) - \lambda_i - \omega_i \mathbf{1}\left[E < E^{r,f}\right]\right) D^f + \left(G_i^t\left(E^{r,w}\right) - \phi_i - \kappa_i \mathbf{1}\left[E < E^{r,w}\right]\right) D^w. \end{aligned} \quad (67)$$

[10] During the JF demonstration project, $\tau_f^1 = 0.30$, $\tau_f^2 = 0.20$ and $\tau_f^3 = 1.3$. The JF experimental policy effectively sets $\tau_f^2 = 1$ when FS is taken up jointly with welfare. This explains why we write the FS transfer as in (64), that is, as the standard FS transfer function evaluated at zero earnings. The eligibility formula shows that a woman with earnings above FPL_i may be eligible for FS and the transfer formula shows that the FS transfer for which she is eligible may be positive. However, under JF experimental policy, a woman with earnings above FPL_i may not receive both welfare and FS because such earnings disqualify her from welfare.

[11] This function is time varying. We dispense with the time subscript for simplicity.

[12] This function is time varying. We dispense with the time subscript for simplicity.

[13] We allow reported earnings to depend on the assistance program mix in order to accommodate the possibility of differential chances of being caught when under-reporting earnings and differential incentives in the FS and welfare transfer formulas.

The parameters $(\lambda_i, \phi_i, \varsigma_i)$ are stigma costs born when the woman receives, respectively, only FS assistance, only welfare assistance, and both FS and welfare assistance, they may vary arbitrarily across women. The parameters $(\kappa_i, \omega_i, \gamma_i)$ are the costs of under-reporting earnings, all strictly positive, and varying arbitrarily across women.

Definition 16. A woman's "state" is defined by the following function:[14]

$$s_i(E, \mathbf{D}, \mathbf{E}^r) = \begin{cases} 0nn & \text{if } E = 0, D = 0. \\ 1nn & \text{if } E \text{ in range 1, } D = 0. \\ 2nn & \text{if } E \text{ in range 2, } D = 0. \\ 0nr & \text{if } E = 0, D^f = 1. \\ 1nr & \text{if } E \text{ in range 1, } D^f = 1, E = E^{r,f}. \\ 2nr & \text{if } E \text{ in range 2, } D^f = 1, E = E^{r,f}. \\ 1nu & \text{if } E \text{ in range 1, } D^f = 1, E < E^{r,f}. \\ 2nu & \text{if } E \text{ in range 2, } D^f = 1, E < E^{r,f}. \\ 0rn & \text{if } E = 0, D^w = 1. \\ 1rn & \text{if } E \text{ in range 1, } D^w = 1, E = E^{r,w}. \\ 2rn & \text{if } E \text{ in range 2, } D^w = 1, E = E^{r,w}. \\ 1un & \text{if } E \text{ in range 1, } D^w = 1, E < E^{r,w}. \\ 2un & \text{if } E \text{ in range 2, } D^w = 1, E < E^{r,w}. \\ 0rr & \text{if } E = 0, D^{wf} = 1. \\ 1rr & \text{if } E \text{ in range 1, } D^{wf} = 1, E = E^{r,wf}. \\ 2rr & \text{if } E \text{ in range 2, } D^{wf} = 1, E = E^{r,wf}. \\ 1uu & \text{if } E \text{ in range 1, } D^{wf} = 1, E < E^{r,wf}. \\ 2uu & \text{if } E \text{ in range 2, } D^{wf} = 1, E < E^{r,wf}. \end{cases}.$$

Definition 17. We say that an allocation (E, C) is compatible with state s under regime t for woman i if there exists a pair $(\mathbf{D}, \mathbf{E}^r) \in \{0,1\}^3 \times [0, E]^3$ such that $s = s_i(E, \mathbf{D}, \mathbf{E}^r)$ and $c = C_i^t(E, \mathbf{D}, \mathbf{E}^r)$.

Definition 18. We say that a state s is no better (worse) under JF than under AFDC if, for any woman i, and any $(E, \mathbf{D}, \mathbf{E}^r)$ such that $s = s_i(E, \mathbf{D}, \mathbf{E}^r)$, $U_i\left(E, C_i^j(E, \mathbf{D}, \mathbf{E}^r)\right) \leq (\geq) U_i(E, C_i^a(E, \mathbf{D}, \mathbf{E}^r))$. We say that a state s is equally attractive under JF and AFDC if, for any owman i, any any $(E, \mathbf{D}, \mathbf{E}^r)$ such that $s = s_i(E, \mathbf{D}, \mathbf{E}^r)$, $U_i\left(E, C_i^j(E, \mathbf{D}, \mathbf{E}^r)\right) = U_i(E, C_i^a(E, \mathbf{D}, \mathbf{E}^r))$.

Definition 19. Define

$$\begin{aligned} \mathcal{S} &\equiv \{0nn, 1nn, 2nn, 0nr, 1nr, 2nr, 1nu, 2nu, 0rr, 1rr, 0rn, 1rn, 1un, 2un, 1uu, 2uu\}, \\ \mathcal{C}_0 &\equiv \{0nn, 1nn, 2nn, 0nr, 1nr, 2nr, 1nu, 2nu, 1uu, 2uu, 1un, 2un\}, \\ \mathcal{C}_+ &\equiv \{1rr, 1rn\}, \\ \mathcal{C}_- &\equiv \{0rr, 0rn\}. \end{aligned}$$

Definition 20. Consider those women who under AFDC choose a triplet $(E, \mathbf{D}, \mathbf{E}^r)$ such that $s^a = s_i(E, \mathbf{D}, \mathbf{E}^r)$. We denote by π_{s^a, s^j} the proportion of them who under JF choose a triplet $(E', \mathbf{D}', \mathbf{E}^{r\prime})$ such that $s^j = s_i(E', \mathbf{D}', \mathbf{E}^{r\prime})$.

[14] In Connecticut welfare and FS assistance programs are managed by the same agency. Accordingly, we do not include states $\{1ur, 1ru, 2ur, 2ru\}$ because it is not possible to make different earning reports to the same agency. Also, we do not include states $\{0un, 0nu, 0uu\}$ because it is not possible to under-report zero earnings.

Definition 21. Let S_i^t denote woman i's potential state under regime $t \in \{a, j\}$. Define the proportion of women occupying state $s \in \mathcal{S}$ under policy regime t as $q_s^t \equiv \Pr\left(S_i^t = s\right)$. Let π_{s^a,s^j} denote the proportion of women occupying state s^j under JF among those who occupied state s^a under AFDC: $\pi_{s^a,s^j} \equiv \Pr\left(S_i^j = s^j | S_i^a = s^a\right)$.

Definition 22. Let $\mathcal{S}^w \equiv \{0n, 1n, 2n, 0r, 1r, 1u, 2u\}$. $\mathcal{S}_w$ is the list of latent states that spell out welfare participation only. The states in $\mathcal{S}_w$ relate to the states in $\mathcal{S}$ as follows:

$$s_w = w(s) = \begin{cases} 0n & \text{if } s \in \{0nn, 0nr\} \\ 1n & \text{if } s \in \{1nn, 1nr, 1nu\} \\ 2n & \text{if } s \in \{2nn, 2nr, 2nu\} \\ 0r & \text{if } s \in \{0rn, 0rr\} \\ 1r & \text{if } s \in \{1rn, 1rr\} \\ 1u & \text{if } s \in \{1un, 1uu\} \\ 2u & \text{if } s \in \{2un, 2uu\} \end{cases},$$

where the number of each state s_w refers to the woman's earnings range, the letter n refers to welfare non-participation, the letter r refers to welfare participation with truthful reporting of earnings, and the letter u refers to welfare participation with under-reporting of earnings.

Definition 23. Let $S_{w,i}^t$ denote the welfare-only potential state of a woman i whose potential state under policy regime t is S_i^t; that is, $S_{w,i}^t = w\left(S_i^t\right)$. Define the proportion of women of occupying state $s_w \in \mathcal{S}_w$ under policy regime t as $p_{s_w}^t \equiv \Pr\left(S_{w,i}^t = s_w\right) = \sum_{s \in \mathcal{S}: s_w = w(s)} q_s^t$. With some abuse of notation (see Definition 20), let $\pi_{s_w^a, s_w^j}$ denote the proportion of women who occupy state s_w^j under JF among those who occupied state s_w^a under AFDC: $\pi_{s_w^a, s_w^j} \equiv \Pr\left(S_{w,i}^j = s_w^j | S_{w,i}^a = s_w^a\right)$.

Assumption 5. *For each woman i, $\left(\mu_i, \eta_i^a, \eta_i^j\right)$ are non-negative, $\eta_i^a \geq \eta_i^j$, $(\kappa_i, \omega_i, \gamma_i) > 0$, $\gamma_i > \kappa_i$,*[15] *$\phi_i \geq \underline{\phi}_i \equiv G_i^a(FPL_i)$, and $\varsigma_i \geq \underline{\varsigma}_i \equiv G_i^a(FPL_i) + F_i(FPL_i, G_i^a(FPL_i))$.*

Assumption 6. *Under regime t woman i makes choices by solving the optimization problem*

$$\max_{E \in \left\{0, O_i^1, O_i^2\right\}, \mathbf{D} \in \{0,1\}^3, \mathbf{E}^r \in [0,E]^3} U_i(E, C) \text{ subject to (67), (59)-(60) and (61)-(64).}$$

Assumption 7. *A woman files (does not file) for federal income taxes and the EITC irrespective of the regime.*

Lemmas

Lemma 5. *Under both JF and AFDC, for every E^r such that $G_i^t(E^r) > 0$, the combined welfare plus FS transfer is no smaller than the sole welfare transfer. Equivalently, $F_i\left(E^r, G_i^t(E^r)\right) \geq 0$ for every E^r such that $G_i^t(E^r) > 0$.*

Proof. It suffices to show that the function $G + F(E, G)$ is non decreasing in G for any E. Consider (65) in Definition 13 and observe that a 1\$ increase in G leads to a less than 1\$ decrease in the FS transfer because $\tau_1^f < 1$. □

[15] The restriction that $\gamma_i > \kappa_i$ is only used to prove $0_{(6)}$ in Proposition 6. This restriction does not affect the "integrated" matrix of response probabilities so it is not strictly necessary.

Lemma 6. *Under AFDC, the FS transfer of a woman who is on both welfare and FS is maximized at $E^r = 0$.*

Proof. Under AFDC, the FS transfer function $F_i(E^r, G_i^a(E^r))$ is weakly decreasing in E^r (Definition 13) hence it attains its maximum value at $F_i(0, \overline{G}_i)$. □

Lemma 7. *Given Assumptions 1, 5, and 6 states $2rr$ and $2rn$ are unpopulated.*

Proof. States $2rr$ and $2rn$ are unpopulated under regime j because $(\phi_i, \varsigma_i) > 0$ for all women (Assumptions 5) and the JF grant amount is zero whenever a woman reports earnings above FPL_i (Assumptions 1 and 6). We next show that states $2rr$ and $2rn$ are also unpopulated under regime a. Denote a woman i's break-even earnings level under a as $\overline{E}_i = \frac{\overline{G}_i}{\tau_i} + \delta_i$, this is the level at which welfare benefits are exhausted. If $\overline{E}_i \leq FPL_i$, she will not choose to truthfully report earnings above FPL_i (range 2) because $(\phi_i, \varsigma_i) > 0$ (Assumptions 5) and the AFDC grant amount is zero whenever she reports earnings above $\overline{E}_i$ (Assumptions 1 and 6). We now prove by contradiction that even when $\overline{E}_i > FPL_i$ a woman will not choose to truthfully report earnings above FPL_i (range 2). Suppose that woman i chooses an allocation that entails earnings $O_i^k \in (FPL_i, \overline{E}_i]$ and reports these earnings truthfully when applying jointly for welfare and FS. By Assumption 6, her choice reveals that $U(O_i^k, T_i(O_i^k) - \mu_i + G_i^a(O_i^k) + F_i(O_i^k, G_i^a(O_i^k)) - \varsigma_i) \geq U(O_i^k, T_i(O_i^k) - \mu_i)$, which, because consumption is a good (Assumption 1), bounds her stigma from above, namely, $G_i^a(O_i^k) + F_i(O_i^k, G_i^a(O_i^k)) \geq \varsigma_i$. We thus have $G_i^a(O_i^k) + F_i(O_i^k, G_i^a(O_i^k)) \geq \varsigma_i \geq \underline{\varsigma}_i$ because ς_i is bounded from below by $\underline{\varsigma}_i$. This yields a contradiction because $G_i^a(O_i^k) < G_i^a(FPL_i)$ and $F_i(O_i^k, G_i^a(O_i^k)) < F_i(FPL_i, G_i^a(FPL_i))$ for any $O_i^k > FPL_i$. Suppose that woman i chooses an allocation that entails earnings $O_i^k \in (FPL_i, \overline{E}_i]$ and reports these earnings truthfully when applying for welfare alone. Her choice reveals that $U(O_i^k, T_i(O_i^k) - \mu_i + G_i^a(O_i^k) - \phi_i) \geq U(O_i^k, T_i(O_i^k) - \mu_i)$, which, because consumption is a good, bounds her stigma from above, namely, $G_i^a(O_i^k) \geq \phi_i$. We thus have $G_i^a(O_i^k) \geq \phi_i \geq \underline{\phi}_i$ because ϕ_i is bounded from below by $\underline{\phi}_i$(Assumption 5). This yields a contradiction because $G_i^a(O_i^k) < G_i^a(FPL_i)$ for any $O_i^k > FPL_i$. Finally, suppose that under a woman i chooses an allocation that entails earnings $O_i^k > \overline{E}_i$ and reports these earnings truthfully (when applying jointly for welfare and FS or only for welfare). We again have a contradiction because $(\phi_i, \varsigma_i) > 0$ (Assumptions 5) for all women and the AFDC grant amount is zero whenever she reports earnings above $\overline{E}_i$ (Assumptions 1 and 6). □

Lemma 8. *Given Assumptions 1, 4, 5, and 6: I) Welfare only: a) the optimal reporting rule, while on assistance, entails either truthful reporting or reporting an amount in the range $[0, FPL_i]$ under JF or in the range $[0, \delta_i]$ under AFDC, b) when earnings are positive, reporting zero earnings is only optimal if hassle under the relevant regime is zero, and c) state $1un$ is unpopulated under JF; II) FS only: a) the optimal reporting rule, while on assistance, entails either truthful reporting or reporting an amount in the range $[0, \underline{E}_i^f]$ under either JF or AFDC, where $\underline{E}_i^f$ is the highest level of reported earnings such that the transfer is unreduced[16]; III) Welfare and FS: a) the optimal reporting rule, while on (joint) assistance, entails either truthful reporting or reporting an amount in the range $[0, FPL_i]$ under JF or in the range $[0, \delta_i]$ under AFDC, and b) state $1uu$ is unpopulated under JF.*

[16] The expression for the threshold level $\underline{E}_i^f$ cannot be had algebraically but such level exists. To see this use (65) and (66) in Definition 13. Let E' denote the earnings level such that $\overline{F}_i = \tau_f^1 \chi_i(E', G)$, given eligibility. Eligibility itself depends on reported earnings. Thus, $\underline{E}_i^f = \min\{E', E''\}$ where E'' is the highest earning amount such that both gross and income tests are met.

Proof. Statement I has the same proof as that of Lemma 2. Consider next statement II. Any report in $[0, \underline{E}_i^f]$ leads to the same transfer $\overline{F}_i$. Any report above $\underline{E}_i^f$ leads to a lower transfer. Thus, depending on the magnitude of the under-reporting cost ω_i the woman will either report an amount in the range $[0, \underline{E}_i^f]$ or report the truth.[17]

Finally consider statement III. It suffices to prove that the combined welfare and FS transfer is maximized when the welfare grant is maximized i.e. when reports are in $[0, \delta_i]$. This is equivalent to showing that $G + F(E, G)$ is increasing in G for any E, that is, the reduction in the FS grant due to an increase in the welfare grant is smaller than the increase in the welfare grant. Lemma 5 does that. □

Lemma 9. *Given Assumptions 1, 4, 5, and 6, the states in $\mathcal{C}_0$ are equally attractive under JF and AFDC, the states in $\mathcal{C}_+$ are no worse under JF than under AFDC and the states in $\mathcal{C}_-$ are no better under JF than under AFDC.*

Proof. It is sufficient to verify that $C_i^j(E, \mathbf{D}, \mathbf{E}^r) \geq C_i^a(E, \mathbf{D}, \mathbf{E}^r)$ for all $(E, \mathbf{D}, \mathbf{E}^r)$ such that $s_i(E, \mathbf{D}, \mathbf{E}^r) \in \mathcal{C}_+$, that $C_i^j(E, \mathbf{D}, \mathbf{E}^r) \geq C_i^a(E, \mathbf{D}, \mathbf{E}^r)$ for all $(E, \mathbf{D}, \mathbf{E}^r)$ such that $s_i(E, \mathbf{D}, \mathbf{E}^r) \in \mathcal{C}_-$, and that $C_i^j(E, \mathbf{D}, \mathbf{E}^r) = C_i^a(E, \mathbf{D}, \mathbf{E}^r)$ for all $\left(E, D_1, D_2, E^{r1}, E^{r2}\right)$ such that $s_i(E, \mathbf{D}, \mathbf{E}^r) \in \mathcal{C}_0$. Start with a septuplet obeying $s_i(E, \mathbf{D}, \mathbf{E}^r) \in C_+$. Consider first state $1rr \in C_+$. This means that E is in range 1, $D^f = D^w = 0$, $D^{wf} = 1$, $E^{r,f}$ and $E^{r,w}$ are undefined, and $E^{r,wf} = E$. By Lemma 5, $\overline{G}_i + F_i\left(E, \overline{G}_i\right) \geq G_i^a(E) + F_i(E, G_i^a(E))$ for all E in range 1,[18]

$$\begin{aligned} C_i^j(E, 0, 0, 1, \bullet, \bullet, E) &= T_i(E) - \mu_i + \overline{G}_i + F_i\left(E, \overline{G}_i\right) - \varsigma_i \\ &\geq T_i(E) - \mu_i + G_i^a(E) + F_i\left(E, \overline{G}_i\right) - \varsigma_i \\ &= C(E, 0, 0, 1, \bullet, \bullet, E), \end{aligned}$$

which verifies the desired inequality. Consider next state $1rn \in \mathcal{C}_+$. This means that E is in range 1, $D^f = D^{fw} = 0$, $D^w = 1$, $E^{r,f}$ and $E^{r,wf}$ are undefined, and $E^{r,w} = E$. By Lemma 5, $\overline{G}_i + F_i\left(E, \overline{G}_i\right) \geq G_i^a(E) + F_i(E, G_i^a(E))$ for all E in range 1,[19]

$$\begin{aligned} C_i^j(E, 0, 1, 0, \bullet, E, \bullet) &= T_i(E) - \mu_i + \overline{G}_i + F_i\left(E, \overline{G}_i\right) - \phi_i \\ &\geq T_i(E) - \mu_i + G_i^a(E) + F_i\left(E, \overline{G}_i\right) - \phi_i \\ &= C_i^a(E, 0, 1, 0, \bullet, E, \bullet), \end{aligned}$$

which verifies the desired inequality. Consider next a septuplet obeying $s_i(E, \mathbf{D}, \mathbf{E}^r) \in \mathcal{C}_-$. Consider first state $0rr \in \mathcal{C}_-$. This means that $D^f = D^w = 0$, $D^{wf} = 1$, $E^{r,f}$ and $E^{r,w}$ are undefined, and $E^{r,wf} = E = 0$. Because $\eta_i^j \geq \eta_i^a$ (Assumption 5),

$$C_i^j(0, 0, 0, 1, \bullet, \bullet, 0) = \overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i - \eta_i^j \leq \overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i - \eta_i^a = C_i^a(0, 0, 0, 1, \bullet, \bullet, 0),$$

[17] Remark that $\underline{E}_i^f$ could fall in range 1 or in range 2. Cataloguing all the possible cases, as done in Lemma 2 with reference to welfare alone, would be very lengthy but not insightful. Besides $\underline{E}_i^f$ we would also have to introduce $\overline{E}_i^f$, that is, the level of earnings at which FS transfers are exhausted. However, the logic of the proof is exactly the same as that of the proof of Lemma 2.

[18] There are earning levels in range 1 such that a woman is ineligible for the combined FS plus welfare assistance under AFDC. Thus, this comparison is meaningful only for earnings that are below the more stringent eligibility threshold; above such threshold state $1rr$ is ruled out under AFDC.

[19] There are earning levels in range 1 such that a woman is ineligible for the combined FS plus welfare assistance under AFDC. Thus, this comparison is meaningful only for earnings that are below the more stringent eligibility threshold; above such threshold state $1rr$ is ruled out under AFDC.

which verifies the desired inequality. Consider next state $0rn \in \mathcal{C}_-$. This means that $D^f = D^{wf} = 0$, $D^w = 1$, $E^{r,f}$ and $E^{r,fw}$ are undefined, and $E^{r,w} = E = 0$. Because $\eta_i^j \geq \eta_i^a$ (Assumption 5),

$$C_i^j(0,0,1,0,\bullet,0,\bullet) = \overline{G}_i + F_i\left(\overline{G}_i\right) - \phi_i - \eta_i^j \leq \overline{G}_i + F_i\left(\overline{G}_i\right) - \phi_i - \eta_i^a = C_i^a(0,0,1,0,\bullet,0,\bullet),$$

which verifies the desired inequality. Finally, consider a septuplet obeying $s_i(E, \mathbf{D}, \mathbf{E}^r) \in \mathcal{C}_0$. If $s_i(E, \mathbf{D}, \mathbf{E}^r) \in \{0nn, 1nn, 1nn, 0nr, 1nr, 2nr\}$, consumption is unaffected by the regime because the FS-only rules are the same for both regimes (Definition 2). It is either zero or $T_i(E) - \mu_i$ or $T_i(E) - \mu_i + F_i(E, 0) - \lambda_i$. If $s_i(E, \mathbf{D}, \mathbf{E}^r) \in \{1nu, 2nu\}$, consumption is unaffected by the regime because the FS-only rules are the same for both regimes and optimal under-reporting yields a transfer of $\overline{F}_i$ under either regime (Lemma 8). It is $T_i(E) - \mu_i + \overline{F}_i - \lambda_i - \omega_i$. If $s_i(E, \mathbf{D}, \mathbf{E}^r) \in \{1uu, 2uu\}$, consumption is unaffected by the regime because optimal under-reporting yields a transfer of $\overline{G}_i + F_i\left(\overline{G}_i\right)$ under either regime (Lemma 8). It is $T_i(E) - \mu_i + \overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i - \gamma_i$. If $s_i(E, \mathbf{D}, \mathbf{E}^r) \in \{1un, 2un\}$, consumption is unaffected by the regime because optimal under-reporting yields a transfer of $\overline{G}_i$ under either regime (Lemma 8). It is $T_i(E) - \mu_i + \overline{G}_i - \phi_i - \kappa_i$. $\square$

Main Propositions For convenience we reproduce here the matrix Π of response probabilities that is referenced below in Propositions 4 and 5. The notation $0_{(k)}$ with $k \in \{1, 2, 3, 4, 5, 6\}$ is used to represent a zero entry for convenient referencing within Proposition 4. The notation K with $K \in \{X, Z, W, X', Z', W'\}$ is used to represent a non zero and non unitary entry for convenient referencing within Proposition 5.

	Earnings / Program Participation State under JF															
AFDC	0nn	1nn	2nn	0nr	1nr	2nr	1nu	2nu	0rn	1rn	1un	2un	0rr	1rr	1uu	2uu
0nn	X'	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$
1nn	$0_{(1)}$	X'	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$
2nn	$0_{(1)}$	$0_{(1)}$	X'	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$
0nr	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X'	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$
1nr	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X'	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$
2nr	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X'	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$
1nu	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X'	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$
2nu	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X'	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$
0rn	Z	$0_{(3)}$	Z	Z	$0_{(3)}$	Z	$0_{(3)}$	Z	Z'	Z	$0_{(2)}$	Z	$0_{(4)}$	Z	$0_{(2)}$	Z
1rn	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	W	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	W'	$0_{(2)}$	$0_{(1)}$
1un	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	W	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	W'	$0_{(2)}$	$0_{(1)}$
2un	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	X'	$0_{(1)}$	X	$0_{(2)}$	$0_{(1)}$
0rr	Z	$0_{(3)}$	Z	Z	$0_{(3)}$	Z	$0_{(3)}$	Z	$0_{(4)}$	Z	$0_{(2)}$	Z	Z'	Z	$0_{(2)}$	Z
1rr	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(5)}$	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	1	$0_{(2)}$	$0_{(1)}$
1uu	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(6)}$	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	1	$0_{(2)}$	$0_{(1)}$
2uu	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(1)}$	$0_{(6)}$	$0_{(2)}$	$0_{(1)}$	$0_{(1)}$	X	$0_{(2)}$	X'

Proposition 4. *Given Assumptions 1, 4, 5, and 6, the responses corresponding to the zero entries of matrix* Π *cannot occur and the response probabilities corresponding to unitary entries must occur.*

Proof. We begin with the zero entries denoted $0_{(2)}$. States $1uu$ and $1un$ are unpopulated under j (Lemma 8). Therefore $\pi_{s^a,1uu} = \pi_{s^a,1un} = 0$ for any $s_a \in \mathcal{S}$. Next, consider the zero entries denoted $0_{(1)}$. Consider any (s_a, s_j) in the collection

$$\{(s_a, s_j) : s_a \in \mathcal{C}_+ \cup \mathcal{C}_0, s_j \in \mathcal{C}_- \cup \mathcal{C}_0, s_a \neq s_j\}. \tag{68}$$

Observe that that properties I-III) of Lemma 3 are met. Property I) holds trivially and properties II-III) hold by Lemma 9. Thus, by Lemma 3 and 9, the response probability π_{s^a,s^j} for any (s_a, s_j) in collection (68) equals zero. Next, consider the zero entries denoted $0_{(3)}$. We now show that $\pi_{0rr,1nn} = 0$, $\pi_{0rr,1nr} = 0$, $\pi_{0rr,1nu} = 0$, $\pi_{0rn,1nn} = 0$, $\pi_{0rn,1nr} = 0$, and $\pi_{0rn,1nu} = 0$. We start by showing that $\pi_{0rr,1nn} = 0$. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $0rr$ under a and selects an allocation compatible with state $1nn$ under j, entailing earnings O_i^k. By Assumption 6, her choice under a reveals that $U_i\left(0, \overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i - \eta_i^a\right) \geq U_i(0,0)$ which implies $\overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i \geq \eta_i^a$. Her choice under j reveals that $U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i\right) \geq U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + \overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i\right)$ which implies $\overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i \leq 0$. Thus, $0 \leq \eta_i^a \leq \overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i \leq 0$ (Assumption 5). If $\eta_i^a > 0$ or $\eta_i^a = 0$ and $\overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i \neq 0$, a contradiction ensues. If $\eta_i^a = 0$ and $\overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i = 0$ an indifference condition ensues and Lemma 4 leads to a contradiction. We now show that $\pi_{0rr,1nr} = 0$. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $0rr$ under a and selects an allocation compatible with state $1nr$ under j, entailing earnings O_i^k. By Assumption 6, her choice under a reveals that $U\left(0, \overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i - \eta_i^a\right) \geq U\left(0, \overline{F}_i - \lambda_i\right)$ which implies $\overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i \geq \eta_i^a + \overline{F}_i - \lambda_i$. Her choice under j reveals that $U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + F_i\left(O_i^k\right) - \lambda_i\right) \geq U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + \overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i\right)$ which implies $\overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i \leq F_i\left(O_i^k\right) - \lambda_i$. Thus, $0 \leq \eta_i^a + \overline{F}_i - \lambda_i \leq \overline{G}_i + F_i\left(\overline{G}_i\right) - \varsigma_i \leq F_i\left(O_i^k\right) - \lambda_i$ which implies $\eta_i^a \leq F_i\left(O_i^k\right) - \overline{F}_i$. This is a contradiction because $\eta_i^a \geq 0$ (Assumption 5) and $F_i\left(O_i^k\right) < \overline{F}_i$. We now show that $\pi_{0rr,1nu} = 0$. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $0rr$ under a and selects an allocation compatible with state $1nu$ under j, entailing earnings O_i^k. By Assumption 6, her choice under a reveals that $U\left(0, \overline{G}_i + F_i\left(\overline{G}_i\right) - \zeta_i - \eta_i^a\right) \geq U\left(0, \overline{F}_i - \lambda_i\right)$ which implies $\overline{G}_i + F_i\left(\overline{G}_i\right) - \zeta_i \geq \eta_i^a + \overline{F}_i - \lambda_i$. Her choice under j reveals that $U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + F_i\left(O_i^k\right) - \lambda_i - \omega_i\right) \geq U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + \overline{G}_i + F_i\left(\overline{G}_i\right) - \zeta_i\right)$ which implies $\overline{G}_i + F_i\left(\overline{G}_i\right) - \zeta_i \leq F_i\left(O_i^k\right) - \lambda_i - \omega_i$. Thus, $0 \leq \eta_i^a + \overline{F}_i - \lambda_i \leq \overline{G}_i + F_i\left(\overline{G}_i\right) - \zeta_i \leq F_i\left(O_i^k\right) - \lambda_i - \omega_i$ which implies $\eta_i^a + \omega_i \leq F_i\left(O_i^k\right) - \overline{F}_i$. This is a contradiction because $\eta_i^a + \omega_i \geq 0$ (Assumption 5) and $F_i\left(O_i^k\right) < \overline{F}_i$. We now show that $\pi_{0rn,1nn} = 0$. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $0rn$ under a and selects an allocation compatible with state $1nn$ under j, entailing earnings O_i^k. By Assumption 6, her choice under a reveals that $U_i\left(0, \overline{G}_i - \phi_i - \eta_i^a\right) \geq U_i(0,0)$ which implies $\overline{G}_i - \phi_i \geq \eta_i^a$. Her choice under j reveals that $U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i\right) \geq U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + \overline{G}_i - \phi_i\right)$ which implies $\overline{G}_i - \phi_i \leq 0$. Thus, $0 \leq \eta_i^a \leq \overline{G}_i - \phi_i \leq 0$ (Assumption 5). If $\eta_i^a > 0$ or $\eta_i^a = 0$ and $\overline{G}_i - \phi_i \neq 0$, a contradiction ensues. If $\eta_i^a = 0$ and $\overline{G}_i - \phi_i = 0$ an indifference condition ensues and Lemma 4 leads to a contradiction. We now show that $\pi_{0rn,1nr} = 0$. The proof is by contradiction. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $0rn$ under a and selects an allocation compatible with state $1nr$ under j, entailing earnings O_i^k. By Assumption 6, her choice under a reveals that $U\left(0, \overline{G}_i - \phi_i - \eta_i^a\right) \geq U\left(0, \overline{F}_i - \lambda_i\right)$ which implies $\overline{G}_i - \phi_i \geq \eta_i^a + \overline{F}_i - \lambda_i$. Her choice under j reveals that $U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + F_i\left(O_i^k\right) - \lambda_i\right) \geq U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + \overline{G}_i - \phi_i\right)$ which implies $\overline{G}_i - \phi_i \leq F_i\left(O_i^k\right) - \lambda_i$. Thus, $0 \leq \eta_i^a + \overline{F}_i - \lambda_i \leq \overline{G}_i - \phi_i \leq F_i\left(O_i^k\right) - \lambda_i$ which implies $\eta_i^a \leq F_i\left(O_i^k\right) - \overline{F}_i$. This is a contradiction because $\eta_i^a \geq 0$ (Assumption 5) and $F_i\left(O_i^k\right) < \overline{F}_i$. We now show that $\pi_{0rn,1nu} = 0$. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $0rn$ under a and selects an allocation compatible with state $1nu$ under j, entailing earnings O_i^k. By Assumption 6, her choice under a reveals that $U\left(0, \overline{G}_i - \phi_i - \eta_i^a\right) \geq U\left(0, \overline{F}_i - \lambda_i\right)$ which implies $\overline{G}_i - \phi_i \geq \eta_i^a + \overline{F}_i - \lambda_i$. Her choice under j reveals that $U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + F_i\left(O_i^k\right) - \lambda_i - \omega_i\right) \geq U_i\left(O_i^k, T_i\left(O_i^k\right) - \mu_i + \overline{G}_i - \phi_i\right)$ which implies $\overline{G}_i - \phi_i \leq F_i\left(O_i^k\right) - \lambda_i - \omega_i$. Thus, $0 \leq \eta_i^a + \overline{F}_i - \lambda_i \leq \overline{G}_i - \phi_i \leq F_i\left(O_i^k\right) - \lambda_i - \omega_i$ which implies $\eta_i^a + \omega_i \leq F_i\left(O_i^k\right) - \overline{F}_i$. This is a contradiction because $\eta_i^a + \omega_i \geq 0$ (Assumption 5) and $F_i\left(O_i^k\right) < \overline{F}_i$. Next, consider the zero entries denoted $0_{(4)}$. We now show that

$\pi_{0rn,0rr}=0$, $\pi_{0rr,0rn}=0$. We start by showing that $\pi_{0rn,0rr}=0$. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $0rn$ under a and selects an allocation compatible with state $0rr$ under j. By Assumption 6, her choice under a reveals that $U_i\left(0,\overline{G}_i+F_i\left(\overline{G}_i\right)-\varsigma_i-\eta_i^a\right)\geq U_i\left(0,\overline{G}_i-\phi_i-\eta_i^a\right)$ which implies $F_i\left(\overline{G}_i\right)\geq\varsigma_i-\phi_i$. Her choice under j reveals that $U_i\left(0,\overline{G}_i-\phi_i-\eta_i^j\right)\geq U_i\left(0,\overline{G}_i+F_i\left(\overline{G}_i\right)-\varsigma_i-\eta_i^j\right)$ which implies $F_i\left(\overline{G}_i\right)\leq\varsigma_i-\phi_i$. Thus, $\varsigma_i-\phi_i\leq F_i\left(\overline{G}_i\right)\leq\varsigma_i-\phi_i$. If $F_i\left(\overline{G}_i\right)\neq\varsigma_i-\phi_i$ we have a contradiction. If $F_i\left(\overline{G}_i\right)=\varsigma_i-\phi_i$, the woman is indifferent between the allocations compatible with states $0rn$ and $0rr$ under both a and j. If however she did not choose the allocations compatible with state $0rn$ under a then she will make the same choice under j (Assumption 4), which implies a contradiction. The proof that $\pi_{0rr,0rn}=0$ is symmetrical. Next, consider the zero entry denoted $0_{(5)}$. We now show that $\pi_{1rr,1rn}=0$. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $1rr$ under a, entailing earnings O_i^k, and selects an allocation compatible with state $1rn$ under j, entailing earnings O_i^l. By Assumption 6, her choice under a reveals that $U_i\left(O_i^k,T_i\left(O_i^k\right)-\mu_i+G_i^a\left(O_i^k\right)+F_i\left(O_i^k,G_i^a\left(O_i^k\right)\right)-\varsigma_i\right)\geq U_i\left(O_i^k,T_i\left(O_i^k\right)-\mu_i+G_i^a\left(O_i^k\right)-\phi_i\right)$ which implies $F_i\left(O_i^k,G_i^a\left(O_i^k\right)\right)\geq\varsigma_i-\phi_i$. Her choice under j reveals that $U_i\left(O_i^l,T_i\left(O_i^l\right)-\mu_i+\overline{G}_i-\phi_i\right)\geq U_i\left(O_i^l,T_i\left(O_i^l\right)-\mu_i+\overline{G}_i+F_i\left(\overline{G}_i\right)-\varsigma_i\right)$ which implies $F_i\left(\overline{G}_i\right)\leq\varsigma_i-\phi_i$. Thus, $F_i\left(\overline{G}_i\right)\leq\varsigma_i-\phi_i\leq F_i\left(O_i^l,G_i^a\left(O_i^l\right)\right)$ which is a contradiction by Lemma 5. Next, consider the zero entry denoted $0_{(6)}$. We show that $\pi_{1uu,1rn}=0$ and $\pi_{2uu,1rn}=0$. We start with $\pi_{1uu,1rn}$. The proof is by contradiction. Suppose there is a woman i who selects an allocation compatible with state $1uu$ under a, entailing earnings O_i^k, and selects an allocation compatible with state $1rn$ under j, entailing earnings O_i^l. By Assumption 6, her choice under a reveals that $U_i\left(O_i^k,T_i\left(O_i^k\right)-\mu_i+\overline{G}_i+F_i\left(\overline{G}_i\right)-\varsigma_i-\gamma_i\right)\geq U_i\left(O_i^k,T_i\left(O_i^k\right)-\mu_i+\overline{G}_i-\phi_i-\kappa_i\right)$ which implies $F_i\left(\overline{G}_i\right)\geq\varsigma_i-\phi_i+\gamma_i-\kappa_i$. Her choice under j reveals that $U_i\left(O_i^l,T_i\left(O_i^l\right)-\mu_i+\overline{G}_i-\phi_i\right)\geq U_i\left(O_i^l,T_i\left(O_i^l\right)-\mu_i+\overline{G}_i+F_i\left(\overline{G}_i\right)-\varsigma_i\right)$ which implies $F_i\left(\overline{G}_i\right)\leq\varsigma_i-\phi_i$. Thus, $\varsigma_i-\phi_i+\gamma_i-\kappa_i\leq F_i\left(\overline{G}_i\right)\leq\varsigma_i-\phi_i$. This is a contradiction because[20] $\gamma_i>\kappa_i$ (Assumption 5). The proof that $\pi_{2uu,1rn}$ is identical.

Turning to the unitary entries, by Lemma 7, the allowable states are given by $\mathcal{S}$. Hence, each row of matrix Π must sum to one. Therefore, $\pi_{1uu,1rr}=1$ and $\pi_{1rr,1rr}=1$. □

Proposition 5. *Given Assumptions 1, 4, 5, and 6, the "free" response probabilities in matrix* Π *given by* π_{s^a,s^j} *for all* (s_a,s_j) *in the three collections:*

$$\mathcal{C}_X\equiv\left\{\left(s^a,s^j\right):s^a\in\{0nn,0nr,1nn,1nr,1nu,2nn,2nr,2nu,2un,2uu\},s^j\in\{1rn,1rr\}\right\},$$

$$\mathcal{C}_Z\equiv\left\{\left(s^a,s^j\right):s^a\in\{0rn,0rr\},s^j\in\{0nn,0nr,2nn,2nr,1rn,1rr,2un,2uu\}\right\},$$

$$\mathcal{C}_W\equiv\left\{\left(s^a,s^j\right):s^a\in\{1rn,1un\},s^j\in\{1rn,1rr\}\right\}.$$

are unrestricted, meaning that they need not equal zero or one.

Proof. Coming soon. □

Proposition 6. *The matrix* Π *of response probabilities over the states in* $\mathcal{S}$ *(Definition 19), reduces to the following matrix* Π_w *of response probabilities over the states in* $\mathcal{S}_w$ *(Definition 22):*

[20] If we do not assume that $\gamma_i>\kappa_i$ then we cannot rule out this pairing and we do not have $0_{(6)}$.

	Earnings / Program Participation State under JF						
AFDC	*0n*	*1n*	*2n*	*0r*	*1r*	*1u*	*2u*
0n	$1-\pi_{0n,1r}$	*0*	*0*	*0*	$\pi_{0n,1r}$	*0*	*0*
1n	*0*	$1-\pi_{1n,1r}$	*0*	*0*	$\pi_{1n,1r}$	*0*	*0*
2n	*0*	*0*	$1-\pi_{0n,1r}$	*0*	$\pi_{2n,1r}$	*0*	*0*
0r	$\pi_{0r,0n}$	*0*	$\pi_{0r,2n}$	$1-\pi_{0r,0n}-\pi_{0r,2n}-\pi_{0r,1r}-\pi_{0r,2u}$	$\pi_{0r,1r}$	*0*	$\pi_{0r,2u}$
1r	*0*	*0*	*0*	*0*	*1*	*0*	*0*
1u	*0*	*0*	*0*	*0*	*1*	*0*	*0*
2u	*0*	*0*	*0*	*0*	$\pi_{2u,1r}$	*0*	$1-\pi_{2u,1r}$

where

$$\begin{aligned}
\pi_{0n,1r} &\equiv (\pi_{0nn,1rn}+\pi_{0nn,1rr})\frac{q^a_{0nn}}{p^a_{0n}}+(\pi_{0nr,1rn}+\pi_{0nr,1rr})\frac{p^a_{0n}-q^a_{0nn}}{p^a_{0n}},\\
\pi_{1n,1r} &\equiv (\pi_{1nn,1rn}+\pi_{1nn,1rr})\frac{q^a_{1nn}}{p^a_{1n}}+(\pi_{1nr,1rn}+\pi_{1nr,1rr})\frac{q^a_{1nr}}{p^a_{1n}}+(\pi_{1nu,1nn}+\pi_{1nu,1rr})\frac{p^a_{1n}-q^a_{1nn}-q^a_{1nr}}{p^a_{1n}},\\
\pi_{2n,1r} &\equiv (\pi_{2nn,1rn}+\pi_{2nn,1rr})\frac{q^a_{2nn}}{p^a_{2n}}+(\pi_{2nr,1rn}+\pi_{2nr,1rr})\frac{q^a_{2nr}}{p^a_{2n}}+(\pi_{2nu,1nn}+\pi_{2nu,1rr})\frac{p^a_{2n}-q^a_{2nn}-q^a_{2nr}}{p^a_{2n}},\\
\pi_{0r,0n} &\equiv (\pi_{0rn,0nn}+\pi_{0rn,0nr})\frac{q^a_{0rn}}{p^a_{0r}}+(\pi_{0rr,0nn}+\pi_{0rr,0nr})\frac{p^a_{0r}-q^a_{0rn}}{p^a_{0r}},\\
\pi_{0r,2n} &\equiv (\pi_{0rn,2nn}+\pi_{0rn,2nr}+\pi_{0rn,2nu})\frac{q^a_{0rn}}{p^a_{0r}}+(\pi_{0rr,2nn}+\pi_{0rr,2nr}+\pi_{0rr,2nu})\frac{p^a_{0r}-q^a_{0rn}}{p^a_{0r}},\\
\pi_{0r,1r} &\equiv (\pi_{0rn,1rn}+\pi_{0rn,1rr})\frac{q^a_{0rn}}{p^a_{0r}}+(\pi_{0rr,1rn}+\pi_{0rr,1rr})\frac{p^a_{0r}-q^a_{0rn}}{p^a_{0r}},\\
\pi_{0r,2u} &\equiv (\pi_{0rn,2un}+\pi_{0rn,2uu})\frac{q^a_{0rn}}{p^a_{0r}}+(\pi_{0rr,2un}+\pi_{0rr,2uu})\frac{p^a_{0r}-q^a_{0rn}}{p^a_{0r}},\\
\pi_{2u,1r} &\equiv (\pi_{2un,1rn}+\pi_{2un,1rr})\frac{q^a_{2un}}{p^a_{2u}}+\pi_{2uu,1rr}\frac{p^a_{2u}-q^a_{2un}}{p^a_{2u}}.
\end{aligned}$$

Proof. The response probabilities over the states in $\mathcal{S}_w$ are of the form:

$$\pi_{s^a_w,s^j_w}\equiv\Pr\left(S^j_{w,i}=s^j_w|S^a_{w,i}=s^a_w\right)=\sum_{s^j\in\mathcal{S}:s^j_w=w(s^j)}\left[\sum_{s^a\in\mathcal{S}:s^a_w=w(s^a)}\Pr\left(S^j_i=s^j|S^a_i=s^a\right)\frac{q^a_{s^a}}{p^a_{s^a_w}}\right].$$

□

Remark. The response matrix implied by the model with only welfare assistance has the same zero and unitary entries as the response matrix Π_w implied by the model with welfare assistance, FS assistance, and taxes.

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Table A1: Cross Tabulation of grant-inferred AU size and kidcount

	kidcount				
	0	1	2	3	Total
Inferred AU Size					
1	0.17	0.08	0.04	0.01	0.05
2	0.53	0.84	0.19	0.06	0.42
3	0.17	0.06	0.72	0.17	0.29
4	0.11	0.01	0.05	0.53	0.17
5	0.00	0.00	0.00	0.14	0.04
6	0.00	0.00	0.00	0.01	0.00
7	0.03	0.00	0.00	0.07	0.02
8	0.00	0.00	0.00	0.00	0.00
# of monthly observations	840	11,361	8,463	8,043	28,707

Notes: Analysis conducted on Jobs First sample over quarters 1-7 post-random assignment. Kidcount variable, which gives the number of children reported in baseline survey, is tabulated conditional on non-missing. The AU size is inferred from (rounded) monthly grant amounts. Starting with AU size 5, the unique correspondence between AU size and rounded grant amount obtains only for units which do not receive housing subsidies. The size inferred during months on assistance is imputed forward to months off assistance and to months that otherwise lack an inferred size.

Table A2: Mean Outcomes Post-Random Assignment

	Overall			Zero Earnings Q7 pre-RA			Positive Earnings Q7 pre-RA		
	Jobs First	AFDC	Adjusted Difference	Jobs First	AFDC	Adjusted Difference	Jobs First	AFDC	Adjusted Difference
Average Earnings	1,191	1,086	**105**	930	751	**179**	1766	1831	**-65**
	(29)	(30)	**(36)**	(32)	(30)	**(42)**	(65)	(65)	**(84)**
Fraction of quarters with positive earnings	0.520	0.440	**0.080**	0.445	0.349	**0.096**	0.686	0.647	**0.039**
	(0.008)	(0.007)	**(0.010)**	(0.009)	(0.009)	**(0.012)**	(0.013)	(0.013)	**(0.017)**
Fraction of quarters with earnings below 3FPL (AU size implied by kidcount+1)	0.906	0.897	**0.009**	0.938	0.940	**-0.002**	0.837	0.803	**0.034**
	(0.007)	(0.007)	**(0.009)**	(0.008)	(0.008)	**(0.010)**	(0.011)	(0.011)	**(0.014)**
Fraction of quarters on welfare	0.748	0.674	**0.074**	0.771	0.718	**0.053**	0.699	0.577	**0.122**
	(0.007)	(0.007)	**(0.010)**	(0.008)	(0.008)	**(0.011)**	(0.014)	(0.015)	**(0.019)**
Average earnings in quarters with any month on welfare	929	526	**403**	762	404	**359**	1316	869	**448**
	(24)	(19)	**(28)**	(25)	(18)	**(30)**	(53)	(43)	**(64)**
Fraction of quarters with no earnings and at least one month on welfare	0.363	0.437	**-0.074**	0.426	0.508	**-0.082**	0.227	0.272	**-0.045**
	(0.007)	(0.007)	**(0.010)**	(0.009)	(0.009)	**(0.012)**	(0.011)	(0.012)	**(0.016)**
# of cases	2,318	2,324		1,630	1,574		688	750	

Notes: Sample covers quarters 1-7 post-random assignment. Sample units with kidcount missing are excluded. Adjusted differences are computed via propensity score reweighting. Numbers in parentheses are standard errors calculated via 1,000 block bootstrap replications (resampling at case level).

Table A3: Probability of Earnings / Participation States in AFDC Sample (Conditional on State=0p in Quarter Prior to Random Assignment)

Quarter post-RA:	1	2	3	4	5	6	7
Pr(State=0n)	0.022	0.062	0.086	0.093	0.114	0.136	0.136
Pr(State=1n)	0.021	0.045	0.058	0.079	0.084	0.101	0.112
Pr(State=2n)	0.006	0.021	0.024	0.033	0.048	0.044	0.074
Pr(State=0p)	0.786	0.723	0.675	0.631	0.584	0.563	0.539
Pr(State=1p)	0.160	0.160	0.145	0.160	0.157	0.150	0.143
Pr(State=2p)	0.002	0.001	0.004	0.004	0.004	0.002	0.005

Notes: Sample consists of 902 AFDC cases that were not working in the quarter prior to random assignment and were on welfare. Sample units with kidcount missing are excluded. Numbers give the reweighted fraction of sample in specified quarter after random assignment occupying each earnings / welfare paticipation state. Number of state refers to earnings level, with 0 indicating no earnings, 1 indicating earnings below 3 times the monthly FPL, and 2 indicating earnings above 3FPL. The letter n indicates welfare nonparticipation throughout the quarter while the letter p indicates welfare participation throughout the quarter. Poverty line computed under assumption AU size is one greater than amount implied by baseline kidcount variable. Probabilities are adjusted via the propensity score reweighting algorithm described in the Appendix.

Table A4: Allowed and Disallowed Responses when Truthful Reporting of Earnings above FPL is Possible under AFDC

State under AFDC	State under Jobs First: 0n	1n	2n	0r	1r	1u	2u	2r
0n	No Response	—	—	—	Extensive LS (+) Take Up Welfare	—	—	—
1n	—	No Response	—	—	Intensive LS (+/0/-) Take Up Welfare	—	—	—
2n	—	—	No Response	—	Intensive LS (-) Take Up Welfare	—	—	—
0r	No LS Response Exit Welfare	—	Extensive LS (+) Exit Welfare	No Response	Extensive LS (+)	—	Extensive LS (+) Under-reporting (Figure 5 (b))	—
1r	—	—	—	—	Intensive LS (+/0/-)	—	—	—
1u	—	—	—	—	Intensive LS (+/0/-) Truthful Reporting	—	—	—
2u	—	—	—	—	Intensive LS (-) Truthful Reporting (Figure 5 (a))	—	No Response	—
2r	Extensive LS (-) Exit Welfare	—	Intensive LS (+/0/-) Exit Welfare	Extensive LS (-)	Intensive LS (-)	—	Intensive LS (+/0/-) Under-reporting	—

Notes: This table catalogues the theoretically allowed response margins given the states that a woman may occupy under AFDC and Jobs First when truthful reporting of earnings above the FPL is possible under AFDC. A state is a pair of coarsened earnings (0 stands for zero earnings, 1 for positive earnings at or below the FPL, and 2 for earnings strictly above the FPL), and participation in the welfare assistance program along with an earnings reporting decision (n stands for "not on assistance", r for "on assistance and truthfully reporting earnings", and u for "on assistance and under-reporting earnings"). The cells containing a "—" represent responses that are either incompatible with the policy rules or not allowed based on revealed preference arguments derived from the nonparametric model of Section 4. Specifically, (a) a woman will not leave a state at least as attractive under JF as under AFDC for a state that is no more attractive under JF than under AFDC ("—" in cells with a solid greyed-out background fill), (b) state 1u is unpopulated under JF ("—" in cells with a horizontally striped background fill), (c) a woman will not pair state 0r under AFDC with state 1n under JF ("—" in cells with a vertically striped background fill), (d) a woman will not pair state 2r under AFDC with state 1n under JF ("—" in cells with a diagonally striped background fill), and (e) state 2r is not defined under JF ("—" in cells with gridded background fill). The remaining cells represent responses that are allowed by the model. Their content summarizes the three possible margins of responses: (a) the labor supply "LS" response (intensive versus extensive and its sign: "+" for increase, "0" for no change, and "-" for decrease), (b) the program participation response (take up of versus exit from welfare assistance), and (c) the reporting of earnings to the welfare agency margin (to truthfully report versus to under-report). When the state that a woman occupies under AFDC and Jobs First is the same, no response occurs along any of these three margins. See Appendix for proof.

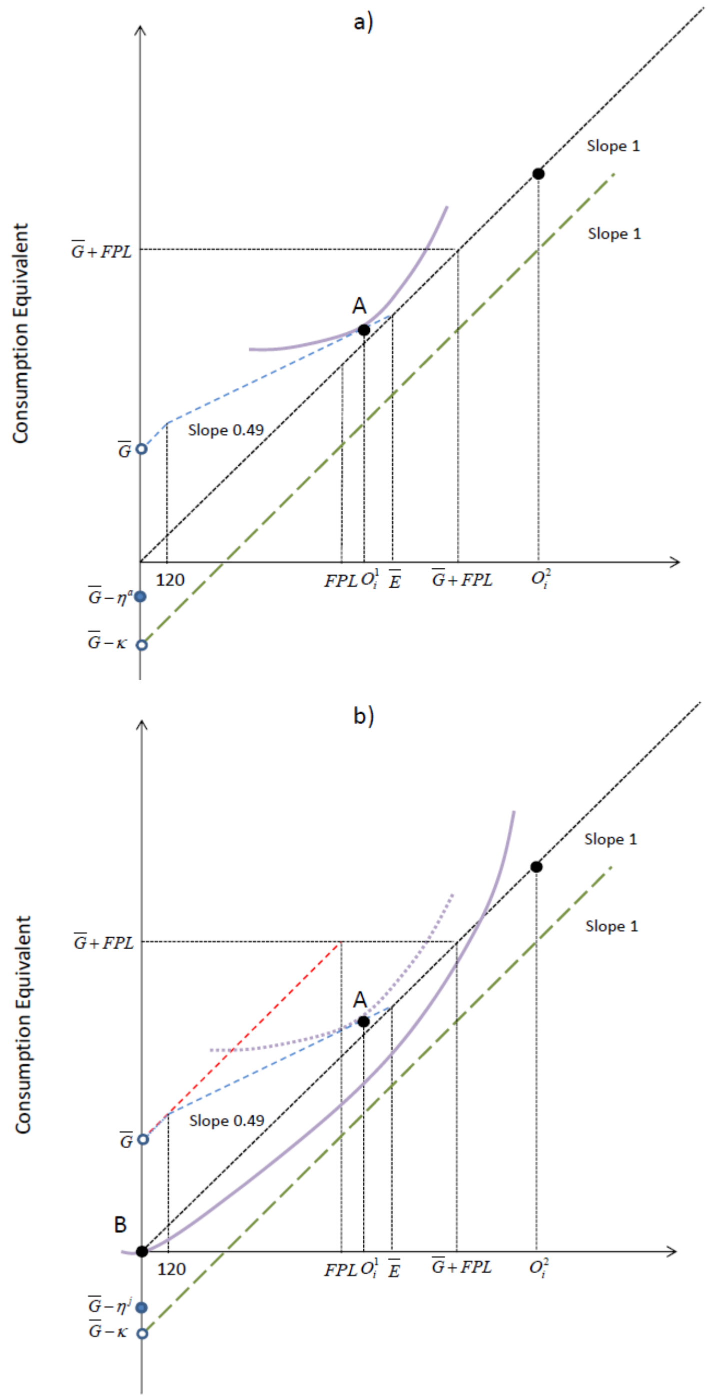
Table A5: Allowed and Disallowed Responses when Incorporating FS and Taxes

State under Jobs First

State under AFDC	0nn	1nn	2nn	0nr	1nr	2nr	1nu	2nu	0rn	1rn	1un	2un	0rr	1rr	1uu	2uu
0nn	No Response	—	—	—	—	—	—	—	—	Extensive LS (+) Take Up Welfare	—	—	—	Extensive LS (+) Take Up Welfare and FS	—	—
1nn	—	No Response	—	—	—	—	—	—	—	Intensive LS (+/0/-) Take Up Welfare	—	—	—	Intensive LS (+/0/-) Take Up Welfare and FS	—	—
2nn	—	—	No Response	—	—	—	—	—	—	Intensive LS (-) Take Up Welfare	—	—	—	Intensive LS (-) Take Up Welfare and FS	—	—
0nr	—	—	—	No Response	—	—	—	—	—	Extensive LS (+) Exit FS, Take Up Welfare	—	—	—	Extensive LS (+) Take Up Welfare	—	—
1nr	—	—	—	—	No Response	—	—	—	—	Intensive LS (+/0/-) Exit FS, Take Up Welfare	—	—	—	Intensive LS (+/0/-) Take Up Welfare	—	—
2nr	—	—	—	—	—	No Response	—	—	—	Intensive LS (-) Exit FS, Take Up Welfare	—	—	—	Intensive LS (-) Take Up Welfare	—	—
1nu	—	—	—	—	—	—	No Response	—	—	Intensive LS (+/0/-) Exit FS, Take Up Welfare	—	—	—	Intensive LS (+/0/-) Exit FS, Take Up Welfare	—	—
2nu	—	—	—	—	—	—	—	No Response	—	Intensive LS (-) Exit FS, Take Up Welfare	—	—	—	Intensive LS (-) Take Up Welfare	—	—
0rn	No LS Response Exit Welfare	—	Extensive LS (+) Exit Welfare	No LS Response Exit Welfare, Take Up FS	—	Extensive LS (+) Exit Welfare, Take Up FS	—	Extensive LS (+) Exit Welfare Take Up FS Under-report	No LS Response Exit Welfare, Take Up FS	Extensive LS (+)	—	Extensive LS (+) Under-report	—	Extensive LS (+) Take Up FS	—	Extensive LS (+) Take Up FS Under-report
1rn	—	—	—	—	—	—	—	—	—	Intensive LS (+/0/-)	—	—	—	Intensive LS (+/0/-) Take Up FS	—	—
1un	—	—	—	—	—	—	—	—	—	Intensive LS (+/0/-) Truthful Report	—	—	—	Intensive LS (+/0/-) Take Up FS Truthful Report	—	—
2un	—	—	—	—	—	—	—	—	—	Intensive LS (-) Truthful Report	—	No Response	—	Intensive LS (-) Take Up FS Truthful Report	—	—
0rr	No LS Response Exit Welfare	—	Extensive LS (+) Exit Welfare and FS	No LS Response Exit Welfare	—	Extensive LS (+) Exit Welfare	—	Extensive LS (+) Exit Welfare Under-report	—	Extensive LS (+) Exit FS	—	Extensive LS (+) Exit FS Under-report	No Response	Extensive LS (+)	—	Extensive LS (+) Under-report
1rr	—	—	—	—	—	—	—	—	—	—	—	—	—	Intensive LS (+/0/-)	—	—
1uu	—	—	—	—	—	—	—	—	—	—	—	—	—	Intensive LS (+/0/-) Truthful Report	—	—
2uu	—	—	—	—	—	—	—	—	—	—	—	—	—	Intensive LS (-) Truthful Report	—	No Response

Notes: This table catalogues the theoretically allowed response margins given the states that a woman may occupy under AFDC and Jobs First in the extended model, that is, when FS and taxes (federal income tax, EITC, payroll and Medicaid taxes) are incorporated. A state is a triplet of coarsened earnings (0 stands for zero earnings, 1 for positive earnings at or below the FPL, and 2 for earnings strictly above the FPL), participation in the welfare assistance program along with an earnings reporting decision (n stands for "not on assistance", r for "on assistance and truthfully reporting earnings", and u for "on assistance and under-reporting earnings"), and participation in the FS assistance program along with an earnings reporting decision (n, r, and u). When both on welfare and FS assistance, a woman makes only one earning report to the welfare agency, hence states such as e.g. 1ru are ruled out and not included in the table. The assumption of a lower bound on stigma rules out states {2rn, 2rr} hence these states are not included in the table. The cells containing a "—" represent responses that are either incompatible with the policy rules or not allowed based on revealed preference arguments derived from the extended model. Specifically, (a) a woman will not leave a state at least as attractive under JF as under AFDC for a state that is no more attractive under JF than under AFDC ("—" in cells with a solid greyed-out background fill); (b) state 1uu is unpopulated under JF ("—" in cells with a horizontally striped background fill); (c) a woman will not pair states {0rn, 0rr} under AFDC with states {1nn, 1nr, 1nu} under JF ("—" in cells with a vertically striped background fill); (d) a woman will not pair state 0rn under AFDC with state 0rr under JF and viceversa ("—" in cells with a diagonally gridded background fill); (e) a woman will not pair state 1rr under AFDC with state 1rn under JF ("—" in cells with a gridded background fill); (f) a woman will not pair states {1uu,2uu} under AFDC with state 1rn under JF ("—" in cells with a right slanted background fill). The remaining cells represent responses that are allowed by the model. Their content summarizes the three possible margins of responses: (a) the labor supply "LS" response (intensive versus extensive and its sign: "+" for increase, "0" for no change, and "-" for decrease), (b) the program participation response (take up of versus exit from welfare assistance and/or FS assistance), and (c) the reporting of earnings to the welfare agency margin (to truthfully report versus to under-report). When the state that a woman occupies under AFDC and Jobs First is the same, no response occurs along any of these three margins. See Appendix for proof.

Figure A1: Earnings and Participation Choices with Earning Constraints and no Stigma



Notes: Panels (a) and (b) are drawn in the earnings (horizontal axis) and equivalent consumption (vertical axis) plane. Equivalent consumption equals earnings plus transfer income from welfare (if any) net of monetized hassle, stigma, work, and under-reporting costs. The welfare stigma and fixed cost of work are set to zero. The cost of under-reporting is set large enough so that under-reporting is a dominated choice. Earnings constraints are imposed in the form of two earnings offers ($O_i^1$and O_i^2), both in range 2 (above the FPL). The horizontal axis displays the same selected earnings levels appearing in Figure 1 but for a situation in which the earnings level at which welfare assistance is exhausted under AFDC ($\overline{E}$) is above the FPL, that is, for a woman who has access to the unreduced fixed ($120) and proportional disregards. It also displays the two earnings offers. Panel (a) depicts a scenario where under AFDC the woman opts to be on assistance earningO_i^1 and truthfully reporting them to the welfare agency (point A). She would make the same choice even in the absence of earnings constraints. Under JF, earning O_i^1 on assistance (and truthfully reporting them) is no longer feasible because welfare eligibility ends at FPL. Panel (b) depicts a scenario where, given the earning constraints, the JF reform induces the woman to exit both welfare and the labor force (point B). However, in the absence of earning constraints, she would choose to lower her earnings below the FPL and remain on assistance as evidenced by the fact that the indifference curve tangent to point A crosses from below the (dashed) JF segment in range 1 (earning levels below FPL).