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BOUNDING THE LABOR SUPPLY RESPONSES TO A RANDOMIZED WELFARE EXPERIMENT:
A REVEALED PREFERENCE APPROACH

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

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ABSTRACT

We study the short-term impact of Connecticut's Jobs First welfare reform experiment on women's labor supply and welfare participation decisions. A non-parametric optimizing model is shown to restrict the set of counterfactual choices compatible with each woman's actual choice. These revealed preference restrictions yield informative bounds on the frequency of several intensive and extensive margin responses to the experiment. We find that welfare reform induced many women to work but led some others to reduce their earnings in order to receive assistance. The bounds on this latter "opt-in" effect imply that intensive margin labor supply responses are non-trivial.

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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). 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.¹ 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), demand side constraints on labor supply may confound the quantitative inferences drawn from bunching approaches (Chetty et al., 2011b).

This paper studies the impact of Connecticut’s Jobs First (JF) welfare reform experiment on the labor supply and program participation decisions of a sample of welfare applicants and recipients. We develop a non-parametric approach to measuring intensive and extensive margin responses to the JF reform 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 follow Manski (2014) in using revealed preference arguments to restrict

¹Heckman (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. (2011a) for an assessment of how macro estimates of these models compare to estimates from micro data.

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 provides an interesting venue for studying labor supply because the reform entailed a mix of positive and negative work incentives characteristic of many transfer programs. First, it strengthened work requirements 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.

Quantifying the frequency of intensive and extensive margin responses to this reform requires additional structure, as the experiment may have shifted women between many points in the earnings distribution, potentially violating the standard “rank preservation” condition needed to infer impact distributions from QTEs.² To narrow down the set of possible responses to the experiment, we develop a non-parametric optimizing model of labor supply and welfare participation. In the model, women value consumption and may derive disutility from welfare participation and work. Labor supply decisions are potentially constrained by the set of job offers drawn; and earnings can, at some cost, be under-reported to the welfare agency, which explains the empirical finding that some women with earnings above the eligibility notch draw welfare benefits. Despite this generality, the model places sharp restrictions on how women may respond to the JF reform that follow from simple revealed preference arguments. Specifically, if the utility of a woman’s choice under AFDC was not lowered by the reform, she will either make the same choice under JF or select an

²Here rank preservation means that the JF reform would not alter a woman’s rank in the distribution of earnings. With this restriction, QTEs can be used to infer the joint distribution of potential earnings under the two policy regimes (Heckman, Smith, and Clements, 1997) and hence to quantify extensive and intensive margin labor supply responses. BGH (2006) are skeptical of the rank preservation assumption and, in a related analysis, provide evidence of rank reversals in the Canadian Self-Sufficiency Project experiment (BGH, 2005). In the JF experiment, rank reversals could occur (for example) because reform induced some skilled women to work and earn above the eligibility notch while leading others to lower their earnings below the notch through an opt-in response.

alternative that the reform made more attractive.

In taking the model to the data, we permit women to vary arbitrarily in their preferences and constraints, which may also evolve over time in an unrestricted fashion. This flexibility allows us to rationalize any distribution of earnings and program participation choices found under a given policy regime.³ Nevertheless, we show that our model places strong testable restrictions on the experimental impacts generated by the JF reform. Specifically, we use the aforementioned revealed preference restrictions to develop analytic bounds on the proportion of women responding along each of nine allowable margins defined by pairings of coarse earnings and program participation categories across policy regimes.

Applying our identification results, we find evidence of substantial intensive and extensive margin responses to reform over the first seven quarters of the experiment. The JF reform incentivized at least 14% of the women who would not have worked to do so and more than 32% of women who would have worked off welfare at low earnings to take up assistance. Importantly, we find that at least 20% of the 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 the reform in fact 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. These findings extend results 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 selection on potential outcome differences, and can easily be adapted to other reforms which alter the value of alternatives in known directions.

We 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. While Manski conducts computational experiments involving a sin-

³This is in contrast to traditional parametric models of labor supply (e.g. Burtless and Hausman, 1978; Hoynes, 1996; Keane and Moffitt, 1998) that can be identified without policy variation. See MaCurdy, Green, and Paarsch (1990) for an early critique of parametrically structured econometric models of labor supply with nonlinear budget sets.

gle tax parameter, we study a reform that changes a bundle of policy features and employ a correspondingly richer model incorporating program participation and reporting decisions. Our additional allowances for labor supply constraints and endogenous wages necessitate the use of policy variation to achieve identification. 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. Finally, Chetty (2012) considers bounds on labor supply elasticities in a class of semi-parametric models with optimization frictions. He too finds evidence of non-trivial intensive margin responsiveness, but relies on strong parametric assumptions.

The remainder of the paper is structured as follows. Section I describes the Jobs First experiment. Section II describes the data from the Jobs First Public Use Files. Section III summarizes the program’s experimental impacts on earnings and provides a test for intensive margin responsiveness. Section IV describes our baseline optimizing model. Section V derives the restrictions implied by revealed preference. Section VI considers some extensions of the baseline model. Section VII studies identification of the probabilities of responding to reform along various margins. Section VIII discusses the computation of bounds on response probabilities and inference issues. Section IX provides our main empirical results and Section X discusses their robustness. Section XI concludes. Technical proofs and additional results are provided in an Online Appendix.

I. The Jobs First Evaluation

With the passage of the Personal Responsibility and Work Opportunity Reconciliation Act in 1996, all fifty states were required to reform their Aid to Families with Dependent Children (AFDC) welfare programs by introducing lifetime time limits, work requirements, and enhanced financial incentives to work while on assistance. The state of Connecticut responded to these changes by implementing the Jobs First 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 JF program with the earlier state AFDC program for low-income single parents with children. Table 1 provides a detailed summary of the JF and AFDC program features, which we now describe in detail.

A. Changes in the Treatment of Earnings

A primary feature of the JF reform was the enhancement of financial incentives to work while on assistance. In the determination of welfare eligibility and grant amounts, Connecticut AFDC recipients faced a fixed earnings disregard of \$120 per month for the twelve months following the first month of employment while on assistance and \$90 per month afterwards (henceforth, the *unreduced* and *reduced* fixed disregards). They also faced a proportional disregard of any additional earnings: 51% for the four months following the first month of employment while on assistance and 27% afterwards (henceforth, the *unreduced* and *reduced* proportional disregards). By contrast, the JF program disregarded 100% of earnings up to the monthly federal poverty line (FPL). This change was meant to incentivize work but also generated 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 poverty line. This created strong incentives for some women to reduce their earnings in order to maintain eligibility for assistance.

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 also varies according to a woman’s history of employment while on assistance (under AFDC only) and the size of a woman’s *assistance unit*, which consists of the woman receiving welfare plus any eligible dependent children.⁴ Letting $\mathbf{1}[\cdot]$ be an indicator for the expression in brackets being true, the regime specific transfer functions can be written:

$$G_i^a(E) = \mathbf{1}[E \leq \bar{E}_i] (\bar{G}_i - \mathbf{1}[E > \delta_i] (E - \delta_i) \tau_i) \quad (1)$$

$$G_i^j(E) = \mathbf{1}[E \leq FPL_i] \bar{G}_i, \quad (2)$$

where $\delta_i \in \{90, 120\}$ and $\tau_i \in \{.73, .49\}$ are the fixed and proportional AFDC earnings disregards, \bar{G}_i is the base grant amount (which is common to JF and AFDC), FPL_i is the federal poverty line, and $\bar{E}_i = \bar{G}_i/\tau_i + \delta_i$ is the so-called AFDC *break-even* earnings level above which a woman becomes ineligible for cash assistance. The i subscripts on \bar{G}_i and FPL_i reflect that these quantities vary with the size of the assistance unit.

Figure 1 provides a stylized depiction of the changes to the cash assistance component of welfare experienced by a woman with two children who, in 1997, would face a base grant

⁴Children are eligible if they are under age eighteen or under age nineteen and in school.

amount of \$543 and a federal poverty line of \$1,111. This woman’s welfare history gives her access only to the reduced fixed and proportional disregards under AFDC. The Figure plots the woman’s disposable income (earned income plus welfare assistance) against her earnings E under AFDC (panel a) and JF (panel b) respectively. Transfers under JF exhibit a large discontinuity at the federal poverty line. By contrast, assistance phases out smoothly under AFDC. For instance, if the woman were to earn \$200 per month, she would receive a welfare transfer that is \$80 (17%) larger under JF than under AFDC. While if she earned \$800 per month, she would receive a transfer that is \$518 (2,098%) larger under JF than under AFDC. Although in Figure 1 the AFDC transfer is fully exhausted at an earnings level \bar{E} that is strictly below the poverty line, 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 poverty line.

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 Food Stamps (FS) program, payroll and Medicaid taxes, and the Earned Income Tax Credit (EITC). The Food Stamps program interacts with welfare assistance both because welfare recipients are categorically eligible for the program and because welfare transfers are treated as income in the determination of the Food Stamps transfer amounts. The JF reform introduced a further link between cash and in-kind assistance: conditional on joint take up, earnings up to the poverty line were disregarded in the determination of both the welfare and the Food Stamps transfers. This feature is clearly visible in Figure 2 – under JF, the combined welfare and FS transfer depends only on whether earnings exceed the poverty line, in which case assistance is denied. Thus, JF’s impact on the Food Stamps program amplifies the notch at the poverty line.⁵

B. *Work Requirements, Sanctions, and Time Limits*

At the time of the reform, Connecticut mandated work requirements for all AFDC recipients except those with a child under age two (who were exempt). AFDC work requirements could be met by paid employment or, in place of employment, by participation in employment-related services. The MDRC final report describes these 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

⁵The EITC and other taxes do not directly interact with cash and in-kind assistance because income from welfare and Food Stamps are not counted in the determination of taxes and tax credits.

one.⁶ Additionally, the JF 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, women could remain on welfare indefinitely under AFDC provided that their children were of eligible age. By contrast, under JF women were limited to a lifetime total of twenty one months of cash assistance. However, months when women were exempt from work requirements did not count towards the lifetime limit and additional exemptions from the time limit were available in some cases (e.g., if the parent was incapacitated or caring for a disabled child). Moreover, six month extensions from the time limit were possible if recipients were deemed to have made a “good faith” effort to find employment. Bloom et al. (2002, p.37) report that “in general, a goodfaith effort was assumed as long as the recipient was not sanctioned more than once and did not quit a job without ‘good cause’ in the final six months of assistance.” There was no limit on the number of six-month extensions a family could receive. 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).

C. *Other Changes*

The JF reform also entailed some minor changes to programs available to women leaving welfare. Under AFDC, recipients were eligible for twelve months of Transitional Child Care subsidies if they left welfare for work, while under JF, cases were eligible for child care subsidies indefinitely provided that their income did not exceed 75% of the state median income. Likewise, under AFDC, assistance units leaving welfare because of increased earnings were eligible for one year of Transitional Medicaid, while under JF, units were eligible for two

⁶Bloom et al. (2002, p.31) note 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.” By contrast, the JF work mandates appear to have been implemented strictly with minimal emphasis on training: “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 up-front job search activities.” (p.11)

years of Medicaid. While these programs could create additional incentives to work, Bloom et al. (2002) argue that these components of the JF reform had little impact on actual access to child- or health care because of contemporaneous state level programs covering essentially the same population.⁷

JF also changed the treatment of income received in the form of child support transfers. Under AFDC, recipients received only the first \$50 of the child support collected by the child support collection agency from the child’s non-custodial father. The amount received was then disregarded in the computation of the welfare grant. Under JF, recipients received a check for the full amount of any child support collected with only the first \$100 disregarded in computing the welfare transfer. These changes may have induced income effects since women whose child support collection was between \$50 and \$100 could enjoy an increased welfare transfer with no change in behavior. However, these income effects are likely negligible given that they only apply to women within this restricted range of child support payments – payments above \$100 were deducted dollar for dollar from benefits – and since the amount of additional income per month was very small.

II. Data and Descriptive Statistics

Before delving into a model of women’s responses to the JF reform, it is useful to first introduce some basic features of the data. Between January of 1996 and February of 1997, MDRC randomly assigned 4,803 welfare recipients and applicants to either an AFDC “control” group or to a JF “experimental” group. Data were collected on these women through the end of 2000 when the experiment ended. We now describe the MDRC Jobs First Public Use Files used in our analysis and briefly examine the baseline characteristics of our estimation sample. We then examine the distribution of earned income relative to the eligibility notch in the experimental sample.

⁷Regarding Transitional Child Care, 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.” As to the effects of Transitional Medicaid, they 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 observations suggests that the additional 12 months of Transitional Medicaid available under JF are unlikely to have induced changes in the value of working off assistance.

A. Data

The MDRC Jobs First Public Use Files contain a baseline survey of demographic and family composition variables merged with longitudinal administrative information on welfare and Food Stamps participation, rounded welfare and Food Stamps payments, and rounded earnings covered by the state Unemployment Insurance (UI) system. There are a number of limitations to these data. While participation and transfers are measured monthly, UI earnings data are only available quarterly. Data on hours and weeks worked are not available, which prevents us from inferring hourly wages. Also, earnings reported to the welfare agency by applicants and recipients are not available.

Another difficulty is that the administrative measure of assistance unit size is missing for most cases. This is problematic because a woman’s assistance unit size determines her poverty line and the corresponding location of the JF eligibility notch she faces. In the JF sample, we are able to infer an assistance unit size from the grant amount in months when a woman is on welfare. But in the AFDC sample, the grant amount depends on the woman’s history of past employment and welfare take up, which we observe only partially. Consequently, we cannot reliably infer an assistance unit size from grant amounts under AFDC. For this reason, when computing treatment effects by assistance unit size, we rely on a variable collected in the baseline survey named “kidcount” that records the number of children in the household at the time of random assignment. As might be expected, using the kidcount variable leads to underestimates of true assistance unit size since women may have additional children over the seven quarters following the baseline survey. To deal with this problem we inflate the kidcount based measure of assistance unit size by one in order to avoid understating the location of the poverty line for most women.⁸ Additional details regarding variable construction are provided in the Online Appendix.

B. Baseline Characteristics of the Analysis Sample

Table 2 provides baseline descriptive statistics for our analysis sample. We have 4,642 cases with complete pre-random assignment data and non-missing values of the kidcount variable.

⁸Understating the poverty line could lead to an over-estimate of the population at risk of opting in to welfare. We err on the side of overstating the poverty line because one of our goals is to provide a conservative assessment of whether opt-in behavior actually takes place. Online Appendix Table A1 tabulates the kidcount variable against the administrative measure available in the JF sample. Our inflation scheme maps the kidcount measure to its modal administrative value plus one. As detailed in Online Appendix Table A7, our main results are robust to alternate codings such as inflating the assistance unit size by two and not inflating it at all.

There are some mildly significant differences between the AFDC and JF groups in their baseline characteristics, however these differences are not jointly significant. We follow BGH (2006) in using propensity score re-weighting to adjust for these baseline differences.⁹ After adjustment, the baseline means of the AFDC and JF groups are very similar. 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 incentives, which makes them useful for exploring treatment effect heterogeneity (see BGH, 2014 for a related subgroup analysis).

C. Earnings Distribution

Figures 3a-3c provide histograms by assistance status of earned income in the JF sample for the seven quarters following random assignment – a horizon over which no case was in danger of reaching the time limit. Earnings are rescaled relative to three times the federal poverty line, which is the maximum amount that a woman can earn in a quarter while maintaining welfare eligibility throughout the quarter. Each woman’s poverty line is determined using our administratively inferred measure of assistance unit size.

Many labor supply models predict bunching of earnings at notches (Slemrod, 2010; Kleven and Waseem, 2013). Like BGH (2006), we find no evidence of such bunching at the JF eligibility notch (Figure 3a). Rather, the earnings density declines smoothly 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). While it is possible to rationalize the absence of bunching with certain distributions of preferences, this evidence is also consistent with the possibility that women face significant labor supply constraints – a conjecture that has received substantial empirical support in related settings (Altonji and Paxson, 1988; Dickens and Lundberg, 1993; Chetty et al., 2011b; Beffy et al., 2014).

A conspicuous feature of Figure 3b is that the distribution of earnings stretches well beyond the poverty line, 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

⁹These techniques are described in the Online Appendix. The baseline sample in BGH (2006) contains 4,803 cases. 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.

result of measurement problems, under-reporting behavior is also undoubtedly at play here. The MDRC final report (Bloom et al., 2002, 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 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. Evidence on such partial under-reporting was found in a related context by Hotz, Mullin, and Scholz (2003), who analyzed data from a welfare reform experiment in California.¹⁰

III. Earnings Impacts and A Test for Intensive Margin Responsiveness

As previously documented by BGH (2006), the JF reform had nuanced effects on the distribution of earned income. Here we briefly review those impacts and then ask whether they could have been generated solely by extensive margin responses.

A. Earnings Impacts

Figure 4a provides reweighted empirical distribution functions (EDFs) by experimental status of rescaled earnings in the first seven quarters of the experiment. The poverty line employed in the rescaling is computed using our survey-based measure of assistance unit size. Significant opt-in behavior should lead earnings levels below the poverty line 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. More quarters exhibit positive earnings in the JF sample than in the AFDC sample, indicating that JF successfully incentivized many women to work.¹¹ The earnings EDF rises more quickly in the JF sample than in the AFDC sample, signaling excess mass at low earnings levels. Also, the EDFs cross below the notch, implying that the

¹⁰Comparing 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. Among these cases, the average fraction of UI earnings reported varied from 64% to 84% depending on the year studied.

¹¹Appendix Table A2 provides standard errors on selected earnings impacts, which confirm the visual impression of Figures 4a-4c.

fraction earning less than the poverty line is slightly greater in the JF sample than among the AFDC controls. A large increase in the fraction earning less than the poverty line would be suggestive evidence of an opt-in response, however the impact here is small and statistically insignificant.

Figures 4b-4c provide corresponding EDFs in the 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 and therefore 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 earnings 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 increase in the fraction of quarters with earnings less than or equal to the poverty line. The zero earnings group, by contrast, exhibits a large increase in the fraction of quarters working, but essentially no impact on the fraction of quarters with earnings less than or equal to the poverty line.

B. *A Test for Intensive Margin Responsiveness*

Could these distributional impacts on earnings have been generated by extensive margin adjustments alone? In the absence of intensive margin adjustments, the distribution of earned income in the JF sample should stochastically dominate the distribution in the AFDC sample as the reform simply shifts mass from zero to positive earnings levels.¹² Using a variant of the testing procedure of Barrett and Donald (2003) described in the Online Appendix, we fail to reject the null hypothesis that the JF earnings distribution stochastically dominates the earnings distribution in the pooled AFDC sample (Figure 4a). However, first order stochastic dominance is rejected at the 5% level in the positive earnings sample (Figure 4c), indicating that intensive margin responses did in fact occur in response to the reform, but are difficult to detect in the pooled sample using earnings alone.

¹²First order stochastic dominance implies the absence of negative QTEs. Therefore the analysis of BGH (2006) 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. The methods used here address this problem.

IV. Model

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.

In this section we develop an optimizing model that formalizes the incentives provided by the JF reform and restricts 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. Motivated by our finding of the absence of a spike in the earnings distribution at the JF eligibility threshold, we allow for the possibility that women face constraints on their labor supply decisions. Women also choose how much of their earnings to report to the welfare agency, creating the possibility that earnings ineligible women are welfare participants.

Our analysis relies on a number of simplifying assumptions. 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 problematic 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 (see Section V). 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, as described in Section X, an adaptation of the Grogger and Michalopoulos (2003) test for anticipatory responses fails to detect forward-looking behavior, leading us to believe that the dynamic incentives of the reform are in fact weak in this sample.¹³ Second, the model

¹³Returns 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.” Couch (2014) uses 14 years of post-randomization earnings data from the JF reform and concludes that “the short-term intervention did not appear to have altered the

ignores the Transitional Child Care, Transitional Medicare, and child support 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 the Food Stamps program, payroll and Medicare taxes, and the EITC. We explain in Section VI why extending the model to incorporate these policies has no effect on our revealed preference arguments. Finally, we present the model for a woman whose break-even earnings level (\bar{E}_i) under AFDC is below the federal poverty line as in Figure 1. In Section VI, we discuss how things differ for women who have access to unreduced earnings disregards yielding $\bar{E}_i > FPL_i$.

A. *The Decision Problem*

Consider a woman with children, call her i , subject to a policy regime indexed by $t \in \{a, j\}$ (AFDC or JF respectively). In a given month, woman i samples $K_i \geq 0$ job offers, composed of wage and hours offer pairs: $\Theta_i \equiv \{(W_i^k, H_i^k)\}_{k=1}^{K_i}$. The woman's offer set Θ_i reflects a mix of luck and the woman's labor market skills. Woman i decides which (if any) of the K_i offers to accept, whether to participate in welfare (represented by the indicator $D \in \{0, 1\}$), and a level ($E^r \geq 0$) of earned income to report to the welfare agency. We assume E^r is less than or equal to her actual earnings $E = WH$ where W and H refer to the wage and hours at her chosen job (which are both zero when no offer is accepted).¹⁴

Woman i consumes her earnings plus any welfare transfer. Specifically, her consumption is given by:

$$C = C_i^t(E, D, E^r) = E + DG_i^t(E^r), \quad (3)$$

where the welfare grant $G_i^t(E^r)$ is determined according to the regime-specific transfer functions (1)-(2) based upon her reported (as opposed to her actual) earnings.

Woman i 's preferences are represented by the utility function:

$$U_i^t(H, C, D, Z, R), \quad (4)$$

where $Z = Z(D, E^r) = D\mathbf{1}[E^r = 0]$ is an indicator that equals one if she reports zero earnings to the welfare agency and $R = R(E, D, E^r) = D\mathbf{1}[E^r < E]$ is an indicator that

long-term outcomes of participants examined in terms of employment or labor market earnings."

¹⁴Allowing 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.

equals one if she under-reports her earnings to the welfare agency. The dependence of utility on D captures the potential for a “stigma” (or, conversely, a psychic benefit) to be associated with welfare participation (Moffitt, 1983), while the dependence on Z captures the “hassle” associated with welfare work requirements. The dependence of utility on R captures the cost of under-reporting to the welfare agency which may reflect the effort exerted in disguising earnings and the possibility of being caught under-reporting.¹⁵ Utility is indexed by the policy regime t to allow for differences in hassle disutility under AFDC and JF.

We assume that the utility function in (4) obeys the following restrictions:

- A.1** utility is strictly increasing in C ;
- A.2** $U_i^t(H, C, 1, Z, 1) < U_i^t(H, C, 1, Z, 0)$ for all $t \in \{a, j\}$;
- A.3** $U_i^t(H, C, 1, 1, R) \leq U_i^t(H, C, 1, 0, R)$ for all $t \in \{a, j\}$;
- A.4** $U_i^j(H, C, 1, 1, R) \leq U_i^a(H, C, 1, 1, R)$;
- A.5** $U_i^j(H, C, 1, 0, R) = U_i^a(H, C, 1, 0, R)$;
- A.6** $U_i^j(H, C, 0, 0, 0) = U_i^a(H, C, 0, 0, 0)$.

Assumption **A.1** is a standard non-satiation condition. Assumption **A.2** states that under-reporting is costly under either policy regime. Assumption **A.3** states that reporting zero earnings weakly lowers utility (due to welfare hassle). Assumptions **A.4–A.6** formalize our institutional knowledge of the JF reform. In accord with JF’s increased work requirements, **A.4** restricts the utility of reporting zero earnings while on welfare to be no higher under JF than AFDC. Assumption **A.5** restricts both the utility costs of under-reporting and the psychic costs (or benefits) of welfare participation to be regime-invariant among recipients who report positive earnings. Finally, assumption **A.6** requires utility to be regime-invariant when off assistance.

The above specification of utility is extremely general. Due to the non-separability of H and C , leisure and consumption may be complements or substitutes and preferences may be non-homothetic as in classic Stone-Geary specifications of utility. Because we do not require monotonicity with respect to H , woman i may value working full time more than working part time or vice versa. Likewise, participation in welfare may increase or decrease her

¹⁵An important restriction here is that the cost of under-reporting does not depend on what fraction of earnings are under-reported. This feature of our model is necessitated by the fact that reported earnings E^r are not included in MDRC’s Public Use Files. See Saez (2010) for a similar restriction involving a fixed “moral” cost of misreporting income to tax authorities.

utility. Welfare stigma creates the possibility that woman i refuses assistance despite being eligible. The effect of welfare participation on her utility is allowed to vary with consumption and leisure due to the non-separability of D . Similarly, the hassle disutility is allowed to vary with consumption and leisure due to the further non-separability of Z . Note that we have not assumed continuity of utility with respect to H or C , which accommodates the possibility that woman i faces a fixed cost (or benefit) of work such as a monthly commuting cost. Fixed costs discourage work at low earnings levels and create the possibility that she responds to marginal changes in work incentives by earning large amounts instead of not working at all (Cogan, 1981).

A special case of (4) monetizes welfare stigma, hassle, the disutility of under-reporting, and the (dis)-utility of working as follows:

$$U_i(H, C - \phi_i D - \eta_i^t Z - \kappa_i R - \mu_i \mathbf{1}[E > 0]), \quad (5)$$

where ϕ_i is the monetized cost of welfare stigma, η_i^t is the hassle cost of reporting zero earnings under regime t , κ_i is the cost of under-reporting, and μ_i is a fixed cost (or benefit) of work. The parameters $(\phi_i, \eta_i^a, \eta_i^j, \kappa_i, \mu_i)$ inherit the above restrictions on preferences. Specifically, **A.2** and **A.4** imply $\kappa_i > 0$ is regime-invariant, **A.3** and **A.4** stipulate that $\eta_i^j \geq \eta_i^a \geq 0$, and **A.5** requires that ϕ_i be regime-invariant. Finally, in accordance with **A.6**, μ_i and the two-argument utility function in (5) are both regime-invariant. We refer to the second argument of (5) as the “consumption equivalent.” We selectively consider this “monetized” specification below to aid in illustrating the mechanics of the model and the implications of further structuring preferences. Our main results rely on the more general specification given in (4).

Woman i 's objective is to maximize her utility under policy regime t . Hence, she selects a labor supply, program participation, and reporting alternative X_i^{t*} that belongs to:¹⁶

$$\arg \max_{(W,H) \in \{\Theta_i, (0,0)\}, D \in \{0,1\}, E^r \in [0,E]} U_i^t(H, C_i^t(WH, D, E^r), D, Z(D, E^r), R(WH, D, E^r)). \quad (6)$$

We refer to X_i^{t*} as woman i 's *choice* under policy regime t . Note that her pair (X_i^{a*}, X_i^{j*})

¹⁶Indifferences between alternatives may arise that lead the arg max to be a set instead of a vector. We do not model how woman i chooses among alternatives between which she is indifferent. We only assume that the rule she uses to choose among them is invariant to the policy regime t .

of regime-dependent choices is governed by the vector of primitives:

$$\theta_i \equiv (U_i^j(\cdot, \cdot, \cdot, \cdot, \cdot), U_i^a(\cdot, \cdot, \cdot, \cdot, \cdot), \Theta_i, \bar{G}_i, \delta_i, \tau_i).$$

We provide some examples of how choices depend on these primitives at the end of the next Section.

B. *Optimal Reporting*

Recall from (4) that woman i 's utility depends on whether or not she under-reports her earnings to the welfare agency but not on the magnitude of the under-reporting. As a result, optimal reporting obeys a particularly convenient decision rule. Specifically, assumptions **A.1**, **A.2**, and **A.3** imply that when concealing her earnings optimally, woman i reports a positive amount to the welfare agency that allows her to avoid any hassle penalty and to receive a transfer \bar{G}_i irrespective of the policy regime she faces (see Lemma 2 in the Online Appendix). Hence by assumption **A.5**, for any level of actual earnings E , the utility she receives from optimally under-reporting while on assistance is the same across regimes. We shall exploit this result repeatedly in what follows.

V. **Revealed Preference Restrictions**

The above model restricts how a woman responds to policy variation. That is, it rules out certain pairings of choices across the two policy regimes. These restrictions stem from simple revealed preference arguments. Specifically, if the utility of a woman's choice under AFDC is not lowered by the reform, she will either make the same choice under JF or select an alternative that the reform made more attractive.

A parsimonious approach to summarizing these restrictions leverages the fact that the JF reform improved (or worsened) the attractiveness of large collections of alternatives based on their implied earnings. To see this, recall that the JF reform altered the mapping between earnings and grant amounts and imposed more stringent work requirements on recipients with zero earnings. In what follows, we group labor supply alternatives into three broad categories based upon the earnings they generate. We then apply revealed preference arguments to rule out possible pairings of alternatives within these broad categories across policy regimes.¹⁷ In Section X, we discuss what can (and cannot) be learned from working with

¹⁷The structural labor supply literature often assumes labor supply choices are constrained to fall into a

finer earnings categories.

A. Earnings Ranges

Consider the following “coarsened” earnings variable \tilde{E}_i , defined by the relation:

$$\tilde{E}_i \equiv \begin{cases} 0 & \text{if } E = 0 \\ 1 & \text{if } E \leq FPL_i \\ 2 & \text{if } E > FPL_i \end{cases} . \quad (7)$$

That is, \tilde{E}_i indicates whether woman i works, and if so, whether her earnings make her ineligible for welfare assistance under JF.

The JF reform had qualitatively similar effects on the attractiveness of alternatives within each of these earnings ranges. To see this, note that the reform potentially reduced the attractiveness of not working ($\tilde{E}_i = 0$) while on welfare because of JF’s more stringent work requirements. By contrast, the reform made earning positive amounts below the poverty line ($\tilde{E}_i = 1$) at least as attractive since a woman with earnings in this range is either off assistance, or on assistance and under-reporting, or on assistance and truthfully-reporting. In the first two circumstances, the utility value she attains is unaffected by the regime (recall the optimal reporting result described in Section IV). In the third circumstance, the utility value she attains under JF is at least as high as that attainable under AFDC because of JF’s enhanced earnings disregard. Finally, the reform had no effect on the utility of working at earnings levels above the poverty line ($\tilde{E}_i = 2$). This follows because a woman with earnings in range 2 is either off assistance or under-reporting while on assistance. In both circumstances, the utility value she attains is unaffected by the regime.

Pairing the earning categories with the decision to participate in welfare and the under-reporting decision yields seven earnings / participation / reporting combinations, 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 few data driven categories such as “part-time” and “full-time” work (e.g. Hoynes, 1996; Keane and Moffitt, 1998; Blundell et al, 2013; Manski, 2014). By contrast, we allow the choice set to vary across women in an unrestricted fashion by means of the heterogeneous offer set Θ_i .

letter describes her combined welfare participation and reporting decisions. Specifically, the letter n denotes welfare non-participation, r denotes welfare participation with truthful reporting of earnings ($E^r = E$), and u denotes welfare participation with under-reporting of earnings ($E^r < E$). Note that state $0u$ is ruled out, as it is not meaningful to “under-report” zero earnings. Likewise, state $2r$ cannot occur under either JF or AFDC because of their respective eligibility rules (recall that we are considering a woman with $\bar{E}_i \leq FPL_i$).

B. *Allowed and Disallowed Responses*

Table 3 catalogs the possible pairings of states across the two policy regimes. Pairs of states labeled “no response” entail the same behavior under the two policy regimes. We term the remaining pairs either “disallowed” or “allowed” responses. The disallowed responses entail a change in behavior that is proscribed by the model. This occurs either because the change in behavior would entail an alternative that is dominated or because the change in behavior is incompatible with revealed preference. In Table 3, the disallowed responses are denoted with a “–” entry. The allowed responses entail a change in behavior that is permitted by the model. These responses are represented by entries that describe the three margins along which behavior may change: 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 logic behind which responses are allowed and which are not. The Online Appendix establishes formally that the restrictions in Table 3 are exhaustive.

Starting with the disallowed responses, a woman will not make a choice corresponding to state $1u$ under JF because under-reporting is costly (**A.2**) and earnings below the poverty line are fully disregarded. For this reason, the column of Table 3 pertaining to state $1u$ under JF is populated with “–” entries over a horizontally striped background. The remaining prohibited responses stem from revealed preference arguments. By assumptions **A.1** and **A.5**, the JF reform may have made alternatives corresponding to state $1r$ more (but not less) attractive. Conversely, by assumption **A.4**, the reform may have made alternatives corresponding to the state $0r$ less (but not more) attractive. Finally, the reform had no effect on the value of alternatives corresponding to the set $\mathcal{C}_0 \equiv \{0n, 1n, 2n, 1u, 2u\}$ by assumption **A.6** and optimal reporting. Therefore, by revealed preference, a woman will not pair any of the states in $\mathcal{C}_\succeq \equiv \{1r\} \cup \mathcal{C}_0$ under AFDC with a (different) state in $\mathcal{C}_\preceq \equiv \{0r\} \cup \mathcal{C}_0$ under JF. This reasoning justifies the “–” entries in the cells with a greyed background.

Proceeding now to responses that are allowed, consider first the extensive margin labor

supply responses. A woman who, under AFDC, chooses not to work while off welfare (state $0n$) must face high welfare stigma, hassle, or under-reporting costs since she is willing to forgo the full grant amount \bar{G}_i . Under JF, she may choose to work while on assistance and earn below the poverty line (state $1r$), as this option entails higher consumption than under AFDC. Next, a woman who, under AFDC, would participate in welfare without working (state $0r$), may respond to JF in several ways. Specifically, she may be induced to: i) work while on welfare (state $1r$), ii) leave welfare and earn less than the federal poverty line (state $1n$), iii) leave welfare and earn more than the federal poverty line (state $2n$), iv) remain on welfare and earn more than the federal poverty line (state $2u$), or v) opt out of welfare (state $0n$). The first response can result from either the reduction in implicit tax rates on earnings or the increased hassle associated with JF. Sufficiently large fixed costs of work can enable the second, third, or fourth responses. A large increase in the hassle costs may induce the fifth response, in which case no labor supply response occurs.

Consider next the allowed intensive margin labor supply responses. The pairing of states $1n$, $1r$, or $1u$ under AFDC with state $1r$ under JF could 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 poverty line, 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 either case will lead her to continue working on welfare. 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. This may result in a reduction in earnings due to income effects. If the woman has high enough welfare stigma, she will not participate in welfare under either regime (i.e. she will pair state $1n$ with state $1n$). The pairing of either state $2n$ or $2u$ under AFDC with state $1r$ under JF also corresponds to an intensive margin response: the reform induces the woman to reduce her earnings below the poverty line.

Some of the above extensive and intensive margin labor supply responses can be accompanied by an adjustment in reporting behavior. Specifically, the JF reform may induce a woman to truthfully report her earnings (pairing states $1u$ or $2u$ with state $1r$). Conversely, the reform may induce a woman to under-report her earnings (pairing state $0r$ with state $2u$). Thus, the JF reform may have mixed effects on reporting behavior.

C. Graphical Examples

Figures 5 and 6 illustrate some of the allowed responses listed above assuming a fixed wage rate and no labor market constraints (i.e., setting $K_i = \infty$). For convenience, both figures employ the monetized form of the utility function given in (5).

Figure 5 illustrates allowed responses that entail either an extensive margin or intensive margin labor supply adjustment. Specifically, Figure 5a illustrates an extensive margin response, corresponding to pairing state $0r$ under AFDC with state $1r$ under JF. As depicted, the hassle costs η_i^a of not working under AFDC are much smaller than the corresponding costs η_i^j under JF. The fixed cost of work μ_i straddles the two hassle costs. In comparison with the fixed costs of work and hassle, the cost of under-reporting κ_i is depicted as being quite large. 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 preferences found in Figure 5a would not work on welfare under AFDC (point A) but would take up work and truthfully report her earnings under JF (point B). Figure 5b illustrates the traditional opt-in response considered in the literature, corresponding to pairing state $2n$ under AFDC with state $1r$ under JF. As depicted, the hassle costs η_i^a of not working under AFDC are large but smaller than the corresponding costs η_i^j under JF. The fixed cost of work μ_i straddles the two hassle costs. A woman with the configuration of costs and preferences found in Figure 5b would earn above the poverty line off assistance under AFDC (point A) but would earn strictly below the poverty line on assistance under JF (point B).

Figure 6 illustrates allowed responses that entail an adjustment in reporting behavior. As depicted, the hassle costs η_i^j of not working under JF are larger than the corresponding costs η_i^a under AFDC, but both are smaller than the fixed cost of work μ_i . In comparison with the fixed costs of work and hassle, the cost of under-reporting κ_i is relatively small. A woman with the configuration of preferences found in Figure 6a 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 6b 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.

VI. Extensions

The model of Section IV pertains to a woman who, under AFDC, would have access to the reduced earnings disregards so that $\bar{E}_i \leq FPL_i$. Here we extend the model by considering a woman for whom $\bar{E}_i > FPL_i$. We show that, for such a woman, the set of theoretically allowable responses to the JF reform is expanded but that these additional responses are empirically irrelevant for the women in our analysis sample. Additionally, we summarize why the inclusion of Food Stamps, payroll taxes, and the EITC does not change our reasoning about the theoretically allowable effects of the JF reform with respect to welfare take up and earnings. The important conclusion to be drawn from these two extensions is that the response margins catalogued in Section V constitute the full list of possible welfare participation and earning responses for the women in our sample.

A. Unreduced Disregards

A woman with breakeven earnings level $\bar{E}_i > FPL_i$ may occupy state $2r$ because AFDC rules permit her to truthfully report earnings above the poverty line. This augments the set of possible responses to the JF reform since, as remarked above, state $2r$ is not permitted by the JF eligibility rules. In particular, access to unreduced disregards enables flows out of the labor force (i.e., pairing of state $2r$ under AFDC with state $0r$ or $0n$ under JF) provided that earning constraints are present (see the Online Appendix for details).

While interesting, the analysis of these additional responses turns out to be purely pedagogical. 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 poverty line and receive a positive welfare transfer no larger than $G_i^a(FPL_i)$. In our data, there are only 3 case-quarters (out of 14,784) meeting these criteria, implying that such behavior is extremely rare.¹⁸ This should not be particularly surprising – if women have convex preferences they are unlikely to earn in the range $(FPL_i, \bar{E}_i]$

¹⁸This 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 (assistance unit size and quarter-specific) poverty line and if she had access to the unreduced fixed and proportional disregards. We round this amount to the nearest \$50 and denote it by $G_i^{a*}(FPL_i)$. Then, we count the number of quarterly observations in the AFDC sample associated with UI earnings above the poverty line and with quarterly welfare transfers no greater than $G_i^{a*}(FPL_i)$.

since AFDC benefit exhaustion induces a non-convex kink in the budget set (Moffitt, 1990). Moreover, even a mild welfare stigma could outweigh the relatively trivial amount of cash assistance available to women with earnings in this range. Whatever the explanation, the conclusion is the same: disregarding state $2r$ (and the related response margins) is empirically inconsequential.

B. *Food Stamps, the EITC, and Payroll Taxes*

In the Online Appendix we develop an extended model where Food Stamp participation is introduced as an additional choice variable, so that a woman may be off assistance, on welfare only, on Food Stamps only, or on both welfare and Food Stamps.¹⁹ Pairing the earnings categories in (7) with the decisions to participate in welfare and/or FS as well as the under-reporting decision yields sixteen states. Revealed preference arguments proscribe 190 out of the $16 \times 15 = 240$ theoretically possible responses leaving us with 50 allowed responses. Crucially, none of the allowed responses involve pairing of earnings, welfare participation and reporting alternatives prohibited by the model of Section IV. The reason for this convenient result is that, under JF, earnings up to the poverty line were disregarded in full for the determination of the Food Stamps grant *only conditional on joint take up* of welfare. Thus, JF's impact on the Food Stamps program effectively amplifies the notch at the poverty line (recall Figure 2) and leaves the attractiveness of the *non-welfare* assistance states unaffected. In summary, the restrictions in Table 3 hold with reference to both the welfare and Food Stamp components of the JF reform and given the tax system in place at the time of the reform.

VII. Identification of Response Probabilities

Table 3 summarizes the restrictions our model 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 both policy regimes at a given point in time. However, the experimental nature of our data allow us to compare groups of women with identical *distributions* of primitives who face different policy rules. In this section, we discuss how the individual level restrictions enumerated in Table 3 can be exploited to test the model and bound the

¹⁹This model allows for separate stigma effects for each combination of Food Stamps and welfare assistance. Under-reporting costs also vary depending on the type of assistance. Filing for EITC is assumed invariant to the policy regime, and payroll and Medicare taxes are levied on earnings under both regimes.

frequency of adjustment to the JF reform along each allowable response margin.

A. *Population Heterogeneity*

We start by assuming the N women in our sample obey assumptions **A.1-A.6** and have primitives $\{\theta_i\}_{i=1}^N$ drawn independently from a distribution function $\Gamma_\theta(\cdot)$. We shall depart from much of the structural labor supply literature by leaving the distribution $\Gamma_\theta(\cdot)$ unrestricted save for the support limitations implied by assumptions **A.1-A.6**, and the logical non-negativity of hours and wage offers. Substantively, this formulation implies that preferences and constraints may vary freely across women, giving rise, for instance, to arbitrary correlations between tastes and offer sets. Such dependence poses difficult endogeneity problems bypassed in much of the recent literature on non-parametric identification of structural labor supply models, which typically treats wages (and policy rules) as exogenous (Manski, 2014; Blomquist et al, 2014).

Because we allow for unrestricted heterogeneity across women, the right mix of preferences and offers can rationalize any distribution of choices under a given policy regime. However, as we show below, our theoretical restrictions do have empirical content when applied to the JF experiment.

B. *The Identification Problem*

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

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

for $(s^a, s^j) \in \mathcal{S} \times \mathcal{S}$, where $P(\cdot)$ is the probability measure induced by the distribution function $\Gamma_\theta(\cdot)$. These probabilities summarize the frequency of adjustment to the JF reform along specific labor supply and participation margins. For example, $\pi_{2n, 1r}$ gives the proportion of those women who under AFDC would earn above the federal poverty line while off assistance that would work on welfare under JF – that is, the share of high earning women who opt-in to welfare.

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

independent of the policy regime to which she is assigned. Formally,

$$T_i \perp (S_i^a, S_i^j), \quad (8)$$

where the symbol \perp denotes independence. The above condition implies that, for every $s \in \mathcal{S}$ and $t \in \{a, j\}$, $P(S_i = s | T_i = t) = P(S_i^t = s) \equiv q_s^t$, 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 $\{\pi_{s^a, s^j}\}$. To see this, observe that by the law of total probability, the marginal distributions of potential states are linked by the relation:

$$\mathbf{q}^j = \mathbf{\Pi}' \mathbf{q}^a, \quad (9)$$

where $\mathbf{q}^t \equiv [q_{0n}^t, q_{1n}^t, q_{2n}^t, q_{0r}^t, q_{1r}^t, q_{1u}^t, q_{2u}^t]'$ 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 $(\mathbf{q}^a, \mathbf{q}^j)$ with certainty, the system in (9) consists of 7 equations (one of which is redundant) and $7 \times 6 = 42$ unknown independent response probabilities. Clearly, the response probabilities are heavily under-identified. As we show next, our model dramatically reduces the degree of under-identification present.

C. *Unrestricted Response Probabilities*

The revealed preference arguments developed in Section IV imply that only ten out of the forty two possible response margins cataloged in Table 3 are allowed. Accordingly, only ten of the forty two response probabilities in the matrix $\mathbf{\Pi}$ are not restricted to equal zero. Furthermore, $\pi_{1u, 1r}$ equals one because no woman pairs state $1u$ under AFDC with any state but $1r$ under JF. Hence, there are nine free response probabilities, which we collect into the vector:

$$\boldsymbol{\pi} \equiv [\pi_{0n, 1r}, \pi_{0r, 0n}, \pi_{2n, 1r}, \pi_{0r, 2n}, \pi_{0r, 1r}, \pi_{0r, 1n}, \pi_{1n, 1r}, \pi_{0r, 2u}, \pi_{2u, 1r}]'. \quad (10)$$

Note that rank reversals in earnings may result from the allowed responses to reform. For example, some women who do not work under AFDC may earn in range 2 under JF ($\pi_{0r, 2n} > 0$ or $\pi_{0r, 2u} > 0$) and thereby “leap over” their peers who earn in range 1 of the earnings distribution under either regime.²⁰

²⁰Many additional sorts of rank reversals are possible in this framework. For example, additional reversals occur in the above case where $\pi_{0r, 2n} > 0$ or $\pi_{0r, 2u} > 0$ if some women who would earn in range 2 under

Recall that we have only seven equations to discipline the nine free response probabilities, which necessitates a partial identification analysis of $\boldsymbol{\pi}$. 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.

D. *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 $g : \mathcal{S} \rightarrow \tilde{\mathcal{S}}$ that reduces the *latent* states \mathcal{S} to *observable* states $\tilde{\mathcal{S}}$ 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 \tilde{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, $\tilde{S}_i^t \equiv g(S_i^t)$ for $t \in \{a, j\}$. Also, define the probability of occupying state $\tilde{s} \in \tilde{\mathcal{S}}$ under policy regime t as $p_{\tilde{s}}^t \equiv P(\tilde{S}_i^t = \tilde{s}) = \sum_{s: \tilde{s}=g(s)} q_s^t$. Finally, denote the vectors of *observable* state probabilities as $\mathbf{p}^t \equiv [p_{0n}^t, p_{1n}^t, p_{2n}^t, p_{0p}^t, p_{1p}^t, p_{2p}^t]'$ for $t \in \{a, j\}$. We are now ready to discuss identification of the nine free response probabilities appearing in (10) based on the regime specific state distributions \mathbf{p}^a and \mathbf{p}^j .

E. *Identified Set*

Integrating the unobserved states out of (9) 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-

AFDC earn in range 1 under JF ($\pi_{2n,1r} > 0$ or $\pi_{2u,1r} > 0$). One also expects reversals to be common among women who do not work under AFDC but earn positive amounts under JF, since the amounts earned under JF are likely to be above the lowest earnings levels of women who would have worked even in the absence of reform.

redundant equations can be given an intuitive representation as:

$$\begin{aligned}
p_{0n}^j - p_{0n}^a &= -p_{0n}^a \pi_{0n,1r} + p_{0p}^a \pi_{0r,0n} \\
p_{1n}^j - p_{1n}^a &= -p_{1n}^a \pi_{1n,1r} + p_{0p}^a \pi_{0r,1n} \\
p_{2n}^j - p_{2n}^a &= -p_{2n}^a \pi_{2n,1r} + p_{0p}^a \pi_{0r,2n} \\
p_{0p}^j - p_{0p}^a &= -p_{0p}^a (\pi_{0r,1n} + \pi_{0r,1r} + \pi_{0r,2u} + \pi_{0r,2n} + \pi_{0r,0n}) \\
p_{2p}^j - p_{2p}^a &= p_{0p}^a \pi_{0r,2u} - p_{2p}^a \pi_{2u,1r}
\end{aligned} \tag{11}$$

The left hand side of (11) catalogs 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 model. The identifying power of the model derives from the fact that only a handful of response probabilities appear in each equation. The *identified set* Ξ of response probabilities consists of the set of vectors $\boldsymbol{\pi}$ obeying (11) that satisfy the usual adding up and non-negativity conditions of probability distributions.²¹

F. Testable Restrictions

As we show in the Online Appendix, System (11) implies sixteen inequality restrictions. These restrictions exhaust the predictions of our model for the distribution of observed states $(\mathbf{p}^a, \mathbf{p}^j)$. As argued above, the restrictions pertain exclusively to the impact $(\mathbf{p}^j - \mathbf{p}^a)$ of the JF reform on state probabilities, as opposed to the cross-sectional distributions of states within a regime. Violation of any of these inequalities would imply that our framework fails to allow for a response actually present in the data. To conserve space, we list the sixteen inequality restrictions in the Online Appendix. Here we report five of them that are particularly intuitive:

$$(p_{0p}^j - p_{0p}^a) \leq 0 \tag{12a}$$

$$(p_{0p}^j - p_{0p}^a) + (p_{0n}^j - p_{0n}^a) \leq 0 \tag{12b}$$

$$(p_{0p}^j - p_{0p}^a) + (p_{2n}^j - p_{2n}^a) + (p_{0n}^j - p_{0n}^a) + (p_{1n}^j - p_{1n}^a) \leq 0 \tag{12c}$$

$$(p_{0p}^j - p_{0p}^a) + (p_{2n}^j - p_{2n}^a) + (p_{0n}^j - p_{0n}^a) + (p_{2p}^j - p_{2p}^a) \leq 0 \tag{12d}$$

$$(p_{0p}^j - p_{0p}^a) + (p_{2n}^j - p_{2n}^a) + (p_{0n}^j - p_{0n}^a) + (p_{2p}^j - p_{2p}^a) + (p_{1n}^j - p_{1n}^a) \leq 0 \tag{12e}$$

These restrictions state that the JF reform must (weakly): lower the fraction of women

²¹Here this means that $\pi \in [0, 1]^9$ and $\pi_{0r,1n} + \pi_{0r,1r} + \pi_{0r,2u} + \pi_{0r,2n} + \pi_{0r,0n} \leq 1$.

on assistance and not working (12a), raise the fraction of women working (12b), raise the fraction of women who work and receive assistance (12c), raise the fraction of women with earnings in range 1 (12d), and raise the fraction of women who receive assistance and have earnings in range 1 (12e).

G. Further Structuring Preferences

As an illustration of the identifying power of further structuring preferences, we also consider the monetized form of the utility function given in (5). In the Online Appendix we show that with this restricted specification, the choice of $0r$ under AFDC by woman i reveals that her stigma cost ϕ_i is below the base grant amount \bar{G}_i . This, in turn, implies that state $1n$ is dominated by state $1r$ under JF. Hence, no woman pairs state $0r$ under AFDC with state $1n$ under JF. Accordingly, $\pi_{0r,1n} = 0$ which reduces the number of unknown response probabilities to eight. Imposing this restriction on system (11) reveals that the second equation uniquely identifies the response probability $\pi_{1n,1r}$. Intuitively, when $\pi_{0r,1n} = 0$, there is a “flow” into but no “flow” out of state $1n$. Furthermore, this version of the model implies that the JF reform must (weakly) reduce the fraction of working women off assistance and earning in range 1, formally:

$$p_{1n}^a - p_{1n}^j \geq 0. \quad (13)$$

VIII. Bounds on Response Probabilities

Subject to the above restrictions holding, we can derive bounds on the nine response probabilities that are set-identified in our baseline model. The upper and lower bounds on each of the response probabilities correspond to vertices of the identified set Ξ . These vertices can be represented as the solution to a pair of linear programming problems of the form:

$$\max_{\boldsymbol{\pi}} \boldsymbol{\pi}' \boldsymbol{\lambda} \text{ subject to } \boldsymbol{\pi} \in \Xi \quad (14)$$

where the layout of $\boldsymbol{\pi}$ was given in (10). For example, solving the above problem for $\boldsymbol{\lambda} = [0, 0, 1, 0, 0, 0, 0, 0, 0]'$ yields the upper bound on $\pi_{2n,1r}$, while choosing $\boldsymbol{\lambda} = [0, 0, -1, 0, 0, 0, 0, 0, 0]'$ yields the lower bound.

A. Composite Margins

We can also use this representation to derive bounds on linear combinations of the response probabilities. We consider the probabilities of adjusting along four “composite” margins:

$$\begin{aligned}
 \pi_{0r,n} &\equiv \pi_{0r,0n} + \pi_{0r,2n} + \pi_{0r,1n}, \\
 \pi_{p,n} &\equiv \frac{p_{0p}^a}{p_{0p}^a + p_{1p}^a + p_{2p}^a} (\pi_{0r,0n} + \pi_{0r,2n} + \pi_{0r,1n}), \\
 \pi_{n,p} &\equiv \frac{p_{0n}^a \pi_{0n,1r} + \pi_{1n,1r} p_{1n}^a + \pi_{2n,1r} p_{2n}^a}{p_{0n}^a + p_{1n}^a + p_{2n}^a}, \\
 \pi_{0,1+} &\equiv \frac{p_{0p}^a (\pi_{0r,1r} + \pi_{0r,2n} + \pi_{0r,2u} + \pi_{0r,1n}) + p_{0n}^a \pi_{0n,1r}}{p_{0p}^a + p_{0n}^a}.
 \end{aligned}$$

The first composite response probability gives the fraction of women who would claim benefits without working under AFDC that are induced to get off welfare under JF (denoted $\pi_{0r,n}$). Upper and lower bounds for this response probability can be had by solving (14) with $\boldsymbol{\lambda} = [0, 1, 0, 1, 0, 1, 0, 0, 0]$ and $[0, -1, 0, -1, 0, -1, 0, 0, 0]$ respectively. We also examine the fraction of all women who would participate in welfare under AFDC that are induced to leave welfare under JF (denoted $\pi_{p,n}$), the fraction of women who are induced to take up welfare under JF (denoted $\pi_{n,p}$), and the fraction of women who are induced by JF to work (denoted $\pi_{0,1+}$). 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.

B. Analytic Expressions

It is useful for conducting inference to obtain 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. The resulting expressions are listed in the Online Appendix. An example is given by the bounds on the opt-in probability $\pi_{2n,1r}$ which

take the form:

$$\max \left\{ 0, \frac{p_{2n}^a - p_{2n}^j}{p_{2n}^a} \right\} \leq \pi_{2n,1r} \leq \min \left\{ \begin{array}{l} 1, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{1n}^a - p_{1n}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{2n}^a} \end{array} \right\}. \quad (15)$$

Note that there are two possible solutions for the lower bound, one of which is zero.²² This turns out to be a generic feature of the lower bounds for each of the nine set-identified response probabilities. Here, the lower bound reflects the model’s restriction that reform-induced reductions in the fraction of women occupying state $2n$ can only be rationalized via opt-in behavior (when positive, $\frac{p_{2n}^a - p_{2n}^j}{p_{2n}^a}$ gives the proportional reduction in the fraction of women choosing state $2n$ under JF relative to AFDC). The upper bound on $\pi_{2n,1r}$ admits nine possible solutions, corresponding to settings where opt-in responses are accompanied by other responses that move probability mass to state $1r$. The upper bounds on the remaining response probabilities can have fewer or more solutions.

C. 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. For example, working off of equation (15), we use $\max \left\{ 0, \frac{\hat{p}_{2n}^a - \hat{p}_{2n}^j}{\hat{p}_{2n}^a} \right\}$ as an estimator of the lower bound for $\pi_{2n,1r}$.

²²From (11), the fraction of people occupying state $2n$ under JF may differ from that under AFDC because of an “in-flow” from state $0r$ (represented by $p_{0p}^a \pi_{0r,2n}$) or because of an “out-flow” to state $1r$ (represented by $-p_{2n}^a \pi_{2n,1r}$). If $p_{2n}^a - p_{2n}^j \leq 0$, the in-flow from state $0r$ must be at least as large as the out-flow to state $1r$. But this latter quantity may be zero, in which case the lower bound on $\pi_{2n,1r}$ is zero. If $p_{2n}^a - p_{2n}^j > 0$, the in-flow from state $0r$ can at most equal the out-flow to state $1r$, in which case this latter quantity must be at least $p_{2n}^a - p_{2n}^j$. Accordingly, the lower bound on $\pi_{2n,1r}$ is the π that solves $p_{2n}^a - p_{2n}^j = p_{2n}^a \pi$, namely $\pi = \frac{p_{2n}^a - p_{2n}^j}{p_{2n}^a}$.

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 (14) 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 many constraints are close to binding. Several approaches to this problem have been proposed that involve conducting pre-tests for which population constraints are binding (e.g. Andrews and Barwick, 2012). We take an alternative approach to inference that is simple to implement, avoids the choice of tuning parameters, and is consistent regardless of the constraints that bind. Specifically, we report two sets of confidence intervals, one “naive” interval that will under-cover when many constraints are close to binding and one “conservative” interval that will cover regardless of which constraints bind (details on both are provided in the Online Appendix).

The procedure for constructing the “naive” confidence interval ignores the uncertainty in which constraints bind – that is, it assumes the bound solution that appears relevant given the sample analogues binds with probability one. In such a case, results from Imbens and Manski (2002) imply a pointwise 95% confidence interval for the parameter in question can be constructed by extending the upper and lower bounds by $1.65\hat{\sigma}$ where $\hat{\sigma}$ is a non-parametric bootstrap estimate of the standard error of the sample moment used to define the relevant bound. These confidence intervals will provide valid inferences only if no other constraints are close to binding.

Our second procedure, which is also based on the bootstrap, assumes that all bound solutions are identical, in which case sampling uncertainty in all of the solution estimates affects the composite bound. As we demonstrate in the Online Appendix, this procedure, which can be thought of as an asymptotically conservative version of the method of Chernozhukov, Lee, and Rosen (2013), covers the parameter under study with asymptotic probability greater than or equal to 95% regardless of which solutions bind. The lower limit of the resulting “conservative” confidence interval coincides with that of the naive confidence 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. Hence, the conservative confidence interval provides fully robust coverage, at the possible expense of reductions in asymptotic power.

D. Panel Data

Thus far we have abstracted from the panel nature of our data and presumed access to only a single cross-section of post-reform choices. In practice, we follow BGH (2006) in conducting a pooled analysis using all person-quarter observations in the seven quarters following random assignment. We treat all person-quarter observations as potentially separate decision-makers in order to accommodate the likely possibility that the primitives θ_i governing a woman’s behavior vary over time. For example, among women in the AFDC control group who chose state $0r$ in the quarter prior to random assignment, more than 20% had switched states by the first quarter after random assignment, which implies that either their preferences or constraints must have changed.²³ Without additional assumptions restricting this evolution, our (static) model has no special implications for sequences of choices over time as opposed to choices made by different women. However, the bootstrapping approach employed to obtain confidence intervals for the bounds accounts for the fact that the observations contributed by a woman over time may be dependent. Specifically, it resamples a woman’s entire profile of choices made during the first 7 quarters after random assignment.

IX. Results

Table 4 reports the estimated probabilities of occupying the six observable earnings and welfare participation states under each policy regime in the seven quarters after random assignment.²⁴ The sixteen testable restrictions of our baseline model, as well as the additional restriction (13) associated with the monetized form of utility, 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 5 provides estimates of the response probabilities that rationalize the impacts in

²³The details of this exercise are in Online Appendix Table A5 which provides the distribution of states occupied in quarters 1 through 7 among the subsample of woman assigned to AFDC who chose state $0r$ in the quarter prior to random assignment.

²⁴We discard from our sample all quarters in which a woman’s welfare participation status varies from month to month as it would be impossible to infer reliably whether such a woman earned above the poverty line in the months when she was on welfare. This selection could confound the experimental impacts reported in Table 4 if the experiment influenced the probability of selection. However, we find that after adjusting for baseline covariates via a linear probability model, the frequency of these “mixed” quarters is roughly the same in the AFDC and JF groups: the estimated impact of JF on the probability of a quarter being mixed is 0.0063 (se=0.0034). Hence, we interpret the impacts reported in Table 4 as average treatment effects on “unmixed” quarters.

Table 4. Panel (a) of the Table reports estimates obtained under the general specification of preferences given in (4), while panel (b) reports estimates obtained under the monetized specification of preferences given in (5).

Starting with panel (a), our most important finding is that the JF reform induced a substantial opt-in response among women who would have otherwise 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 – an intensive margin labor supply response. Accounting for sampling uncertainty in the bounds extends this lower limit to 20%, which is still quite substantial. The upper bounds for this parameter are not informative leading us to conclude that the interval $[.20, 1]$ covers the true opt-in probability with 95% probability. We also find suggestive evidence of a second opt-in effect from non-participation, this time entailing an extensive margin labor supply response. Specifically, 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 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 $[.02, .10]$. Thus, JF induced at least one sub-population to under-report earnings. The finding that both $\pi_{0r,2u}$ and $\pi_{2n,1r}$ are significantly positive indicates that earnings rank reversals occurred in response to reform. JF also had a strong effect on entry into the program by the working poor. The bootstrap confidence interval for $\pi_{1n,1r}$ indicates that at least 32% 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.

The remaining response probabilities $(\pi_{0r,0n}, \pi_{0r,2n}, \pi_{0r,1n}, \pi_{0r,1r}, \pi_{2u,1r})$ each have zero lower bounds. However, we can reject the null that they are jointly zero. From (11) such a joint restriction implies $p_{0p}^j - p_{0p}^a = -(p_{2p}^j - p_{2p}^a)$, which is easily rejected in 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.

The last four rows of panel (a) in Table 5 report the estimated bounds, and corresponding confidence intervals, for the composite margins described in Section VII. First is the probability $\pi_{0,1+}$ that a woman responds along the extensive margin from non-work to work. A 95% confidence interval for this probability is $[0.14, 0.20]$. 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 49%) 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 most 15%.

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 21% 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.

Consider now panel (b), which reports results when utility is assumed to be of the monetized form given in (5). Here, the response probability $\pi_{0r,1n}$ is constrained to equal zero which renders $\pi_{1n,1r}$ point identified. According to these estimates, the JF reform had a strong effect on entry into the program by the working poor. The bootstrap confidence interval for $\pi_{1n,1r}$ indicates that 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. The estimates of the remaining response probabilities and composite margins are omitted because they are the same as in panel (a).²⁵

X. Robustness

We now discuss some potential extensions and issues which may affect the interpretation of our results.

A. *Finer Earnings Ranges*

The above analysis was predicated on the coarsening of earnings dictated in (7). This coarsening scheme is “natural” in the sense that the JF reform changed the utility of all the alternatives corresponding to each of the earning ranges in (7) in the *same* direction. Nevertheless, it can be of interest to consider finer coarsenings of earnings. For instance, our

²⁵Although the expressions for the bounds differ depending on whether the utility function obeys (4) or (5), the solutions that bind in the data are the same. This is because inequality (13) holds in the sample.

finding in Table 5 of a significant opt-in response could hypothetically reflect trivial earnings reductions from a dollar above the poverty line to exactly the poverty line. To assess such possibilities, consider the following finer coarsening of earnings obtained by partitioning range 2 into two sub-ranges:

$$\tilde{E}_i \equiv \begin{cases} 0 & \text{if } E = 0 \\ 1 & \text{if } E \leq FPL_i \\ 2' & \text{if } E \in (FPL_i, 1.2 \times FPL_i] \\ 2'' & \text{if } E > 1.2 \times FPL_i \end{cases}. \quad (16)$$

In the Online Appendix, we derive bounds on the response probabilities $\pi_{2'n,1r}$ and $\pi_{2''n,1r}$ which correspond to the fraction of women in earnings ranges 2' and 2'' who opt-in to assistance by reducing their earnings. These bounds exploit the fact that, by revealed preference, no woman will pair state 2'u under AFDC with state 2''u under JF. Likewise, no woman will pair state 2'n under AFDC with state 2''n under JF.

Implementing these formulas, we find that at least 27% of women who would work off assistance in earnings range 2'' under AFDC reduced their earnings below the poverty line in response to the JF reform. Accounting for sampling uncertainty yields a lower limit on a 95% confidence interval for $\pi_{2'',1r}$ of 0.17. Hence, the evidence is strong that some large earnings reductions occurred in response to the JF reform. We also find that at least 31% of women who would work off assistance in earnings range 2' under AFDC reduced their earnings below the poverty line in response to reform. The lower limit of the confidence interval for $\pi_{2',1r}$ is 0.19, which indicates that some opt-in responses also took place from earnings ranges closer to the poverty line.²⁶

It is also possible to partition range 1 into two or more sub-ranges. We have experimented with such extensions but found that they fail to offer additional insights regarding the effects of the JF reform.²⁷

²⁶Note that some of the responses involving reductions from earnings range 2' to range 1 could be larger than those from earnings range 2'' to range 1 since we don't know which earnings level in range 1 is being selected. The upper bounds on these response probabilities are uninformative.

²⁷There are good reasons for this. Recall that the theory does not constrain the sign of the labor supply responses that occur within range 1. This theoretical indeterminacy persists if range 1 is partitioned into sub-ranges and prevents identification of the magnitude of these allowed intensive margin responses. Additionally, the possibility of under-reporting limits the utility of revealed preference arguments because states 1u and 1r are not empirically distinguishable. This prevents identification of the magnitude of any responses to the reform entailing adjustments in reporting behavior within range 1.

B. *A Test for Anticipation*

As mentioned in Section IV, 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. This could, in turn, lead to a violation of our model’s static revealed preference restrictions.

Following Grogger and Michalopoulos (2003), we conduct a simple test for whether the JF time limits in fact yielded 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 6, 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 anticipatory 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.²⁸

XI. 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 entail an intensive margin and some of which entail an extensive margin labor supply response. 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

²⁸Grogger and Michalopoulos (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 particularly disadvantaged). JF’s more stringent twenty one month time limit might be expected to produce a larger anticipatory response than found by Grogger and Michalopoulos. It does not. One possible explanation for this discrepancy is that, as mentioned in Section I, 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. (2002, 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.”

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, Pistaferri, and Saporta-Eksten, 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 to other policy reforms.

Though we studied a randomized experiment, our approach is easily adapted 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 sub-populations.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.

A potentially fruitful avenue for future research is to consider the application of revealed preference arguments to dynamic models. Alternatives in such models consist of sequences of possible choices, which significantly enlarges the space of potential responses that can occur. However, explicitly dynamic models also provide additional opportunities to incorporate plausible non-parametric restrictions (e.g., stationary and time-separable preferences) that may yield interesting empirical predictions.

Finally, it is worth noting that decision-makers have sometimes been found to violate revealed preference restrictions empirically (e.g., Choi et al., 2014). An interesting question for future research is whether comparably informative non-parametric restrictions can be derived from behavioral models designed to explain systematic deviations from rationality.

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²⁹For example, if one uses an instrumental variables design, counterfactuals are, under weak assumptions, identified only for the sub-population of “compliers” (Imbens and Rubin, 1997).

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Table 1: Summary of Differences Between Status Quo and Jobs First Policy Regimes

	Jobs First	Status Quo
Welfare:		
Name of Program	Temporary Family Assistance (JF-TFA)	Aid for Families with Dependent Children (AFDC)
Eligibility	Earnings Below Poverty Line	Earnings level at which benefits are exhausted (see disregard parameters below)
Earnings Disregards:		
Fixed	n.a.	\$120 /mo. (first 12 months of work), \$90 /mo. (afterwards)
Proportional	100%	51% (first 4 months of work), 27% (afterwards)
Time Limit	21 months	None
Work Requirements	Mandatory work first employment services (exempt if child <1)	Education / training (exempt if child < 2)
Other Features:		
Sanctions	Grant reduced by 20%, 35%, or 100% depending on the infraction (1st, 2nd, or 3rd) for 3 months; moderately enforced	Grant reduced to reflect removal of adult from assistance unit; rarely enforced
Asset Limit	\$3,000	\$1,000
Family Cap	\$50 /mo.	\$100 /mo.
Transitional Medicaid	2 years	1 year
Transitional Child Care	Indefinitely as long as income is <75% of state median	1 year as long as income is <75% of state median
Child Support	\$100 /mo. disregarded; full pass-through	\$50 /mo. disregarded; \$50 /mo. maximum pass-through
Food Stamps (if joint with welfare):		
Earnings Disregards:		
Fixed	n.a.	n.a.
Proportional	100% of earnings up to FPL	76% of earnings up to the eligibility threshold

Notes: The left panel of the table, titled “Jobs First”, pertains to the experimental policy regime while the right panel, titled “Status Quo”, pertains to the control policy regime. The top panel of the table, titled “Welfare”, reports on the rules of the regime-specific welfare policy while the bottom panel, titled “Food Stamps”, reports on the rules of the regime-specific Foods Stamps program when taken up jointly with welfare assistance (as a stand-alone program Foods Stamps is the same under both policy regimes). Specifically, “Welfare” is the “family group” variant of welfare assistance considered in the JF experiment called, respectively, AFDC under the status quo and JF-TFA under Jobs First. Categorical eligibility for both AFDC and JF-TFA 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 reflects 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 $.73 \times (1-1/3) \times 100=49\%$, hence a proportional disregard of 51% ensues. From the 5th month forward the usual tax rate would be 100% but in CT it is $.73 \times (1-0) \times 100=73\%$, hence a proportional disregard of 27% ensues. Certain families, such as those in which the parent is incapacitated, are exempt from the Job First time limits. In addition, JF-TFA 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-TFA impose work requirements. Unless they are exempt, JF-TFA recipients are required to look for a job, either on their own or through Job Search Skills Training courses that teach job-seeking 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 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-TFA, 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-TFA recipient’s cash grant was reduced by 20% for three months in response to the first instance of noncompliance and by 35% 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-TFA 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-TFA 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, Job First's enhanced earning disregard applies to the FS grant calculation so that all earnings below the poverty line are disregarded. When JF-TFA recipients lose their welfare grant, they also lose the enhanced FS earned income disregard.

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)
<i>Demographic Characteristics</i>												
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
<i>Average quarterly pretreatment values</i>												
Earnings	673 [1306]	750 [1379]	-76* (40)	4 (6)	174 [465]	185 [479]	-11 (17)	2 (4)	1856 [1802]	1935 [1828]	-79 (99)	11 (21)
Cash welfare	903 [805]	845 [784]	58** (23)	-1 (2)	1050 [811]	1022 [799]	28 (28)	0 (3)	555 [677]	475 [602]	80** (35)	-4 (7)
Food stamps	356 [320]	344 [304]	12 (9)	0 (1)	399 [326]	398 [310]	1 (11)	1 (1)	253 [282]	230 [256]	23 (15)	-2 (4)
<i>Fraction of pretreatment quarters with</i>												
Any earnings	0.319 [0.361]	0.347 [0.370]	-0.029*** (0.011)	0.000 (0.001)	0.137 [0.211]	0.143 [0.215]	-0.007 (0.008)	0.000 (0.001)	0.751 [0.262]	0.776 [0.239]	-0.025* (0.014)	0.000 (0.002)
Any welfare assistance	0.581 [0.451]	0.551 [0.449]	0.030* (0.013)	-0.001 (0.001)	0.650 [0.439]	0.636 [0.439]	0.014 (0.015)	0.000 (0.001)	0.418 [0.438]	0.373 [0.416]	0.045* (0.023)	-0.002 (0.004)
Any Food Stamp assistance	0.613 [0.437]	0.605 [0.431]	0.008 (0.012)	0.000 (0.001)	0.670 [0.427]	0.674 [0.421]	-0.004 (0.015)	0.001 (0.001)	0.480 [0.433]	0.460 [0.418]	0.020 (0.023)	-0.003 (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. The included units are organized into the following sub-samples: “Overall Sample / Jobs First” refers to units in the experimental sample, “Overall Sample / AFDC” refers to units in the control sample, “Zero Earnings Q7 pre-RA / Jobs First” refers to units in the experimental sample that have zero earnings in the seventh quarter prior to random assignment (RA), “Zero Earnings Q7 pre-RA / AFDC” refers to units in the control sample that have zero earnings in the seventh quarter prior to RA, “Positive Earnings Q7 pre-RA / Jobs First” refers to units in the experimental sample that have positive earnings in the seventh quarter prior to RA, and “Positive Earnings Q7 pre-RA / AFDC” refers to units in the control sample that have positive earnings in the seventh quarter prior to RA. 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: Allowed and Disallowed Responses

State under Jobs First							
State under AFDC	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 (Figure 5 b)	—	—
0r	No LS Response Exit Welfare	Extensive LS (+) Exit Welfare	Extensive LS (+) Exit Welfare	No Response	Extensive LS (+) (Figure 5 a)	—	Extensive LS (+) Under-reporting (Figure 6 b)
1r	—	—	—	—	Intensive LS (+/0/-)	—	—
1u	—	—	—	—	Intensive LS (+/0/-) Truthful Reporting	—	—
2u	—	—	—	—	Intensive LS (-) Truthful Reporting (Figure 6 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 termed “no response” entail the same behavior under the two policy regimes. The cells containing a “—” represent responses that are not allowed based on revealed preference arguments derived from the model of Section IV. Specifically, (a) state 1u is unpopulated under JF (“—” in cells with a horizontally striped background fill) and (b) 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). 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). See Online Appendix for details.

Table 4: 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 (0.005)	0.135 (0.006)	-0.007 (0.008)
Pr(State=1n)	0.076	0.130	-0.055	0.078 (0.004)	0.126 (0.005)	-0.048 (0.006)
Pr(State=2n)	0.068	0.099	-0.031	0.069 (0.004)	0.096 (0.005)	-0.027 (0.006)
Pr(State=0p)	0.366	0.440	-0.074	0.359 (0.008)	0.449 (0.008)	-0.090 (0.010)
Pr(State=1p)	0.342	0.185	0.157	0.343 (0.007)	0.184 (0.005)	0.159 (0.009)
Pr(State=2p)	0.022	0.009	0.013	0.023 (0.002)	0.009 (0.001)	0.014 (0.002)
<i># of quarterly observations</i>	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 cases 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 Assistance Unit size is one greater than amount implied by baseline kidcount variable. Adjusted probabilities are computed via propensity score reweighting. Standard errors computed using 1,000 block bootstrap replications (resampling at case level).

Table 5: Point and Set-identified Response Probabilities

Response Type	State Occupied under		(a) General Specification of Preferences				
	AFDC	JF	Symbol	Estimate	Standard Error	95% CI (naive)	95% CI (conservative)
Detailed	On	1r	$\pi_{0n,1r}$	{0.055, 0.620}		[0.000, 0.739]	[0.000, 0.775]
	1n	1r	$\pi_{1n,1r}$	{0.382, 0.987}		[0.317, 1.000]	[0.317, 1.000]
	2n	1r	$\pi_{2n,1r}$	{0.280, 1.000}		[0.198, 1.000]	[0.198, 1.000]
	0r	0n	$\pi_{0r,0n}$	{0.000, 0.170}		[0.000, 0.205]	[0.000, 0.216]
	"	1n	$\pi_{0r,1n}$	{0.000, 0.170}		[0.000, 0.211]	[0.000, 0.215]
	"	2n	$\pi_{0r,2n}$	{0.000, 0.154}		[0.000, 0.171]	[0.000, 0.225]
	"	1r	$\pi_{0r,1r}$	{0.000, 0.170}		[0.000, 0.205]	[0.000, 0.219]
	"	2u	$\pi_{0r,2u}$	{0.031, 0.051}		[0.022, 0.058]	[0.022, 0.099]
	2u	1r	$\pi_{2u,1r}$	{0.000, 1.000}		[0.000, 1.000]	[0.000, 1.000]
Composite	Not working	Working	$\pi_{0,1+}$	0.167	0.016	[0.136, 0.198]	[0.136, 0.198]
	Off welfare	On welfare	$\pi_{n,p}$	{0.231, 0.445}		[0.189, 0.484]	[0.189, 0.486]
	On welfare	Off welfare	$\pi_{p,n}$	{0.000, 0.119}		[0.000, 0.144]	[0.000, 0.148]
	On welfare, not working	Off welfare	$\pi_{0r,n}$	{0.000, 0.170}		[0.000, 0.205]	[0.000, 0.212]
Detailed	0r	1n	$\pi_{0r,1n}$	0			
	1n	1r	$\pi_{1n,1r}$	0.382	0.039	[0.305, 0.459]	[0.305, 0.459]

(b) Restricted Specification of Preferences

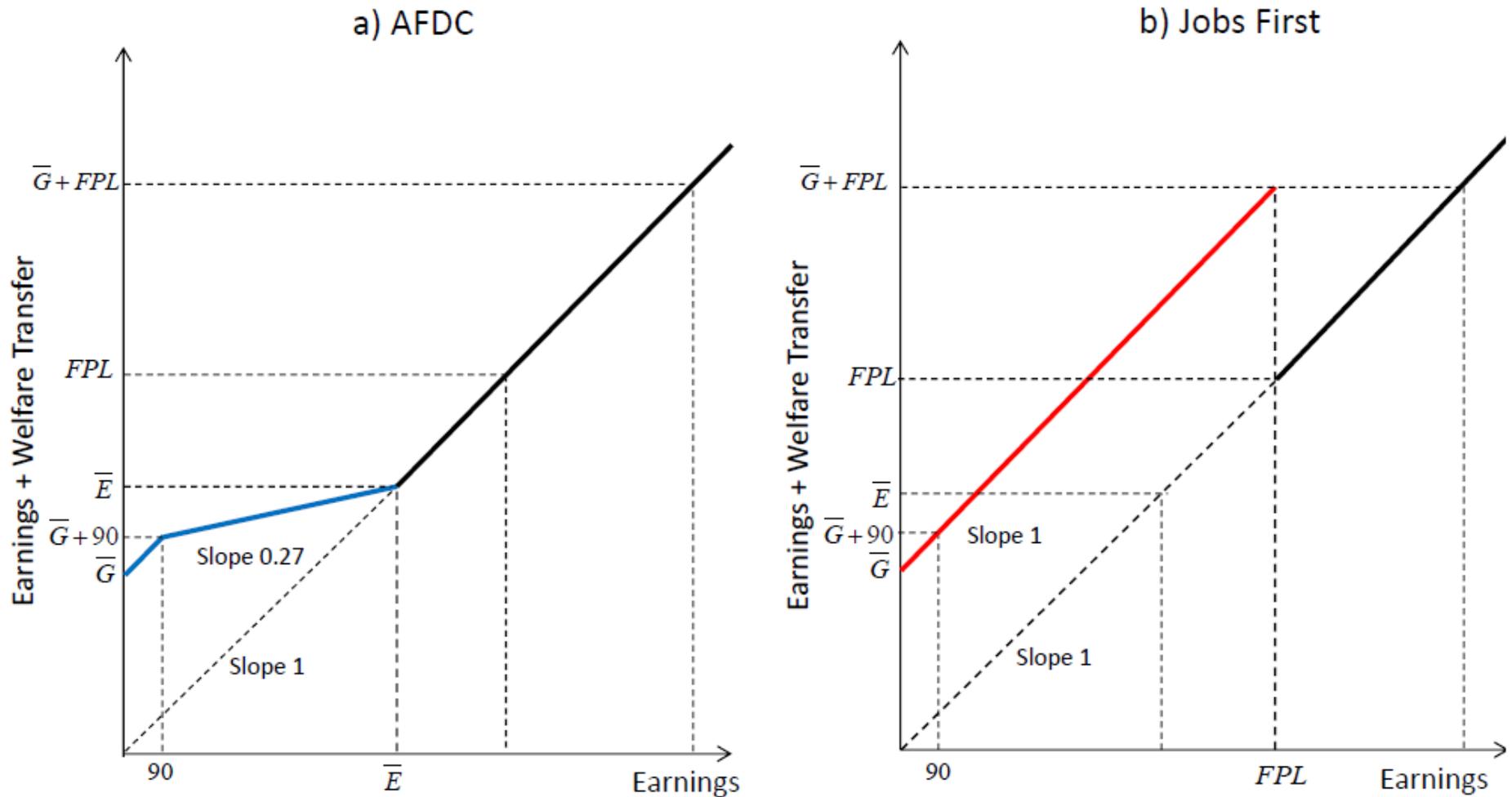
Notes: Number of state refers to earnings level, with 0 indicating no earnings, 1 indicating earnings below 3 times the monthly FPL, 2 indicating earnings above 3FPL, and 1+ indicating positive earnings. The letter "n" indicates welfare nonparticipation, the letter "r" indicates welfare participation with truthful reporting of earnings, the letter "u" indicates welfare participation with under-reporting of earnings, the letter "p" indicates welfare participation (irrespective of reporting). Composite response probabilities are linear combination of the detailed response probabilities (see Section VIII for the exact expressions). Estimates inferred from probabilities in Table 4, see text for formulas. 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 Online Appendix for details. Panel a refers to the general specification of preferences (expression (4) in the paper). Panel b refers to the restricted specification (expression (5) in the paper). Panel b omits all response probabilities whose estimates are the same as in Panel a.

Table 6: 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	0.185 (0.078)	0.383 (0.069)
JF	0.251 (0.077)	0.473 (0.069)
Difference	0.066 (0.054)	0.090 (0.010)
Difference in Differences	-0.024 (0.054)	

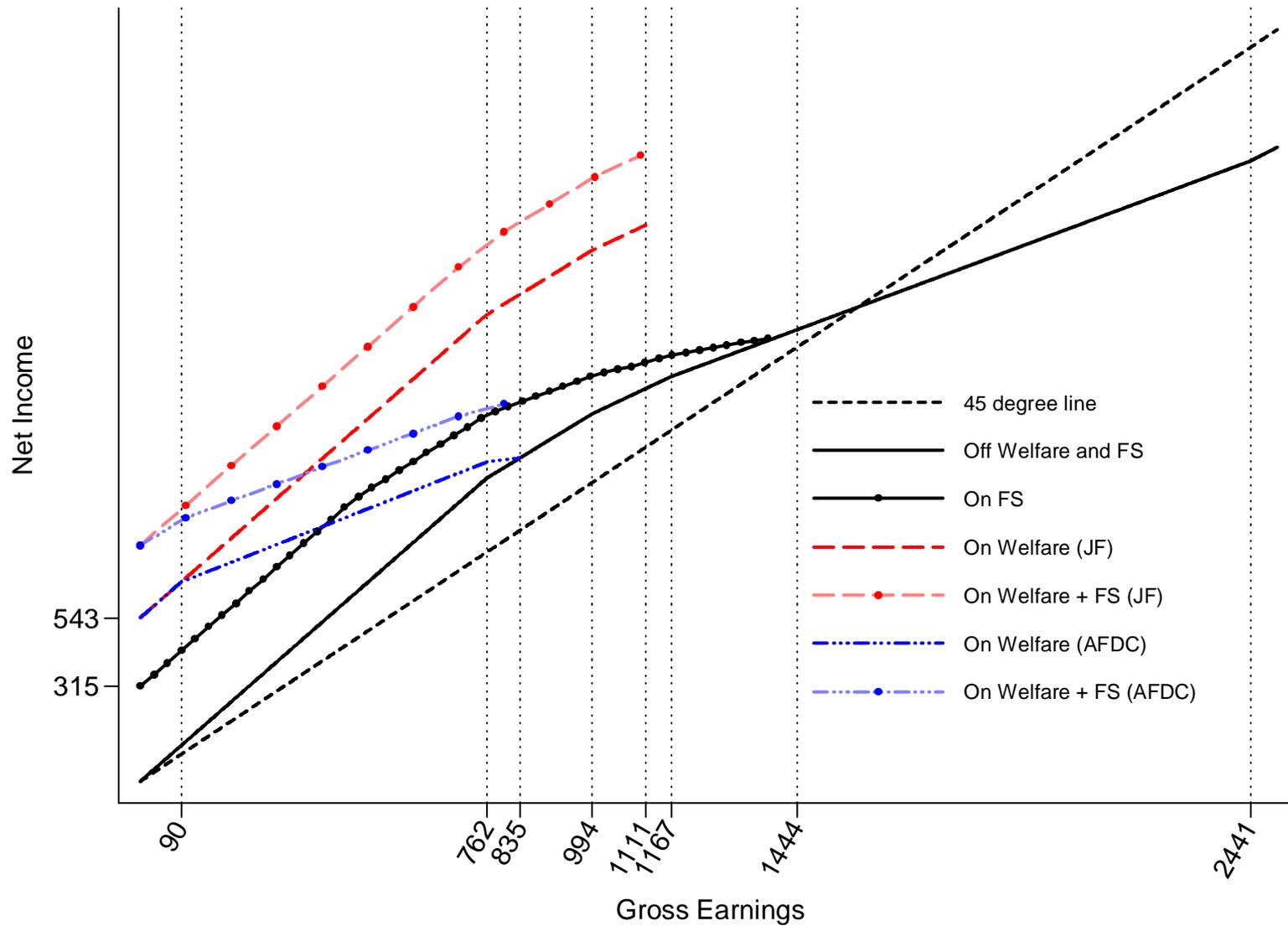
Notes: Sample consists of 87,717 case-months: 21 months of data on each of 4,177 cases with non-missing baseline information on age of youngest child. Table gives regression-adjusted fraction of case-months that women participated in welfare by experimental status and age of youngest child at baseline. Robust standard errors computed using clustering at case level.

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 transfers 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 \bar{G} is the base grant amount (\$543). The illustration assumes that the woman only has access to the fixed \$90 disregard and the proportional 73% disregard under AFDC which implies that the AFDC transfer is exhausted at earnings level \bar{E} corresponding to $\bar{G}/0.73 + 90$ (\$834). The JF welfare transfer falls to zero at earnings levels above $FPL + \bar{G}$ (\$1,654) can increase the sum of earnings and welfare transfers by taking up welfare assistance and working less.

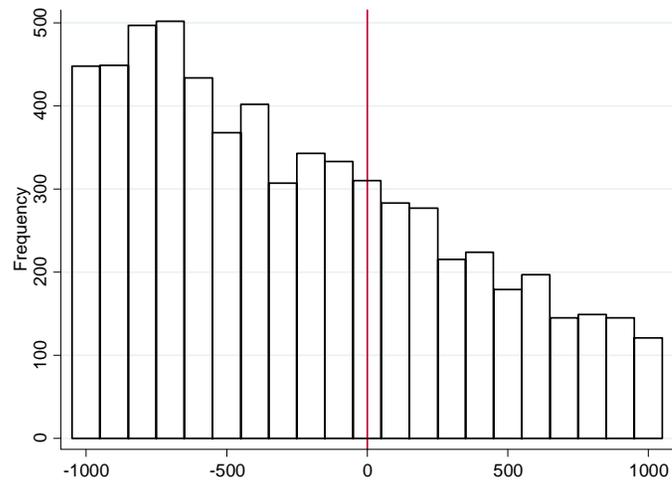
Figure 2: Net Income under Status Quo and Jobs First Policies, Accounting for Food Stamps and Taxes



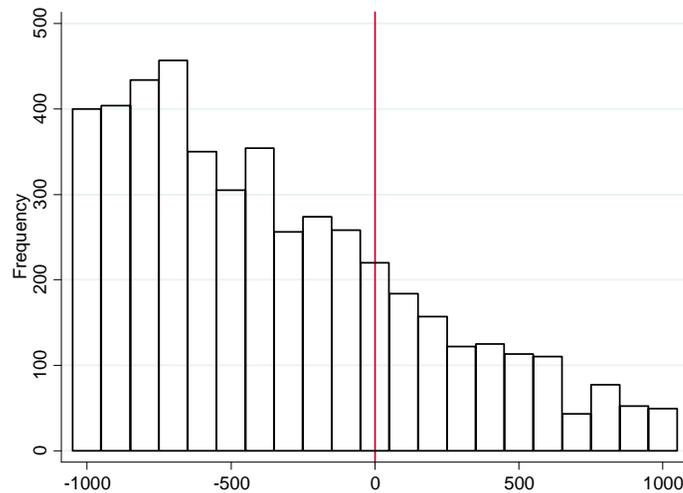
Notes: Figure depicts net income as a function of gross earnings for an assistance unit of size 3 in 1997 under the status-quo policy and the JF policy rules. Illustration assumes household only has access to fixed \$90 disregard under AFDC and faces \$366 in monthly rental expenses. Net income is earnings net of federal income taxes and inclusive of EITC and welfare and Food Stamps transfers (given participation in either program). *Vertical lines:* at the AFDC fixed earning disregard and break-even level (\$90 and \$835), at the end of the EITC's 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 1.3xFPL (\$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

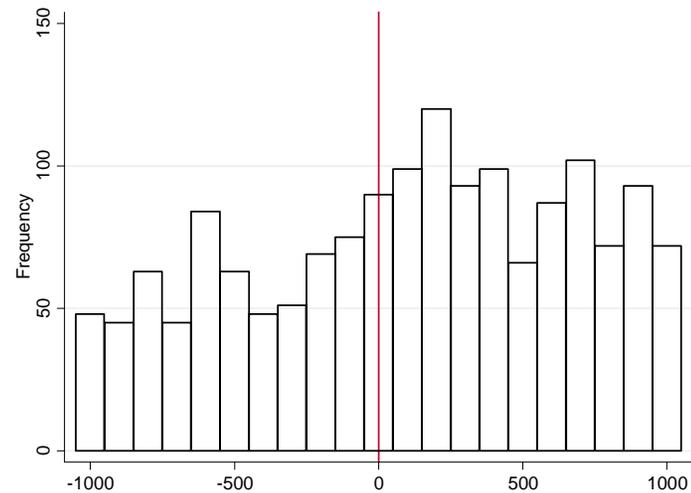
a) Unconditional



b) On Assistance all 3 Months of the Quarter



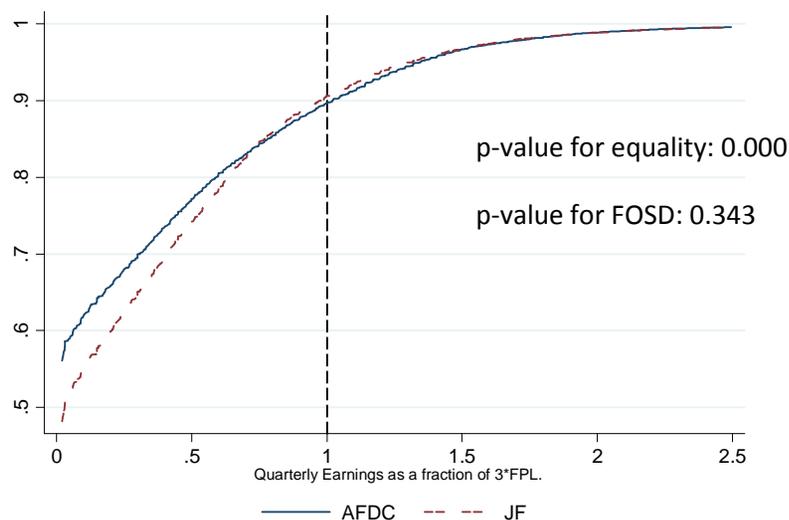
c) Off Assistance all 3 Months of the Quarter



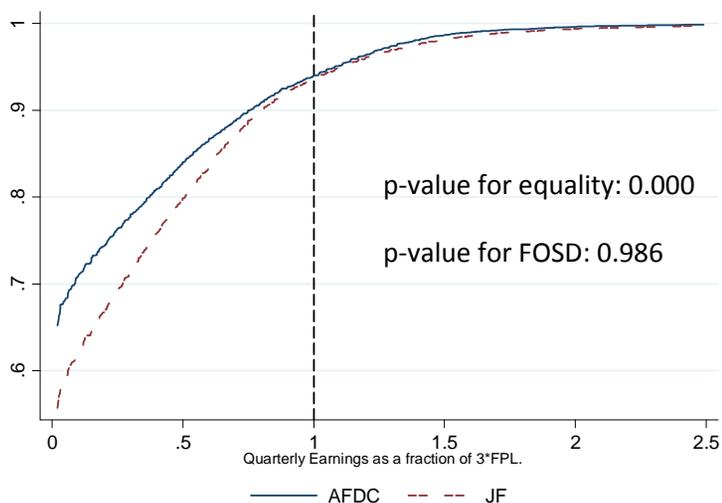
Notes: Restricted to the Jobs First sample in quarters 1-7 post random assignment. Assistance unit size has been inferred from monthly aid payment (sizes above eight have been excluded). The bins in the histograms are \$100 wide with bin 0 containing three times the monthly federal poverty line corresponding to the assistance unit's 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: EDFs of Quarterly Earnings Relative to 3 x Federal Poverty Line

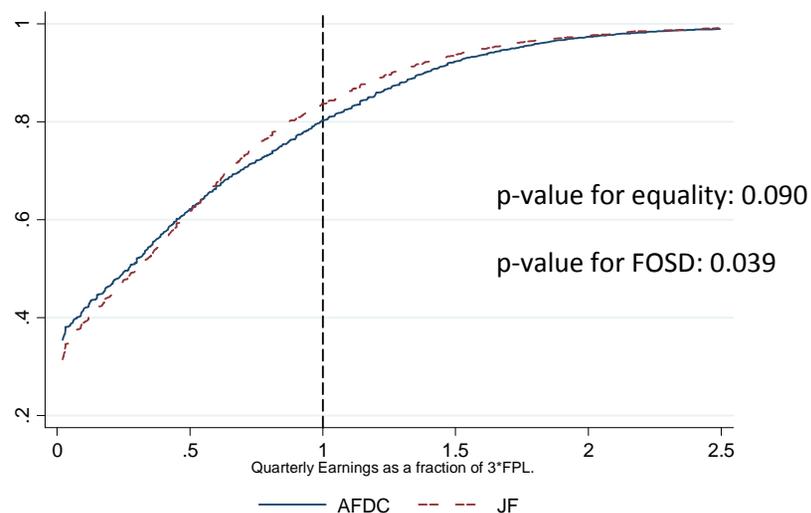
a) Unconditional



b) Zero Earnings Prior to Random Assignment



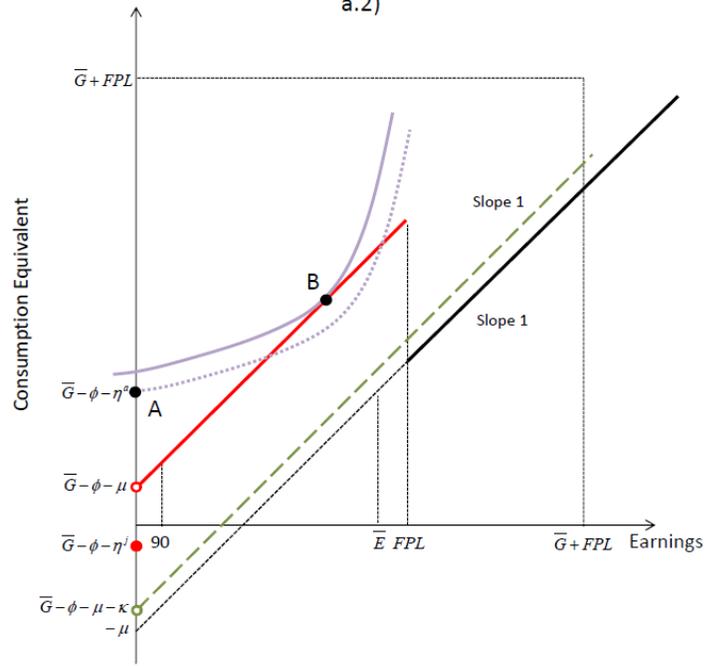
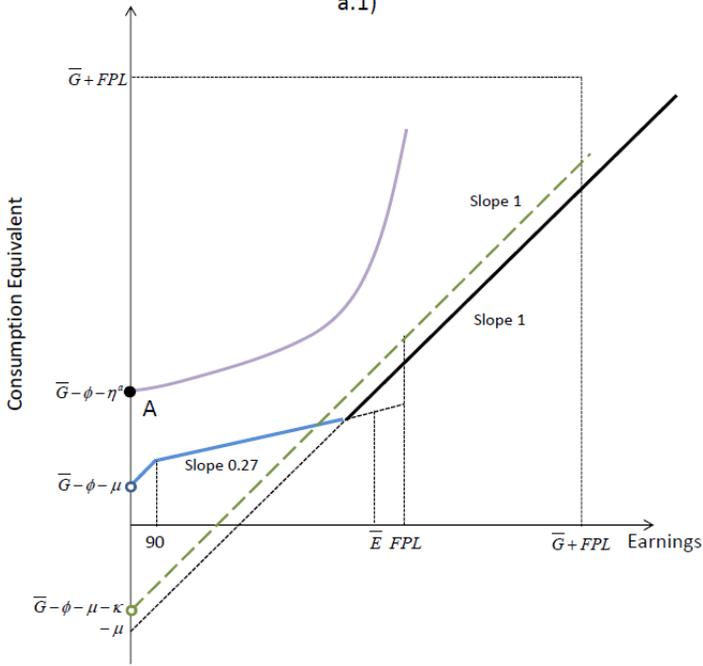
c) Positive Earnings Prior to Random Assignment



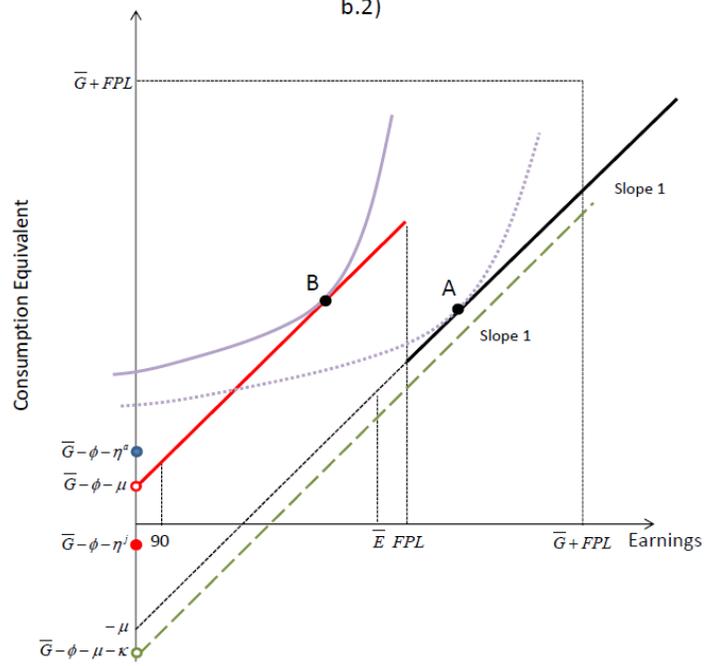
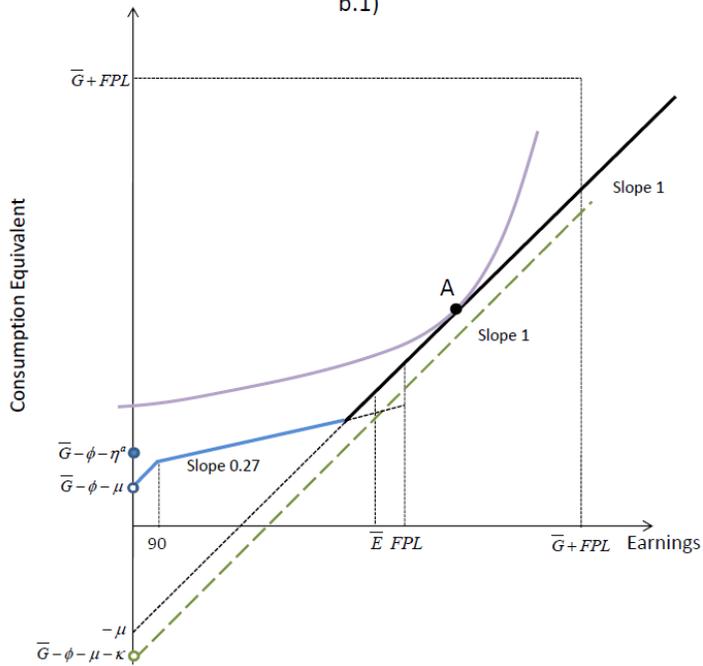
Notes: Figures give reweighted empirical distribution functions of quarterly UI earnings (in quarters 1-7 post-randomization) in JF and AFDC samples relative to three times the monthly federal poverty line. Assistance unit size determined by baseline survey variable “kidcount” (see text for details). Panel (b) refers to women with zero earnings in the 7th quarter prior to random assignment, while panel (c) refers to women with positive earnings in that quarter. 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 block bootstrap replications at case level, see Online Appendix for details).

Figure 5: Extensive and Intensive Margin Responses to Reform

a) From Not Working on Assistance under AFDC to Earning in Range 1 under Jobs First
 a.1) a.2)



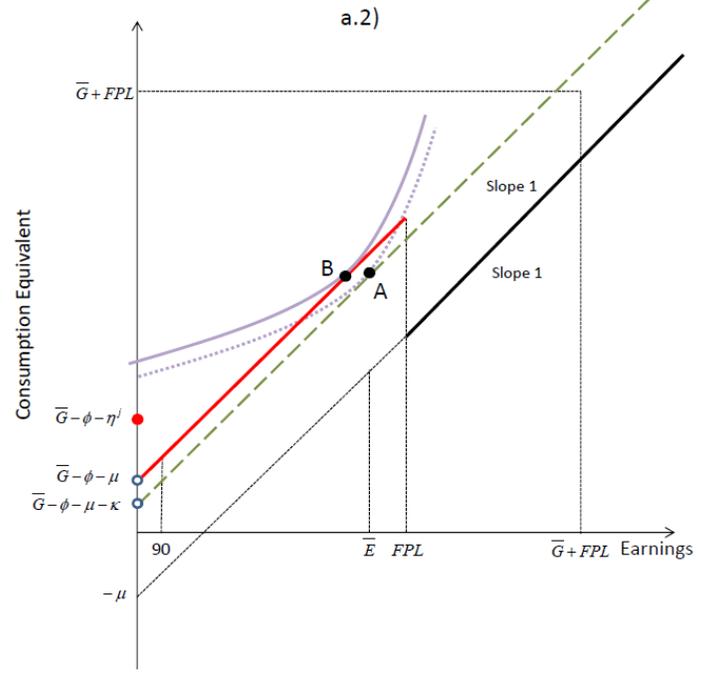
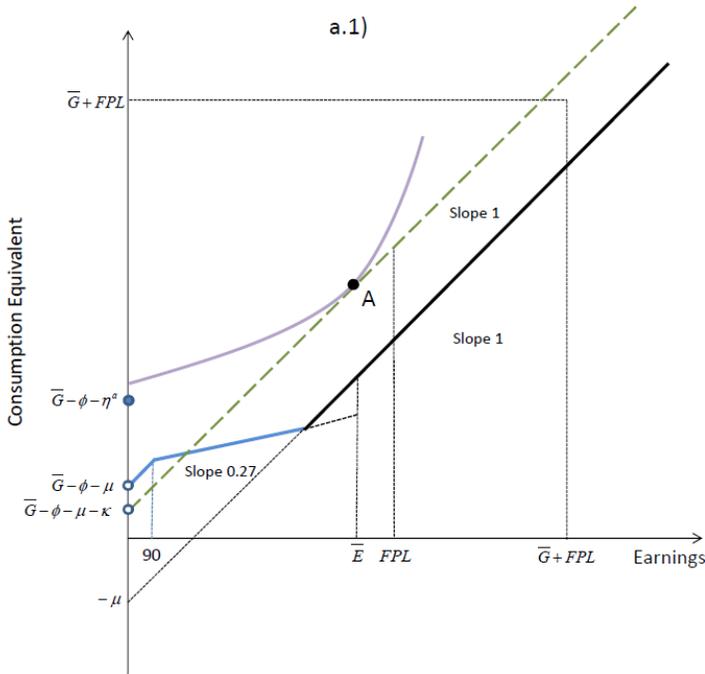
b) From Working in Range 2 off Assistance under AFDC to Earning in Range 1 under Jobs First
 b.1) b.2)



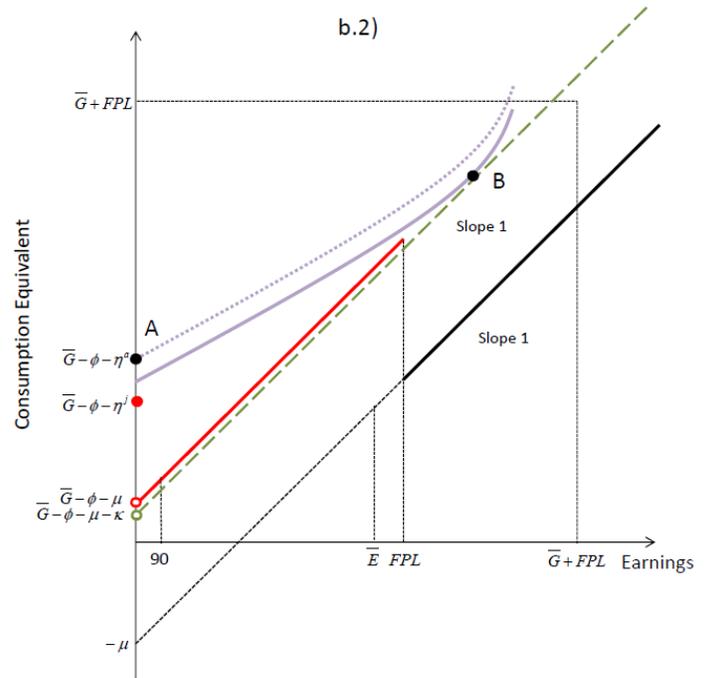
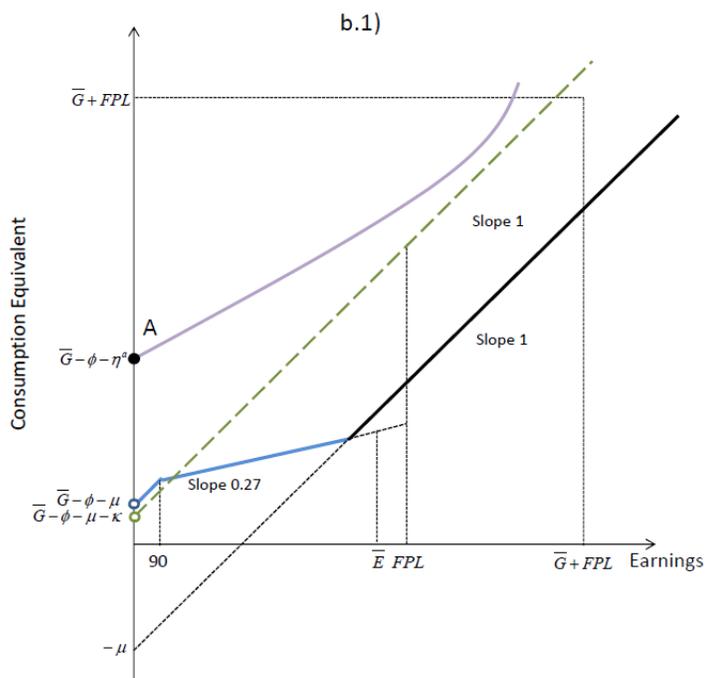
Notes: Panels a and b are drawn in the earnings (horizontal axis) and consumption equivalent (vertical axis) plane. The consumption equivalent equals earnings plus transfer income from welfare (if any) net of monetized hassle, stigma, work, and under-reporting costs (if any, see text for details). At each level of earnings, the bold lines correspond to consumption either off welfare or on welfare with truthful reporting of earnings to the welfare agency. The dashed lines correspond to consumption on welfare with under-reporting. Vertical lines represent the same earnings levels depicted in Figure 1: the fixed earning disregard under AFDC (\$90), the earnings level \bar{E} at which welfare assistance is exhausted under AFDC, and the FPL. For clarity, the graphs assume away earnings constraints and use a fixed wage rate. Panel a depicts a scenario where the JF reform induces a woman who would participate in welfare and not work under AFDC (point A) to take up work and truthfully report her earnings under JF (point B) – an extensive margin response. Panel b depicts a scenario where the JF reform induces a woman who be off assistance and earn in range 2 (point A) to reduce her earnings to range 1 and take up assistance under JF (point B) – an intensive margin response.

Figure 6: Earnings and Participation Choices with Under-reporting

a) From Under-reporting under AFDC to Truthful Reporting under Jobs First



b) From Truthful Reporting under AFDC to Under-reporting under Jobs First



Notes: Panels a and b are drawn in the earnings (horizontal axis) and consumption equivalent (vertical axis) plane. The consumption equivalent 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 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 consumption on welfare with under-reporting. Vertical lines represent the same earnings levels depicted in Figure 1: the fixed earning disregard under AFDC (\$90), the earnings level \bar{E} at which welfare assistance is exhausted under AFDC, and the FPL. For clarity, the graphs assume away earnings constraints and use a fixed wage rate. Panel a depicts a scenario where the JF reform induces a woman who would participate in welfare, work, and under-report her earnings under AFDC (point A) to work and truthfully report her earnings under JF (point B) thanks to the 100% earning disregard under JF. Panel b depicts a scenario where the JF reform induces a woman who would participate in welfare without work under AFDC (point A) to work and under-report her earnings under JF (point B) to avoid the hassle cost under JF.

Online Appendix

Outline

- Section 1 provides additional details about the data and variable construction summarized in Section II of the paper.
- Section 2 describes the propensity score re-weighting method used to adjust for chance imbalances in baseline characteristics mentioned in Section II of the paper.
- Section 3 explains how we construct the tests for equality and first order stochastic dominance whose p-values are reported in Figure 4 of the paper.
- Section 4 presents the baseline model described in Section IV of the paper. For expositional simplicity, Section IV of the paper describes the decision problem of a woman for whom $\bar{E}_i \leq FPL_i$. Here we handle both the case when $\bar{E}_i \leq FPL_i$ and $\bar{E}_i > FPL_i$. We do so by introducing an additional assumption on preferences (denoted **A.7**) which caps the value of being on assistance and truthfully reporting earning levels in $(FPL_i, \bar{E}_i]$. Assumption **A.7** is clearly void when $\bar{E}_i \leq FPL_i$, so the model presented here nests that described in Section IV of the paper. Instead, when $\bar{E}_i > FPL_i$ assumption **A.7** ensures that no woman chooses to earn in range 2, be on assistance, and truthfully report her earnings under AFDC. In brief, thanks to assumption **A.7** we do not need to distinguish between the case when $\bar{E}_i \leq FPL_i$ and $\bar{E}_i > FPL_i$ because in both cases the alternatives compatible with state $2r$ are either incompatible with the policy rules *or* compatible with the policy rules but not utility maximizing. Section 4 starts by introducing definitions and restating the assumptions made in the paper. We then prove a few intermediate lemmas and conclude with the main propositions and their proofs which support the revealed preference restrictions summarized in Section V of the paper. Specifically,
 - Lemma 1 establishes that no woman truthfully reports earnings above the federal poverty level while on assistance. Lemma 2 characterizes optimal reporting of earnings to the welfare agency. Corollary 1 describes the implications of optimal reporting for the dependence of preferences on the policy regime.
 - Lemma 3 characterizes the relative attractiveness of each state under the two policy regimes. Lemma 4 provides the main revealed preference argument regarding pairing of states under JF and AFDC.
 - Propositions 1 and 2 formally establish Table 3 in the paper. Corollary 2 establishes additional disallowed responses under the special form of the utility function introduced in Section IV of the paper.
- Section 5, specifically Lemma 5, describes the exhaustive set of testable restrictions on state probabilities implied by revealed preference, as presented in Section VII of the paper.

- Section 6 lists the analytical expressions for the bounds on the response probabilities and explain how they were derived. An example of such bounds is reproduced in Section VIII of the paper.
- Section 7 describes the construction of the 95% confidence intervals reported in Table 5 of the paper.
- Section 8 develops an extended model that relaxes assumption **A.7** made in Section 4 of this Appendix (see above) so that it becomes possible for a woman with $\bar{E}_i > FPL_i$ to select an alternative compatible with state $2r$ under AFDC. This extended model is referenced in Section VI of the paper. Specifically,
 - Propositions 3 and 4 establishes the effect of this relaxation on the set of allowed response margins, as summarized in Table A3. Corollary 4 establishes additional disallowed responses under the special form of the utility function introduced in Section IV of the paper.
 - Corollary 5 shows that, when women may select alternatives compatible with state $2r$ under AFDC, exits from the labor force (in the form of pairings of state $2r$ under AFDC with state $0r$ or $0n$ under JF) are allowed responses to the JF reform provided that labor market constraints are present.
- Section 9 develops an extended model that allows for participation in the Food Stamps (FS) program and accounts for taxes, including the EITC. This extended model is summarized in Section VI of the paper. Specifically,
 - Lemmas 6 and 7 characterize the combined welfare and FS transfer.
 - Lemma 8 establishes that no woman truthfully reports earnings above the federal poverty level while on welfare assistance. Lemma 9 characterizes optimal reporting. Corollary 6 describes the implication of optimal reporting for the dependence of preferences on the policy regime.
 - Lemma 10 provides the main revealed preference argument regarding pairing of states under JF and AFDC. Lemma 11 characterizes the relative attractiveness of each state under the two policy regimes.
 - Propositions 6 and 7 establish the allowed and disallowed responses, as summarized in Table A4.
 - Proposition 8 derives the form of the matrix Π of response probabilities. Proposition 9 and Remark 12 demonstrate that integrating out FS participation yields a matrix with the same zero and unitary entries as in the baseline model.
- Section 10 establishes the form of the matrix of response probabilities when a finer coarsening of earnings is adopted. The results of this extension are summarized in Section X of the paper. The empirical choice probabilities used for this exercise are reported in Table A8.
- 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 Assistance Unit (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→3, 1→3, 2→4, 3→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.

¹Changes 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.

2 Propensity Score Re-weighting

We use propensity score re-weighting 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; 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 \hat{p}_i . The propensity score weights used to adjust the moments of interest are given by:

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

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 re-weighted Kolmogorov-Smirnov (K-S) tests for equality of distribution functions across treatment groups. Let $F_n^t(e)$ be the propensity score re-weighted EDF of earnings in treatment group t . That is,

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

Define the corresponding bootstrap EDF as:

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

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:

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

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:

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

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 re-centered version of this statistic given by:

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

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

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

4 Baseline Model

Notation, Definitions, and Assumptions

Notation (Policy Regimes). 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, Reported Earnings, and Program Participation). Let D be an indicator for a woman participating in welfare: $D = 1$ if she is on assistance and $D = 0$ otherwise. Let E denote a woman's earnings. Earnings are the product of hours of work, H , and an hourly wage rate, W . Let E^r denote the earnings a woman reports to the welfare agency; Z be an indicator that takes the value 1 when a welfare recipient reports zero earnings and takes the value 0 otherwise, that is, $Z = Z(D, E^r) \equiv \mathbf{1}[E^r = 0]D$; and R be an indicator that takes the value 1 when a welfare recipient under-reports her earnings to the welfare agency and takes the value 0 otherwise, that is, $R = R(E, D, E^r) \equiv \mathbf{1}[E^r < E]D$.

Definition 2 (Earning Ranges). 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 3 (Welfare Transfer Functions). For any reported earnings E^r , the regime dependent transfers are

$$G_i^a(E^r) \equiv \mathbf{1}[E^r \leq \bar{E}_i] (\bar{G}_i - \mathbf{1}[E^r > \delta_i] (E^r - \delta_i) \tau_i),$$

and

$$G_i^j(E^r) \equiv \mathbf{1}[E^r \leq FPL_i] \bar{G}_i.$$

The parameter $\delta_i \in \{90, 120\}$ gives woman i 's fixed disregards, the parameter $\tau_i \in \{.49, .73\}$ governs her proportional disregard, $\bar{E}_i \equiv \bar{G}_i/\tau_i + \delta_i$ is woman i 's break-even earnings level under regime a (i.e. the level at which benefits are exhausted), and \bar{G}_i is the base grant amount. \bar{E}_i , \bar{G}_i , and FPL_i vary across women due to differences in AU size.

Definition 4 (Consumption). Consider the triple (E, D, E^r) . Under regime $t \in \{a, j\}$, woman i 's consumption corresponding to (E, D, E^r) is

$$C_i^t(E, D, E^r) \equiv E + G_i^t(E^r) D. \quad (1)$$

Below, when the consumption associated with a triple (E, D, E^r) and calculated according to (1) does not vary across regimes we omit the superscript t , and we omit the subscript i when it does not vary across women.

Definition 5 (State). Consider the triple (E, D, E^r) . The state corresponding to (E, D, E^r) is defined by the function:

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

Definition 6 (Job Offers). A woman's samples K_i job offers, composed of wage and hours offer pairs: $\Theta_i = \{(W_i^k, H_i^k)\}_{k=1}^{K_i}$ where K_i is an integer number (possibly zero), $(W_i^k, H_i^k) \in (0, \infty) \times (0, \overline{H}_i]$ with \overline{H}_i denoting the woman's total disposable time. The limiting case $K_i = \infty$ is treated as follows: for any $H \in (0, \overline{H}_i]$ a woman's samples a wage offer $W_i(H)$. When $K_i = \infty$ let $\Theta_i = W_i(\cdot) \times (0, \overline{H}_i]$.

Definition 7 (Alternative). An alternative is a wage, hours of work, welfare participation indicator, and earning report tuple (W, H, D, E^r) .

Definition 8 (Sub-alternative). A sub-alternative is a wage, hours of work, and welfare participation indicator tuple (W, H, D) .

Definition 9 (Alternative Compatible with a State). We say that alternative (W, H, D, E^r) is compatible with state s for woman i if, letting $E \equiv WH$, $s = s(E, D, E^r)$.

Definition 10 (Alternative Compatible with a State and Available). We say that alternative (W, H, D, E^r) is available and compatible with state s for woman i if (W, H, D, E^r) is compatible with state s and $(W, H) \in \Theta_i \cup (0, 0)$.

Definition 11 (Dominated State). We say that state s is dominated under regime t if no available alternative compatible s under regime t is chosen by any woman.

Definition 12 (Utility Function). Define $U_i^t(H, C, D, Z, R)$ as the utility woman i derives from the tuple (H, C, D, Z, R) under regime $t \in \{a, j\}$. When the utility of a tuple (H, C, D, Z, R) is regime-invariant we omit the superscript t .

Definition 13 (Relative attractiveness of a State). We say that state s is:

1. no better under regime j than under regime a if, for any alternative (W, H, D, E^r) compatible with state s , and letting $E \equiv WH$, $C_i^t \equiv C_i^t(E, D, E^r)$, $Z \equiv Z(D, E^r)$ and $R \equiv R(E, D, E^r)$,

$$U_i^j(H, C_i^j, D, Z, R) \leq U_i^a(H, C_i^a, D, Z, R) \text{ for all } i.$$

2. no worse under regime j than under regime a if, for any alternative (W, H, D, E^r) compatible with state s , and letting $E \equiv WH$, $C_i^t \equiv C_i^t(E, D, E^r)$, $Z \equiv Z(D, E^r)$ and $R \equiv R(E, D, E^r)$,

$$U_i^j(H, C_i^j, D, Z, R) \geq U_i^a(H, C_i^a, D, Z, R) \text{ for all } i.$$

3. equally attractive under regime j and regime a if, for any alternative (W, H, D, E^r) compatible with state s , and letting $E \equiv WH$, $C_i^t \equiv C_i^t(E, D, E^r)$, $Z \equiv Z(D, E^r)$ and $R \equiv R(E, D, E^r)$,

$$U_i^j(H, C_i^j, D, Z, R) = U_i^a(H, C_i^a, D, Z, R) \text{ for all } i.$$

Definition 14 (Collections of States). Define $\mathcal{S} \equiv \{0n, 1n, 2n, 0r, 1r, 1u, 2u\}$, $\mathcal{C}_+ \equiv \{1r\}$, $\mathcal{C}_- \equiv \{0r\}$, and $\mathcal{C}_0 \equiv \{0n, 1n, 2n, 1u, 2u\}$.

Assumption 1 (Preferences). Woman i 's utility functions $U_i^a(\cdot, \cdot, \cdot, \cdot, \cdot)$ and $U_i^j(\cdot, \cdot, \cdot, \cdot, \cdot)$ satisfy the following restrictions:

- A.1** utility is strictly increasing in C ;

- A.2** $U_i^t(H, C, 1, Z, 1) < U_i^t(H, C, 1, Z, 0)$ for all (H, C, Z) and $t \in \{a, j\}$;
- A.3** $U_i^t(H, C, 1, 1, R) \leq U_i^t(H, C, 1, 0, R)$ for all (H, C, R) and $t \in \{a, j\}$;
- A.4** $U_i^j(H, C, 1, 1, R) \leq U_i^a(H, C, 1, 1, R)$ for all (H, C, R) ;
- A.5** $U_i^a(H, C, 1, 0, R) = U_i^j(H, C, 1, 0, R)$ for all (H, C, R) ;
- A.6** $U_i^a(H, C, 0, 0, 0) = U_i^j(H, C, 0, 0, 0)$ for all (H, C) ;
- A.7** $U_i^a(H, C_i^a(E, 1, E), 1, 0, 0) < U_i^a(H, C_i^a(E, 0, E), 0, 0, 0)$ for all (H, W) such that $E = WH \in (FPL_i, \bar{E}_i]$ whenever $\bar{E}_i > FPL_i$.

Remark 1 (Preferences: Verbalizing Assumption 1). **A.2** states that under-reporting decreases utility; this “under-reporting disutility” may vary across alternatives. **A.3** states that hassle does not increase utility; this “hassle disutility” may vary with hours worked and consumption. **A.4** states that regime j ’s hassle disutility is no smaller than regime a ’s; the difference in hassle disutility between the two regimes may vary with hours worked and consumption. Assumption **A.5** states that the utility value of an alternative entailing hours of work and consumption (H, C) and welfare reciprocity does not vary with the regime whenever reported earnings are positive, irrespective of whether earnings are under-reported or reported truthfully. **A.6** states that the utility value of an alternative entailing no welfare reciprocity is independent of the treatment. As mentioned in the introductory Outline to this Appendix, **A.7** implicitly defines a *local* lower bound on the disutility from stigma disutility. It says that at earnings levels in $(FPL_i, \bar{E}_i]$, the extra consumption due to the transfer income that a woman receives under regime a when truthfully reporting her earnings does not suffice to compensate her for the stigma disutility she incurs. Clearly, **A.7** is void for any woman with $\bar{E}_i \leq FPL_i$, in which case Assumption 1 reduces to the set of assumptions on preferences made in Section IV of the paper.

Remark 2 (Preferences: A Special Case). In Section IV of the paper, we consider a restricted specification of the 5-argument utility function $U_i^t(\cdot, \cdot, \cdot, \cdot, \cdot)$ in Assumption 1. We do so to aid in illustrating the mechanics of the model and the implications of further restricting preferences. Specifically, we employ a 2-argument utility function $U_i(\cdot, \cdot)$:

$$U_i(H, C - \mu_i \mathbf{1}[E > 0] - \phi_i D - \eta_i^t Z - \kappa_i R), \quad (2)$$

where κ_i is an under-reporting penalty, μ_i is a fixed cost (or benefit) of working, ϕ_i is a stigma cost (or benefit) from welfare participation, and η_i^t is a hassle cost from reporting zero earnings on assistance. The parameters $(\phi_i, \eta_i^a, \eta_i^j, \kappa_i, \mu_i)$ obey the following restrictions: ϕ_i is regime invariant in accordance with **A.5** in Assumption 1, $\eta_i^j \geq \eta_i^a \geq 0$ in accordance with **A.3** and **A.4**, $\kappa_i > 0$ is regime invariant in accordance with **A.2** and **A.5**, and μ_i is regime invariant in accordance with **A.6**. The utility function is not indexed by regime t in accordance with **A.6** in Assumption 1. A sufficient condition for **A.7** in Assumption 1 to hold, is that, $\phi_i > G_i^a(FPL_i)$; hence ϕ_i must be a stigma cost not a benefit for any woman with $\bar{E}_i > FPL_i$. Furthermore, the 2-argument utility function $U_i(\cdot, \cdot)$ is strictly increasing in its second argument in accordance with **A.1** in Assumption 1. To preview, form (2) is used below in Corollaries 2 and 4.

Remark 3 (Preferences: Another Special Case). In this Appendix (proof of Propositions 2 and 4), we consider a second special case of the 5-argument utility function $U_i^t(\cdot, \cdot, \cdot, \cdot, \cdot)$ under

Assumption 1. We do so to provide examples. Specifically, we let the utility that a generic woman i derives under regime t from alternative (W, H, D, E^r) be (letting $E \equiv WH$):

$$U_i^t (H, C_i^t (E, D, E^r), D, Z (D, E^r)) = -\alpha_i H + v (C_i^t (E, D, E^r) - \mu_i \mathbf{1} [E > 0] - \kappa_i R) - \phi_i D - \eta_i^t Z (D, E^r) \quad (3)$$

where α_i is the change in utility that the woman derives from one additional unit of work, κ_i is an under-reporting penalty, μ_i is a fixed cost (or benefit) of working, ϕ_i is a stigma cost (or benefit) from welfare participation, η_i^t is a hassle cost from reporting zero earnings on assistance, and $v(\cdot)$ is a strictly increasing function by **A.1** and regime invariant by **A.6**. By **A.3-A.4** in Assumption 1, the parameters (η_i^j, η_i^a) are such that $\eta_i^j \geq \eta_i^a \geq 0$. By **A.2** and **A.5** in Assumption 1 $\kappa_i > 0$ and regime invariant. By **A.5** in Assumption 1 ϕ_i is regime invariant and by **A.7** in Assumption 1 ϕ_i is bounded below by $\underline{\phi}_i \equiv \max_{E \in [FPL_i, \bar{E}_i]} [v(E - \mu_i + G_i^a(FPL_i)) - v(E - \mu_i)]$. For convenience we assume that $\alpha_i \geq 0$, that is, leisure is a good. We consider three forms of $v(\cdot)$: the identity function (hence $v(\cdot)$ linear), a strictly concave function (hence the marginal utility of consumption is strictly decreasing in consumption), a strictly convex function (hence the marginal utility of consumption is strictly increasing in consumption). When $v(\cdot)$ is linear the lower bound on the stigma disutility implied by **A.7** in Assumption 1 simplifies to $\underline{\phi}_i \equiv G_i^a(FPL_i)$.

Assumption 2 (Ineligible Earning Levels). *No woman may be on welfare assistance and truthfully report earnings above FPL_i under regime j or above \bar{E}_i under regime a .*

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

$$\max_{(W, H) \in \Theta_i \cup (0, 0), D \in \{0, 1\}, E^r \in [0, WH]} U_i^t (H, C_i^t (WH, D, E^r), D, Z (D, E^r), R (WH, D, E^r)).$$

Assumption 4 (Breaking Indifference). *Women break indifference in favor of the same alternative irrespective of the regime.*

Intermediate Lemmas

Lemma 1 (State 2r). *Given Assumptions 1, 2, and 3, no woman chooses an alternative compatible with state 2r.*

Proof. Under regime j no alternative is compatible with state 2r by Assumption 2. Consider now a woman with $\bar{E}_i \leq FPL_i$ under regime a . By Assumption 2 she may not be on assistance and truthfully report earnings above FPL_i (range 2). Finally, consider a woman with $\bar{E}_i > FPL_i$ under regime a . By Assumption 2 she may not be on assistance and truthfully report earnings above \bar{E}_i . By **A.7** in Assumption 1 she will not truthfully report earnings in $(FPL_i, \bar{E}_i]$ because she can attain a higher utility level by being off assistance (Assumption 3): the extra consumption due to the transfer income does not suffice to compensate the woman for the stigma disutility she incurs when being on assistance. \square

Lemma 2 (Optimal Reporting). *Write woman i 's optimization problem (Assumption 3) as a nested maximization problem:*

$$\max_{(W, H) \in \Theta_i \cup (0, 0), D \in \{0, 1\}} \left[\max_{E^r \in [0, WH]} U_i^t (H, C_i^t (WH, D, E^r), D, Z (D, E^r), R (WH, D, E^r)) \right]. \quad (4)$$

Focus on the inner maximization problem in (4) for given sub-alternative (W, H, D) with $D = 1$. Let $E \equiv WH$ and $E_i^{r,t} \equiv E_i^{r,t}(W, H)$ denote woman i 's utility maximizing earning report conditional on $(W, H, 1)$. Given Assumptions 1-4:

1. under regime j : $E_i^{r,j}$ entails either truthful reporting, that is, $E_i^{r,j} = E$, or under-reporting such that $E > E_i^{r,j} \in [0, FPL_i]$; in particular, state $1u$ is dominated;
2. under regime a : $E_i^{r,a}$ entails either truthful reporting, that is, $E_i^{r,a} = E$, or under-reporting such that $E > E_i^{r,a} \in [0, \delta_i]$.

Proof. We prove each part of the Lemma in turn. In what follows, for convenience, we let U_i^t serve as be shortcut notation for $U_i^t(H, C_i^t(E, 1, E^r), 1, Z(1, E^r), R(E, D, E^r))$.

1. Under regime j , consider three mutually exclusive pairs (W, H) spanning the range of values for E :

- (a) (W, H) **such that** $E = 0$

A woman cannot over-report earnings (Assumption 3). Thus, $E_i^{r,j} = E$.

- (b) (W, H) **such that** $E \in (0, FPL_i]$

Woman i 's utility while on welfare depends on reported earnings E^r as follows:

$$U_i^j = \begin{cases} [1] : U_i^j(H, E + \bar{G}_i, 1, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^j(H, E + \bar{G}_i, 1, 0, 1) & \text{if } E^r \in (0, E) \\ [3] : U_i^j(H, E + \bar{G}_i, 1, 0, 0) & \text{if } E^r = E \end{cases} . \quad (5)$$

By **A.2** in Assumption 1, truthful reporting yields higher utility than any under-report $E^r \in (0, E)$: $[3] > [2]$ in (5). By **A.3** in Assumption 1, any under-report $E^r \in (0, E)$ yields at least as much utility as reporting $E^r = 0$: $[2] \geq [1]$ in (5). Thus, truthful reporting solves the inner maximization problem in (4) hence $E_i^{r,j} = E$. This shows that state $1u$ is dominated under regime j because the previous arguments holds for all $E \in (0, FPL_i]$ and $(0, FPL_i]$ corresponds to range 1 (Definition 2).

- (c) (W, H) **such that** $E > FPL_i$

Woman i must be under-reporting (Lemma 1). Her utility while on welfare depends on reported earnings E^r as follows:

$$U_i^j = \begin{cases} [1] : U_i^j(H, E + \bar{G}_i, 1, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^j(H, E + \bar{G}_i, 1, 0, 1) & \text{if } E^r \in (0, FPL_i] \end{cases} . \quad (6)$$

By **A.3** in Assumption 1, any report $E^r \in (0, FPL_i]$ yields at least as much utility as reporting $E^r = 0$: $[2] \geq [1]$ in (6). If **A.3** in Assumption 1 holds as an equality then $[2] = [1]$ in (6) and woman i is indifferent among reports in $[0, FPL_i]$. In this case, any $E^r \in [0, FPL_i]$ solves the inner maximization problem in (4) thus $E_i^{r,j} \in [0, FPL_i]$. If **A.3** in Assumption 1 holds as a strict inequality then $[2] > [1]$ in (6) and woman i is indifferent among (under-) reports in $(0, FPL_i]$ and prefers them to (under-) reporting $E^r = 0$. In this case, any report $E^r \in (0, FPL_i]$ solves the inner maximization problem in (4) thus $E_i^{r,j} \in (0, FPL_i]$.

2. Under regime a , consider four mutually exclusive pairs (W, H) spanning the range of values for E :

- (a) (W, H) **such that** $E = 0$

A woman cannot over-report earnings (Assumption 3). Thus, $E_i^{r,a} = E$.

(b) (W, H) **such that** $E \in (0, \delta_i]$

Woman i 's utility while on welfare depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, E + \bar{G}_i, 1, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, E + \bar{G}_i, 1, 0, 1) & \text{if } E^r \in (0, E) \\ [3] : U_i^a(H, E + \bar{G}_i, 1, 0, 0) & \text{if } E^r = E \end{cases} . \quad (7)$$

By **A.3** and **A.2** in Assumption 1: $[3] > [2] \geq [1]$ in (7). Thus, truthful reporting solves the inner maximization problem in (4) hence $E_i^{r,a} = E$.

(c) (W, H) **such that** $E \in (\delta_i, FPL_i]$

Woman i 's utility while on welfare depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, E + \bar{G}_i, 1, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, E + \bar{G}_i, 1, 0, 1) & \text{if } E^r \in (0, \delta_i] \\ [3] : U_i^a(H, E + G_i^a(E^r), 1, 0, 1) & \text{if } E^r \in (\delta_i, E) \\ [4] : U_i^a(H, E + G_i^a(E^r), 1, 0, 0) & \text{if } E^r = E \end{cases} . \quad (8)$$

By **A.1** and **A.3** in Assumption 1, and the fact that $\bar{G}_i = G_i^a(0) > G_i^a(E^r)$ for all E^r in $(\delta_i, FPL_i]$: $[1] \leq [2]$ and $[3] < [2]$ in (8). Thus, only truthful reports *or* under-reports in $[0, \delta_i]$ may solve the inner maximization problem in (4). Specifically, if **A.3** in Assumption 1 holds as an equality then $[1] = [2]$ in (8) and woman i is indifferent among (under-) reports in $[0, \delta_i]$. In this case $E_i^{r,a} = E$ *or* $E_i^{r,a} \in [0, \delta_i]$ depending on whether $[4] \geq [2]$ or $[4] \leq [2]$. If **A.3** in Assumption 1 holds as a strict inequality then $[1] < [2]$ in (8) and woman i is indifferent among (under-) reports in $(0, \delta_i]$. In this case $E_i^{r,a} = E$ *or* $E_i^{r,a} \in (0, \delta_i]$ depending on whether $[4] \geq [2]$ or $[4] \leq [2]$.

(d) (W, H) **such that** $E > FPL_i$

Woman i must be under-reporting (Lemma 1). Her utility while on welfare depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, E + \bar{G}_i, 1, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, E + \bar{G}_i, 1, 0, 1) & \text{if } E^r \in (0, \delta_i] \\ [3] : U_i^a(H, E + G_i^a(E^r), 1, 0, 1) & \text{if } E^r \in (\delta_i, FPL_i] \end{cases} . \quad (9)$$

By **A.1** and **A.3** in Assumption 1, and the fact that $\bar{G}_i = G_i^a(0) > G_i^a(E^r)$ for all E^r in $(\delta_i, FPL_i]$: $[3] < [2]$ and $[1] \leq [2]$ in (9). Thus, only under-reports in $[0, \delta_i]$ may solve the inner maximization problem in (4). Specifically, if **A.3** in Assumption 1 holds as an equality then $[1] = [2]$ in (9) and woman i is indifferent among (under-) reports in $[0, \delta_i]$. In this case $E_i^{r,a} \in [0, \delta_i]$. If **A.3** in Assumption 1 holds as a strict inequality then $[1] < [2]$ in (9) and woman i is indifferent among (under-) reports in $(0, \delta_i]$ and prefers them to reporting $E^r = 0$. In this case $E_i^{r,a} \in (0, \delta_i]$.

□

Corollary 1 (Optimal Reporting and Policy Invariance). *Given Assumptions 1-4, the utility associated with any alternative compatible with states 1u and 2u and entailing optimal reporting is regime invariant.*

Proof. We examine each state in turn. □

1. State 1u

- (a) Consider a woman i and any sub-alternative $(W, H, 1)$ such that, letting $E \equiv WH$, E is in range 1 and $E_i^{r,j}(W, H) < E$. Thus alternative $(W, H, 1, E_i^{r,j}(W, H))$ is compatible with state $1u$ and entails optimal reporting under regime j . Let $C_i^j \equiv C_i^j(E, 1, E_i^{r,j}(W, H))$, $Z_i^j \equiv Z(1, E_i^{r,j}(W, H))$, and $R_i^j \equiv R_i^j(E, 1, E_i^{r,j}(W, H))$. We next show that $U_i^j(H, C_i^j, 1, Z_i^j, R_i^j) = U_i(H, C_i^j, 1, Z_i^j, R_i^j)$. By Lemma 2, $E_i^{r,j}(W, H) \in (0, FPL_i]$ or $E_i^{r,j}(W, H) \in [0, FPL_i]$ depending on the woman's preferences. In the first case, the utility woman i enjoys is $U_i^j(H, E + \bar{G}_i, 1, 0, 1)$ which equals $U_i(H, E + \bar{G}_i, 1, 0, 1)$ by **A.5** in Assumption 1. In the second case, the utility woman i enjoys is $U_i^j(H, E + \bar{G}_i, 1, 0, 1)$ which also equals $U_i(H, E + \bar{G}_i, 1, 0, 1)$ by **A.5** in Assumption 1 and because she is indifferent between (under-) reports in $(0, FPL_i]$ and reporting zero earnings, that is, $U_i^j(H, E + \bar{G}_i, 1, 1, 1) = U_i^j(H, E + \bar{G}_i, 1, 0, 1)$.
- (b) Consider any sub-alternative $(W, H, 1)$ such that, letting $E \equiv WH$, E is in range 1 and $E_i^{r,a}(W, H) < E$. Thus alternative $(W, H, 1, E_i^{r,a}(W, H))$ is compatible with state $1u$ and entails optimal reporting under regime a . Let $C_i^a \equiv C_i^a(E, 1, E_i^{r,a}(W, H))$, $Z_i^a \equiv Z(1, E_i^{r,a}(W, H))$, and $R_i^a \equiv R_i^a(E, 1, E_i^{r,a}(W, H))$. We next show that $U_i^a(H, C_i^a, 1, Z_i^a, R_i^a) = U_i(H, C_i^a, 1, Z_i^a, R_i^a)$. By Lemma 2, $E_i^{r,a}(W, H) \in (0, \delta_i]$ or $E_i^{r,a}(W, H) \in [0, \delta_i]$ depending on the woman's preferences. In the first case, the utility woman i enjoys is $U_i^a(H, E + \bar{G}_i, 1, 0, 1)$ which equals $U_i(H, E + \bar{G}_i, 1, 0, 1)$ by **A.5** in Assumption 1. In the second case, the utility woman i enjoys is also $U_i^a(H, E + \bar{G}_i, 1, 0, 1) = U_i(H, E + \bar{G}_i, 1, 0, 1)$ by **A.5** in Assumption 1 and because she is indifferent between (under-) reports in $(0, \delta_i]$ and reporting zero earnings, that is, $U_i^a(H, E + \bar{G}_i, 1, 1, 1) = U_i^a(H, E + \bar{G}_i, 1, 0, 1)$.
- (c) In 1.(a) and 1.(b) we have shown that any alternative compatible with state $1u$ and entailing optimal reporting yields regime-invariant consumption $E + \bar{G}_i$ and regime-invariant utility level $U_i(H, E + \bar{G}_i, 1, 0, 1)$.

2. State $2u$

The proof corresponding to state $2u$ is the same as that for state $1u$ once we consider a sub-alternative $(W, H, 1)$ such that, letting $E \equiv WH$, E is in range 2 (Lemma 2).

Remark 4 (Optimal under-Reporting and Alternatives Considered). In what follows, it is without loss of generality that we only focus on alternatives entailing optimal (under-) reporting among those compatible with states $1u$ and $2u$. No woman would select an alternative compatible with states $1u$ or $2u$ not entailing optimal (under-) reporting (Assumption 3). Additionally, it is without loss of generality that we disregard alternatives compatible with state $1u$ under regime j . No woman would select an alternative compatible with state $1u$ under regime j because it is dominated (Lemma 2, part 1.(b)).

Lemma 3 (Policy Impact on Attractiveness of States). *Given Assumptions 1-4:*

1. the states in \mathcal{C}_+ are no worse under regime j than under regime a ;
2. the states in \mathcal{C}_- are no better under regime j than under regime a ;
3. the states in \mathcal{C}_0 are equally attractive under regime j and regime a .

Proof. We prove each statement in turn.

1. The only state in \mathcal{C}_+ is $1r$. All alternatives compatible with state $1r$ entail E in range 1, $D = 1$, and $E^r = E$ hence $Z = 0$. Thus, the utility function associated with each of these alternatives is invariant to the treatment (**A.5** in Assumption 1). Accordingly, it suffices to show that the consumption associated with any one of these alternatives is not lower under regime j than under regime a . Because $G_i^a(E) \leq \overline{G}_i$ for all E in range 1, $C_i^j(E, 1, E) = E + \overline{G}_i \geq E + G_i^a(E) = C_i^a(E, 1, E)$, which verifies the desired inequality (**A.1** in Assumption 1).
2. The only state in \mathcal{C}_- is $0r$. All the alternatives compatible with state $0r$ entail $E = H = 0$, $D = 1$, and $E^r = 0$ hence $Z = 1$ and $R = 0$. Thus, it suffices to show that $U_i^a(0, \overline{G}_i, 1, 1, 0) \geq U_i^j(0, \overline{G}_i, 1, 1, 0)$. This inequality holds by **A.4** in Assumption 1.
3. All alternatives compatible with states $\{0n, 1n, 2n\}$ entail $D = 0$. Thus, the utility associated with each of these alternatives is invariant to the policy regime (**A.6** in Assumption 1). Accordingly, it suffices to show that the consumption associated with any of these alternatives is the same under regime j than under regime a . Because off assistance consumption is either zero, when $s_i = 0n$, or E , when $s_i \in \{1n, 2n\}$ consumption is unaffected by the regime. Finally consider states $\{1u, 2u\}$ entailing $0 \leq E^r < E$ and $D = 1$. Given optimal reporting, the utility function associated with each of these alternatives is invariant to the policy regime (Corollary 1). Accordingly, it suffices to show that the consumption associated with any one of these alternatives is the same under regime j and under regime a . If $s_i \in \{1u, 2u\}$ consumption is $E + \overline{G}_i$ under both regimes (see Lemma 2). Thus consumption is also policy invariant.

□

Lemma 4 (Revealed Preferences). *Consider any pair of states (s^a, s^j) obeying: I) $s^a \neq s^j$; II) state s^a is no worse under regime j than under regime a ; III) state s^j is no better under regime j than under regime a . Given Assumptions 3 and 4, no woman pairs states s^a and s^j .*

Proof. The proof is by contradiction. Consider any pair of states (s^a, s^j) satisfying properties I)-III) and suppose that there exists a woman i who pairs states s^a and s^j . By Assumption 3, this means that there exists an alternative (W, H, D, E^r) that is compatible with state s^a and utility maximizing under regime a ; and an alternative (W', H', D', E'^r) compatible with state s^j and utility maximizing under regime j . Define $E \equiv WH$ and $E' \equiv W'H'$. Let $C_i^t = C_i^t(E, D, E^r)$ and $C_i^{t'} = C_i^t(E', D', E'^r)$ for all $t \in \{a, j\}$, $Z = Z(D, E^r)$ and $Z' = Z(D', E'^r)$, $R = R(E, D, E^r)$ and $R' = R(E', D', E'^r)$. Thus, the woman's choices under regime a and, respectively, j reveal that

$$U_i^a(H, C_i^a, D, Z, R) \geq U_i^a(H', C_i^{a'}, D', Z', R'),$$

and

$$U_i^j(H', C_i^{j'}, D', Z', R') \geq U_i^j(H, C_i^j, D, Z, R).$$

By property II)

$$U_i^j(H, C_i^j, D, Z, R) \geq U_i^a(H, C_i^a, D, Z, R).$$

Combining the above three inequalities we have

$$U_i^j(H', C_i^{j'}, D', Z', R') \geq U_i^j(H, C_i^j, D, Z, R) \geq U_i^a(H, C_i^a, D, Z, R) \geq U_i^a(H', C_i^{a'}, D', Z', R'). \quad (10)$$

If any of the inequalities in (10) is strict, property III) is violated therefore we have a contradiction. If no inequality is strict, (10) rewrites as

$$U_i^j \left(H', C_i^{j'}, D', Z', R' \right) = U_i^j \left(H, C_i^j, D, Z, R \right) = U_i^a \left(H, C_i^a, D, Z, R \right) = U_i^a \left(H', C_i^{a'}, D', Z', R' \right). \quad (11)$$

The first equality in (11) means that woman i is indifferent between allocation (W, H, D, E^r) and $(W', H', D', E^{r'})$ under regime j and the last equality in (11) means that woman i is indifferent between allocation (W, H, D, E^r) and $(W', H', D', E^{r'})$ under regime a . She breaks the indifference in favor of allocation (W, H, D, E^r) under regime a and in favor of allocation $(W', H', D', E^{r'})$ under regime j . By Assumption 4 this means that $(W, H, D, E^r) = (W', H', D', E^{r'})$ which implies that $s^a = s^j$ which violates property I) therefore we have a contradiction. \square

Main Propositions

Proposition 1 (Restricted Pairings). *Given Assumptions 1-4, the pairings of states corresponding to the “-” entries in Table 3 are disallowed and the pairings of states $(1r, 1r)$ and $(1u, 1r)$ must occur.*

Proof. We begin with the pairings that are disallowed. State $1u$ is dominated under regime j (Lemma 2). Therefore no woman will pair state s^a with state $s^j = 1u$ for any $s^a \in \mathcal{S}$. Next, by Lemmas 4 and 3, no pairing of state s^a with state s^j can occur for all (s^a, s^j) in the collection

$$\left\{ (s^a, s^j) : s^a \in \mathcal{C}_0 \cup \mathcal{C}_+, s^j \in \mathcal{C}_0 \cup \mathcal{C}_-, s^a \neq s^j \right\}. \quad (12)$$

Thus, it suffices to show that the properties I)-III) of Lemma 4 are met. Property I) holds trivially and properties II) and III) hold by Lemma 3. Therefore no woman will select any of the pairings in (12). We next turn to the responses that must occur. By Lemma 1, the allowable states are given by $\mathcal{S} = \{0n, 1n, 2n, 0r, 1r, 1u, 2u\}$. We just argued that the pairings $\{(1r, s^j) : s^j \in \{0n, 1n, 2n, 0r, 1u, 2u\}\}$ are disallowed, therefore the pairing $(1r, 1r)$ must occur. Similarly, we just argued that the pairings $\{(1u, s^j) : s^j \in \{0n, 1n, 2n, 0r, 1u, 2u\}\}$ are disallowed, therefore the pairing $(1u, 1r)$ must occur. \square

Corollary 2 (Additional Restricted Pairings under Utility Specification (2)). *Given Assumptions 1-4 and subject to specification (2) of the utility function, the pairing of states $(0r, 1n)$ is disallowed.*

Proof. To enhance readability we employ the symbol $[s \succ^t s']$ to signify that under regime t an alternative compatible with state s is weakly preferred to an alternative compatible with state s' . The proof is by contradiction. Suppose there is a woman i who selects an alternative compatible with state $0r$ under regime a and selects an alternative compatible with state $1n$ under regime j entailing earnings $E^k \equiv W^k H^k$. By Assumption 3, her choice under regime a reveals that

$$[0r \succ^a 0n] : U_i^a(0, \bar{G}_i - \phi_i - \eta_i^a) \geq U_i(0, 0)$$

which implies $\bar{G}_i \geq \phi_i + \eta_i^a$. Her choice under regime j reveals that

$$[1n \succ^j 1r] : U_i(H^k, E^k - \mu_i) \geq U_i(H^k, E^k - \mu_i + \bar{G}_i - \phi_i)$$

which implies $\bar{G}_i \leq \phi_i$. Thus, optimality implies $\phi_i \geq \bar{G}_i \geq \phi_i + \eta_i^a$. If the inequality in **A.3** of Assumption 1 holds as a strict inequality $\eta_i^a > 0$ and a contradiction ensues. If the inequality in

A.3 of Assumption 1 holds as an equality $\eta_i^a = 0$. Thus, $\phi_i = \bar{G}_i$ and woman i must be indifferent between the alternative compatible with state $0r$ and the alternative compatible with state $0n$ under regime a which means that $U_i(0,0) \geq U_i(H^l, E^l)$ for any offer (w^l, H^l) entailing earnings $E^l \equiv W^l H^l$ in range 1, including E^k . The choice of the alternative compatible with state $1n$ under regime j reveals that $U_i(H^k, E^k) \geq U_i(0,0)$. Thus, $U_i(0,0) \geq U_i(H^l, E^l) \geq U_i(0,0)$. If either inequality is strict a contradiction ensues. Otherwise $U_i(0,0) = U_i(H^l, E^l) = U_i(0,0)$ and the woman must be indifferent under regime a between the alternative compatible with state $0n$ and the alternative entailing earnings E^k off assistance. If however she does not choose earnings E^k off assistance under regime a then she breaks indifference in the same way under j (Assumption 4), which contradicts her choosing earnings E^k off assistance under regime j . \square

Proposition 2 (Unrestricted Pairings). *Given Assumptions 1-4, the pairings of states corresponding to the non “-” entries in Table 3 are allowed.*

Proof. State pairings $(1r, 1r)$ and $(1u, 1r)$ must occur by Proposition 1. Table 3’s remaining allowed state pairings can be conveniently organized in two collections:

$$\{(s^a, 1r) : s^a \in \{0n, 1n, 2n, 2u\}\}, \quad (13)$$

$$\{(0r, s_j) : s_j \in \{0n, 1n, 2n, 1r, 2u\}\}. \quad (14)$$

We start by considering the collection of pairs in (13). The common feature of the states in $\{0n, 1n, 2n, 2u\}$ is that they are equally attractive under regimes a and j (Lemma 3). Instead, state $1r$ is no worse under regime j than under regime a (Lemma 3). In light of Proposition (1), to prove that the pairs in collection (13) are allowed it suffices to provide examples where two women occupy the same state $s^a \in \{0n, 1n, 2n, 2u\}$ under regime a , but the first woman occupies state $s^j = s^a$ under regime j and the second woman occupies state $s^j = 1r$ under regime j . This also proves that no pairing in collection (13) is constrained to occur. We then turn to the collection of state pairs in (14). The common feature of the states in $\{0n, 1n, 2n, 1r, 2u\}$ is that they are no worse under regime j than under regime a (Lemma 3). Instead, state $0r$ is no better under regime j than under regime a (Lemma 3). To prove that the pairs in collection (14) are allowed it suffices to provide the example of a woman who occupies state $0r$ under regime a and state $s^j \in \{0n, 1n, 2n, 1r, 2u\}$ under regime j . This also proves that no pairing in collection (14) is constrained to occur.

When providing examples we consider the specification of the utility function given in (3). Finally, we assume that woman i receives either one or two job offers, that is, either $K_i = 1$ or $K_i = 2$. To enhance readability we employ the symbol $[s \succsim^t s']$ to signify that under regime t an alternative compatible with state s is weakly preferred to an alternative compatible with state s' .

1. Pairings $(0n, 1r)$ and $(0n, 0n)$ are allowed, hence neither must occur.

Consider two women i' and i'' with preferences represented by (3) with $v(x) = x$. Let $K_i = 1$. Assume that each woman’s job offer entails earnings in range 1. That is, for $i \in \{i', i''\}$, $E_i^k \equiv W_i^k H_i^k$ is in range 1. Let

(a) woman $i = i'$ be such that $\mu_i = 0$, and $\alpha_i \geq W_i^k$ and

$$\bar{G}_i - \phi_i \leq 0,$$

(b) woman $i = i''$ be such that $\mu_i = 0$, and $\alpha_i \geq W_i^k$ and

$$H_i^k \left(\alpha_i - W_i^k \right) < \bar{G}_i - \phi_i \leq \min \left\{ \eta_i^a, H_i^k \left(\alpha_i - W_i^k \right) + \kappa_i, H_i^k \left(\alpha_i - W_i^k \right) + \bar{G}_i - G_i^a \left(E_i^k \right) \right\}.$$

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

$$[0n \succsim^a 0r] : 0 \geq \bar{G}_i - \phi_i - \eta_i^a, \quad (15)$$

$$[0n \succsim^a 1r] : 0 \geq E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k, \quad (16)$$

$$[0n \succsim^a 1u] : 0 \geq E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k, \quad (17)$$

$$[0n \succsim^a 1n] : 0 \geq E_i^k - \alpha_i H_i^k. \quad (18)$$

It is easy to verify that descriptions (1a) and (1b) are compatible with optimality under regime a , that is, with (15)-(18). Both women prefer state $0n$ under regime j to the available alternatives compatible with states $\{0r, 1n, 1u\}$ by Proposition 1. Woman $i = i'$ also prefers state $0n$ to the available alternatives compatible with state $1r$ under regime j because by description (1a) we have $\bar{G}_i - \phi_i \leq 0$ and $\alpha_i \geq W_i^k$ which imply (19):

$$[0n \succsim^j 1r] : 0 \geq E_i^k + \bar{G}_i - \phi_i - \alpha_i H_i^k. \quad (19)$$

By Assumption 4 she breaks an indifference situation in favor of state $0n$. Instead, woman $i = i''$ prefers an alternative available and compatible with state $1r$ under regime j to state $0n$ because by description (1b) we have $H_i^k(\alpha_i - W_i^k) < \bar{G}_i - \phi_i$ which imply (20):

$$[1r \succsim^j 0n] : E_i^k + \bar{G}_i - \phi_i - \alpha_i H_i^k > 0. \quad (20)$$

2. Pairings $(1n, 1r)$ and $(1n, 1n)$ are allowed, hence neither must occur.

Consider two women i' and i'' with preferences represented by (3) with $v(x) = x$. Let $K_i = 1$. Assume that each woman's job offer entails earnings in range 1. That is, for $i \in \{i', i''\}$, $E_i^k \equiv W_i^k H_i^k$ is in range 1. Let

- (a) woman $i = i'$ be such that $\mu_i = \eta_i^a = \eta_i^j = \alpha_i = 0$ and

$$\bar{G}_i - \phi_i \leq 0,$$

- (b) woman $i = i''$ be such that $\mu_i = \eta_i^a = \eta_i^j = \alpha_i = 0$ and

$$0 < \bar{G}_i - \phi_i \leq \min \left\{ \kappa_i, E_i^k, \bar{G}_i - G_i^a(E_i^k) \right\}.$$

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

$$[1n \succsim^a 0n] : E_i^k \geq 0, \quad (21)$$

$$[1n \succsim^a 0r] : E_i^k \geq \bar{G}_i - \phi_i, \quad (22)$$

$$[1n \succsim^a 1n] : E_i^k \geq E_i^l \forall E_i^l, \quad (23)$$

$$[1n \succsim^a 1r] : E_i^k \geq E_i^k + G_i^a(E_i^k) - \phi_i, \quad (24)$$

$$[1n \succsim^a 1u] : E_i^k \geq E_i^k + \bar{G}_i - \phi_i - \kappa_i. \quad (25)$$

It is easy to verify that descriptions (2a) and (2b) are compatible with optimality under regime a , that is, with (21)-(25). Both women prefer state $1n$ under regime j to the available alternatives compatible with states $\{0r, 0n, 1u\}$, by Proposition 1. Woman $i = i'$ also prefers state $1n$ to the available alternatives compatible with state $1r$ under regime j because by description (2a) we have $\bar{G}_i - \phi_i \leq 0$ which implies (26):

$$[1n \succsim^j 1r] : E_i^k \geq E_i^k + \bar{G}_i - \phi_i. \quad (26)$$

By Assumption 4 she breaks an indifference situation in favor of state $1n$. Instead, woman $i = i''$ prefers earning E_i^k on assistance to earning the same amount off assistance under regime j because by description (2b) we have $\bar{G}_i - \phi_i > 0$ which implies (27):

$$[1r \succsim^j 1n] : E_i^k + \bar{G}_i - \phi_i > E_i^k. \quad (27)$$

Thus, the available alternative entailing earnings E_i^k on assistance is preferred under regime j to the available alternatives compatible with all states but $1r$.

3. Pairings $(2n, 1r)$ and $(2n, 2n)$ are allowed, hence neither must occur.

Consider two women i' and i'' with preferences represented by (3) with $v(x) = x$. Let $K_i = 2$. Assume that each woman's two job offers entail earnings in range 1 and in range 2 respectively. That is, for $i \in \{i', i''\}$, $E_i^l \equiv W_i^l H_i^l$ is in range 1 and $E_i^k \equiv W_i^k H_i^k$ is in range 2. Let

(a) woman $i = i'$ be such that $\mu_i = \eta_i^a = \eta_i^j = \alpha_i = 0$, $W_i^k \geq W_i^l$ and

$$\bar{G}_i - \phi_i \leq 0,$$

(b) woman $i = i''$ be such that $\mu_i = \eta_i^a = \eta_i^j = \alpha_i = 0$, $W_i^k \geq W_i^l$ and

$$E_i^k - E_i^l < \bar{G}_i - \phi_i \leq \min \left\{ \kappa_i, E_i^k, \bar{G}_i - G_i^a(E_i^l) + E_i^k - E_i^l \right\}.$$

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

$$[2n \succsim^a 0n] : E_i^k \geq 0, \quad (28)$$

$$[2n \succsim^a 0r] : E_i^k \geq \bar{G}_i - \phi_i, \quad (29)$$

$$[2n \succsim^a 1n] : E_i^k \geq E_i^l, \quad (30)$$

$$[2n \succsim^a 1r] : E_i^k \geq E_i^l + G_i^a(E_i^l) - \phi_i, \quad (31)$$

$$[2n \succsim^a 1u] : E_i^k \geq E_i^l + \bar{G}_i - \phi_i - \kappa_i, \quad (32)$$

$$[2n \succsim^a 2u] : E_i^k \geq E_i^k + \bar{G}_i - \phi_i - \kappa_i. \quad (33)$$

It is easy to verify that descriptions (3a) and (3b) are compatible with optimality under regime a , that is, with (28)-(33). Both women prefer state $2n$ under regime j to the available alternatives compatible with states $\{0r, 2u, 0n, 1n, 1u\}$, by Proposition 1. Woman $i = i'$ also prefers state $2n$ to the available alternatives compatible with state $1r$ under regime j because $E_i^k \geq E_i^l$ by (30) and by description (3a) we have $\bar{G}_i - \phi_i \leq 0$ which implies (34):

$$[2n \succsim^j 1r] : E_i^k \geq E_i^l + \bar{G}_i - \phi_i. \quad (34)$$

By Assumption 4 she breaks indifference in favor of state $1n$. Instead, woman $i = i''$ prefers earning E_i^l on assistance to earning E_i^k off assistance under regime j because by description (3b) we have $\bar{G}_i - \phi_i > E_i^k - E_i^l$ which implies (35):

$$[1r \succsim^j 2n] : E_i^l + \bar{G}_i - \phi_i > E_i^k. \quad (35)$$

4. Pairings $(2u, 1r)$ and $(2u, 2u)$ are allowed, hence neither must occur.

Consider two women i' and i'' with preferences represented by (3) with $v(x) = x$. Let $K_i = 2$. Assume that each woman's two job offers entail earnings in range 1 and in range 2 respectively. That is, for $i \in \{i', i''\}$, $E_i^l \equiv W_i^l H_i^l$ is in range 1 and $E_i^k \equiv W_i^k H_i^k$ is in range 2. Let

(a) woman $i = i'$ be such that $\mu_i = \eta_i^a = \eta_i^j = \alpha_i = 0$, $\phi_i > \underline{\phi}_i$, $W_i^k \geq W_i^l$ and

$$\kappa_i \leq \min \left\{ \bar{G}_i - \phi_i, E_i^k - E_i^l \right\},$$

(b) woman $i = i''$ be such that $\mu_i = \eta_i^a = \eta_i^j = \alpha_i = 0$, $\phi_i > \underline{\phi}_i$, $W_i^k \geq W_i^l$ and

$$E_i^k - E_i^l < \kappa_i \leq \min \left\{ \bar{G}_i - \phi_i, E_i^k - E_i^l + \bar{G}_i - G_i^a(E_i^l) \right\}.$$

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

$$[2u \succsim^a 0n] : E_i^k + \bar{G}_i - \phi_i - \kappa_i \geq 0, \quad (36)$$

$$[2u \succsim^a 0r] : E_i^k + \bar{G}_i - \phi_i - \kappa_i \geq \bar{G}_i - \phi_i, \quad (37)$$

$$[2u \succsim^a 1n] : E_i^k + \bar{G}_i - \phi_i - \kappa_i \geq E_i^l, \quad (38)$$

$$[2u \succsim^a 1r] : E_i^k + \bar{G}_i - \phi_i - \kappa_i \geq E_i^l + G_i^a(E_i^l) - \phi_i, \quad (39)$$

$$[2u \succsim^a 1u] : E_i^k + \bar{G}_i - \phi_i - \kappa_i \geq E_i^l + \bar{G}_i - \phi_i - \kappa_i, \quad (40)$$

$$[2u \succsim^a 2n] : E_i^k + \bar{G}_i - \phi_i - \kappa_i \geq E_i^k. \quad (41)$$

It is easy to verify that descriptions (4a) and (4b) are compatible with optimality under regime a , that is, with (36)-(41). Both women prefer state $2u$ under regime j to the available alternatives compatible with states $\{0r, 0n, 1n, 2n, 1u\}$, by Proposition 1. Woman $i = i'$ also prefers state $2u$ to the available alternative compatible with state $1r$ under regime j because by description (4a) we have $\kappa_i \leq E_i^k - E_i^l$ which implies (42):

$$[2u \succsim^j 1r] : E_i^k + \bar{G}_i - \phi_i - \kappa_i \geq E_i^l + \bar{G}_i - \phi_i. \quad (42)$$

By Assumption 4 she breaks an indifference situation in favor of state $2u$. Instead, woman $i = i''$ prefers earning and truthfully reporting E_i^l on assistance to under-reporting earnings E_i^k on assistance under regime j because $\bar{G}_i \geq G_i^a(E_i^l)$ and by description (4b) we have $\kappa_i > E_i^k - E_i^l$ which implies (43):

$$[1r \succsim^j 2u] : E_i^l + \bar{G}_i - \phi_i > E_i^k + \bar{G}_i - \phi_i - \kappa_i. \quad (43)$$

5. Pairings $(0r, s^j)$ with $s^j \in \{0r, 0n, 2n, 1r, 2u\}$ are allowed.

Consider five women $\{i', i'', i''', i^{IV}, i^V\}$ with preferences represented by (3) with $v(x) = x$. Let $K_i = 2$. Assume that each woman's two job offers entail earnings in range 1 and in range 2 respectively. That is, for $i \in \{i', i'', i''', i^{IV}, i^V\}$, $E_i^l \equiv W_i^l H_i^l$ is in range 1 and $E_i^k \equiv W_i^k H_i^k$ is in range 2. Let

(a) woman $i = i'$ be such that $\mu_i = 0$, $\eta_i^a = \eta_i^j = \eta_i$, $\phi_i > \underline{\phi}_i$, $W_i^l = W_i^k = W_i \leq \alpha_i$, and

$$0 \leq \eta_i \leq \min \left\{ \bar{G}_i - \phi_i, H_i^l(\alpha_i - W_i) \right\},$$

(b) woman $i = i''$ be such that $\mu_i = 0$, $\eta_i^a = \eta_i^j = \eta_i$, $\phi_i > \underline{\phi}_i$, $W_i^l = W_i^k = W_i \leq \alpha_i$, and

$$H_i^l(\alpha_i - W_i) < \eta_i \leq \min \left\{ \bar{G}_i - \phi_i, H_i^l(\alpha_i - W_i) + \kappa_i, H_i^l(\alpha_i - W_i) + \bar{G}_i - G_i^a(E_i^l) \right\},$$

(c) woman $i = i'''$ be such that $\mu_i = 0$, $\eta_i^a < \eta_i^j$, $W_i^l = W_i^k = W_i < \alpha_i$ and

$$\eta_i^a \leq \bar{G}_i - \phi_i < \min \left\{ H_i^l(\alpha_i - W_i), \eta_i^j \right\},$$

(d) woman $i = i^{IV}$ be such that $\eta_i^a \leq \mu_i \leq H_i^k(W_i^k - \alpha_i)$, $\phi_i > \underline{\phi}_i$, $\eta_i^a < \eta_i^j$, $W_i^k > \alpha_i = W_i^l$ and

$$H_i^k(W_i^k - \alpha_i) - \mu_i + \eta_i^a \leq \bar{G}_i - \phi_i < \min \left\{ H_i^k(W_i^k - \alpha_i) - \mu_i + \eta_i^j, H_i^k(W_i^k - \alpha_i), \kappa_i \right\},$$

(e) woman $i = i^V$ be such that $\eta_i^a \leq \mu_i \leq H_i^k(W_i^k - \alpha_i)$, $\phi_i > \underline{\phi}_i$, $\eta_i^a < \eta_i^j$, $W_i^k > \alpha_i = W_i^l$ and

$$H_i^k(W_i^k - \alpha_i) - \mu_i + \eta_i^a \leq \kappa_i \leq \min \left\{ H_i^k(W_i^k - \alpha_i) - \mu_i + \eta_i^j, H_i^k(W_i^k - \alpha_i), \bar{G}_i - \phi_i \right\}.$$

All these women chose an alternative compatible with state $0r$ under regime a . We now show that, under regime j , woman i' selects an alternative compatible with state $0r$, woman i'' selects an alternative compatible with state $1r$, woman i''' selects an alternative compatible with state $0n$, woman i^{IV} selects an alternative compatible with state $2n$, and woman i^V selects an alternative compatible with state $2u$. For all women, the choice of the alternative compatible with state $0r$ under regime a reveals (Assumption 3) that this alternative yields as much utility as the available alternatives compatible with states $\{0n, 1n, 2n, 1r, 1u, 2u\}$. Thus, for $i \in \{i', i'', i''', i^{IV}, i^V\}$:

$$[0r \succsim^a 0n] : \bar{G}_i - \phi_i - \eta_i^a \geq 0, \quad (44)$$

$$[0r \succsim^a 1n] : \bar{G}_i - \phi_i - \eta_i^a \geq E_i^l - \mu_i - \alpha_i H_i^l, \quad (45)$$

$$[0r \succsim^a 2n] : \bar{G}_i - \phi_i - \eta_i^a \geq E_i^k - \mu_i - \alpha_i H_i^k, \quad (46)$$

$$[0r \succsim^a 1r] : \bar{G}_i - \phi_i - \eta_i^a \geq E_i^l - \mu_i + G_i^a(E_i^l) - \phi_i - \alpha_i H_i^l, \quad (47)$$

$$[0r \succsim^a 1u] : \bar{G}_i - \phi_i - \eta_i^a \geq E_i^l - \mu_i + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^l, \quad (48)$$

$$[0r \succsim^a 2u] : \bar{G}_i - \phi_i - \eta_i^a \geq E_i^k - \mu_i + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k. \quad (49)$$

It is easy to verify that descriptions (5a)-(5e) are compatible with optimality under regime a , that is, with (44)-(49). Because $\eta_i^a = \eta_i^j$ for $i \in \{i', i''\}$, state $0r$ has the same utility value under both regimes hence both women prefer state $0r$ under regime j to the available alternatives compatible with states $\{0n, 1n, 2n, 1u, 2u\}$, by Proposition 1. Woman $i = i'$ also prefers state $0r$ to the available alternative compatible with state $1r$ under regime j because by description (5a) we have $\eta_i \leq H_i^l(\alpha_i - W_i)$ and $\mu_i = 0$ which imply (50):

$$[0r \succsim^j 1r] : \bar{G}_i - \phi_i - \eta_i \geq E_i^l + \bar{G}_i - \phi_i - \alpha_i H_i^l. \quad (50)$$

By Assumption 4 she breaks an indifference situation in favor of state $0r$. Instead, woman $i = i''$ prefers earning and truthfully reporting E_i^l on assistance to not working on assistance

under regime j because by description (5b) we have $\eta_i > H_i^l(\alpha_i - W_i)$ and $\mu_i = 0$ which imply (51):

$$[1r \succsim^j 0r] : E_i^l + \bar{G}_i - \phi_i - \alpha H_i^l > \bar{G}_i - \phi_i - \eta_i. \quad (51)$$

Consider now women $\{i^{III}, i^{IV}, i^V\}$. None selects an alternative compatible with state $1u$ under regime j by Proposition 1. Woman $i = i^{III}$ prefers not working off assistance (state $0n$) to the available alternatives compatible with states $\{0r, 1n, 1r, 2n, 2u\}$ under regime j because, by description (5c), we have $\mu_i = 0$ and, respectively, $\bar{G}_i - \phi_i < \eta_i^j$ which implies (52); $H_i^l(\alpha_i - W_i) \geq 0$ which implies (53); $H_i^k(\alpha_i - W_i) \geq 0$ which implies (54); $H_i^l(\alpha_i - W_i) \geq \bar{G}_i - \phi_i$ which implies (55); and $H_i^k(\alpha_i - W_i) + \kappa_i \geq \bar{G}_i - \phi_i$ which implies (56):

$$[0n \succsim^j 0r] : 0 > \bar{G}_i - \phi_i - \eta_i^j, \quad (52)$$

$$[0n \succsim^j 1n] : 0 \geq E_i^l - \alpha_i H_i^l, \quad (53)$$

$$[0n \succsim^j 2n] : 0 \geq E_i^k + -\alpha H_{ii}^k, \quad (54)$$

$$[0n \succsim^j 1r] : 0 \geq E_i^l + \bar{G}_i - \phi_i - \alpha_i H_i^l, \quad (55)$$

$$[0n \succsim^j 2u] : 0 \geq E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k. \quad (56)$$

Woman $i = i^{IV}$ prefers earning E_i^k off assistance (state $2n$) to the available alternatives compatible with states $\{0n, 0r, 1n, 1r, 2u\}$ under regime j because, by description (5d), we have $H_i^k(W_i^k - \alpha_i) \geq \mu_i$ which implies (57); $\bar{G}_i - \phi_i < H_i^k(W_i^k - \alpha_i) - \mu_i + \eta_i^j$ which implies (58); $W_i^k > \alpha_i = W_i^l$ which imply (59); $\bar{G}_i - \phi_i < H_i^k(W_i^k - \alpha_i)$ and $W_i^k > \alpha_i = W_i^l$ which imply (60); $\bar{G}_i - \phi_i < \kappa_i$ which implies (61):

$$[2n \succsim^j 0n] : E_i^k - \mu_i - \alpha_i H_i^k \geq 0, \quad (57)$$

$$[2n \succsim^j 0r] : E_i^k - \mu_i - \alpha_i H_i^k > \bar{G}_i - \phi_i - \eta_i^j, \quad (58)$$

$$[2n \succsim^j 1n] : E_i^k - \mu_i - \alpha_i H_i^k \geq E_i^l - \mu_i - \alpha_i H_i^l, \quad (59)$$

$$[2n \succsim^j 1r] : E_i^k - \mu_i - \alpha_i H_i^k \geq E_i^l - \mu_i + \bar{G}_i - \phi_i - \alpha_i H_i^l, \quad (60)$$

$$[2n \succsim^j 2u] : E_i^k - \mu_i - \alpha_i H_i^k \geq E_i^k - \mu_i + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k. \quad (61)$$

Woman $i = i^V$ prefers under-reporting earning E_i^k on assistance (state $2u$) to the available alternatives compatible with states $\{0n, 0r, 1n, 1r, 2n\}$ under regime j because, by description (5e), we have $H_i^k(W_i^k - \alpha_i) \geq \mu_i$ and $\bar{G}_i - \phi_i \geq \kappa_i$ which imply (62); $H_i^k(W_i^k - \alpha_i) + \eta_i^j - \mu_i \geq \kappa_i$ which implies (63); $H_i^k(W_i^k - \alpha_i) \geq \mu_i$, $\bar{G}_i - \phi_i \geq \kappa_i$ and $W_i^l = \alpha_i$ which imply (64); $H_i^k(W_i^k - \alpha_i) \geq \kappa_i$ and $W_i^l = \alpha_i$ which imply (65); $\bar{G}_i - \phi_i \geq \kappa_i$ which implies (66):

$$[2u \succsim^j 0n] : E_i^k - \mu_i + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k \geq 0, \quad (62)$$

$$[2u \succsim^j 0r] : E_i^k - \mu_i + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k > \bar{G}_i - \phi_i - \eta_i^j, \quad (63)$$

$$[2u \succsim^j 1n] : E_i^k - \mu_i + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k \geq E_i^l - \mu_i - \alpha_i H_i^l, \quad (64)$$

$$[2u \succsim^j 1r] : E_i^k - \mu_i + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k \geq E_i^l - \mu_i + \bar{G}_i - \phi_i - \alpha_i H_i^l, \quad (65)$$

$$[2u \succsim^j 2n] : E_i^k - \mu_i + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k \geq E_i^k - \mu_i - \alpha_i H_i^k. \quad (66)$$

6. Pairing $(0r, 1n)$ is allowed.

Consider a woman i with preferences represented by (3) with $v(\cdot)$ strictly concave. Let $K_i = 1$. Assume that her job offer entails earnings in range 1. That is, $E_i^k \equiv W_i^k H_i^k$ is in range 1. Let

(a) woman i be such that $\eta_i^a = \mu_i = 0$ and²

$$\max \left\{ \begin{array}{l} v(\bar{G}_i) - v(E_i^k) + \alpha_i H_i^k - \eta_i^j, \\ v(E_i^k + \bar{G}_i) - v(E_i^k) \end{array} \right\} < \phi_i \leq \min \left\{ \begin{array}{l} v(\bar{G}_i) - v(0), \\ v(\bar{G}_i) - v(E_i^k) + \alpha_i H_i^k \end{array} \right\},$$

$$\max \left\{ \begin{array}{l} v(E_i^k + G_i^a(E_i^k)) - v(\bar{G}_i), \\ v(E_i^k + \bar{G}_i - \kappa_i) - v(\bar{G}_i) \end{array} \right\} \leq \alpha_i H_i^k \leq v(E_i^k) - v(0).$$

Woman i chooses an alternative compatible with state $0r$ under a . We now show that, under regime j , she selects an alternative compatible with state $1n$. The choice of the alternative compatible with state $0r$ under regime a reveals (Assumption 3) that this alternative yields as much utility as the available alternatives compatible with states $\{0n, 1n, 1r, 1u\}$. Thus:

$$[0r \succsim^a 0n] : v(\bar{G}_i) - \phi_i \geq v(0), \quad (67)$$

$$[0r \succsim^a 1n] : v(\bar{G}_i) - \phi_i \geq v(E_i^k) - \alpha_i H_i^k, \quad (68)$$

$$[0r \succsim^a 1r] : v(\bar{G}_i) - \phi_i \geq v(E_i^k + G_i^a(E_i^k)) - \phi_i - \alpha_i H_i^k, \quad (69)$$

$$[0r \succsim^a 1u] : v(\bar{G}_i) - \phi_i \geq v(E_i^k + \bar{G}_i - \kappa_i) - \phi_i - \alpha_i H_i^k. \quad (70)$$

It is easy to verify that description (6a) is compatible with optimality under regime a , that is, with (67)-(70). Woman i will not selected an alternative compatible with state $1u$ under regime j by Proposition 1. She prefers earning E_i^k off assistance (state $1n$) to the available alternatives compatible with states $\{0n, 0r, 1r\}$ under j because, by description (6a), we have $v(E_i^k) - v(0) \geq \alpha_i H_i^k$ which implies (71); $v(\bar{G}_i) - v(E_i^k) + \alpha H_i^k - \eta_i^j < \phi_i$ which implies (72); and $v(E_i^k + \bar{G}_i) - v(E_i^k) \leq \phi_i$ which implies (73):

$$[1n \succsim^j 0n] : v(E_i^k) - \alpha_i H_i^k \geq v(0), \quad (71)$$

$$[1n \succsim^j 0r] : v(E_i^k) - \alpha_i H_i^k > v(\bar{G}_i) - \phi_i - \eta_i^j, \quad (72)$$

$$[1n \succsim^j 1r] : v(E_i^k) - \alpha_i H_i^k \geq v(E_i^k + \bar{G}_i) - \phi_i - \alpha_i H_i^k. \quad (73)$$

7. We conclude the proof by remarking that, because pairings $(0r, s^j)$ with $s^j \in \{0r, 0n, 1n, 2n, 1r, 2u\}$ are allowed, none of them must occur.

□

²Concavity of $v(\cdot)$ enables the conditions imposed. For instance, the first condition requires $v(E_i^k + \bar{G}_i) - v(E_i^k) < v(\bar{G}_i) - v(0)$ which cannot hold unless $v(\cdot)$ is (strictly) concave.

5 Testable Revealed Preference Restrictions

Lemma 5 (Revealed Preference Restrictions). *Consider the system of equations:*

$$\begin{aligned}
p_{0n}^j - p_{0n}^a &= -\pi_{0n,1r} p_{0n}^a + \pi_{0r,0n} p_{0p}^a \\
p_{1n}^j - p_{1n}^a &= -\pi_{1n,1r} p_{1n}^a + \pi_{0r,1n} p_{0p}^a \\
p_{2n}^j - p_{2n}^a &= -\pi_{2n,1r} p_{2n}^a + \pi_{0r,2n} p_{0p}^a \\
p_{0p}^j - p_{0p}^a &= -(\pi_{0r,0n} + \pi_{0r,2n} + \pi_{0r,1r} + \pi_{0r,1n} + \pi_{0r,2u}) p_{0p}^a \\
p_{2p}^j - p_{2p}^a &= \pi_{0r,2u} p_{0p}^a - \pi_{2u,1r} p_{2p}^a
\end{aligned} \tag{74}$$

System (74) implies 16 inequality restrictions on $\mathbf{p}^j - \mathbf{p}^a$:

$$(p_{0p}^a - p_{0p}^j) \geq 0 \tag{75}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) \geq 0 \tag{76}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) \geq 0 \tag{77}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) \geq 0 \tag{78}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j) \geq 0 \tag{79}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{1n}^a - p_{1n}^j) \geq 0 \tag{80}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0n}^a - p_{0n}^j) \geq 0 \tag{81}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j) \geq 0 \tag{82}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{1n}^a - p_{1n}^j) \geq 0 \tag{83}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j) + (p_{1n}^a - p_{1n}^j) \geq 0 \tag{84}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{2p}^a - p_{2p}^j) \geq 0 \tag{85}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0n}^a - p_{0n}^j) + (p_{1n}^a - p_{1n}^j) \geq 0 \tag{86}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j) + (p_{1n}^a - p_{1n}^j) \geq 0 \tag{87}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j) \geq 0 \tag{88}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{2p}^a - p_{2p}^j) + (p_{1n}^a - p_{1n}^j) \geq 0 \tag{89}$$

$$(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j) + (p_{1n}^a - p_{1n}^j) \geq 0 \tag{90}$$

Proof. Restrictions (75-90) are obtained by using the fact that, by definition, $0 \leq \pi_{s^a, s^j} \leq 1$ all $s^a, s^j \in \mathcal{S}$ and $\sum_{s^j \in \mathcal{S}} \pi_{s^a, s^j} = 1$ all $s^a \in \mathcal{S}$. The response margins $(\pi_{0n,1r}, \pi_{1n,1r}, \pi_{2n,1r}, \pi_{2u,1r})$ may each take value 0 or 1. The response margins $(\pi_{0r,0n}, \pi_{0r,1n}, \pi_{0r,1r}, \pi_{0r,2n}, \pi_{0r,2u})$ may each take value 0 or 1 but if one of them takes the value 1 the others are constrained to take the value 0. Thus, there are $2^4 + 1 + 5 = 22$ viable ordered arrangements of 9 elements each taking the boundary value 0 or 1. Each arrangement implies restrictions on $\mathbf{p}^j - \mathbf{p}^a$ through system (74). 16 restrictions are non redundant: they are inequalities (75-90). For instance, consider the fourth equation in system (74). Letting $\pi_{0r,0n} + \pi_{0r,2n} + \pi_{0r,1r} + \pi_{0r,1n} + \pi_{0r,2u} = 0$, this equation implies (75). As another example, sum the first and the fourth equations in system (74) to obtain $(p_{0n}^j - p_{0n}^a) + (p_{0p}^j - p_{0p}^a) = -\pi_{0n,1r} p_{0n}^a - (\pi_{0r,2n} + \pi_{0r,1r} + \pi_{0r,1n} + \pi_{0r,2u}) p_{0p}^a$. Letting $\pi_{0r,2n} + \pi_{0r,1r} + \pi_{0r,1n} + \pi_{0r,2u} = 0$ and $\pi_{0n,1r} = 0$, this equation implies (76). \square

Remark 5 (Easy to Describe Testable Restrictions). In Section VII of the paper we explicitly refer to five of the inequalities in (75-90). They are: inequality (75), inequality (76) which rewrites as $p_0^a - p_0^j \geq 0$ where $p_0^t \equiv p_{0n}^t + p_{0p}^t$ for $t \in \{a, j\}$; inequality (86) which rewrites as $p_{1+,p}^a - p_{1+,p}^j \leq 0$ where $p_{1+,p}^t \equiv p_{1p}^t + p_{2p}^t$ for $t \in \{a, j\}$; inequality (88) which rewrites as $p_1^a - p_1^j \leq 0$ where $p_1^t \equiv p_{1n}^t + p_{1p}^t$ for $t \in \{a, j\}$; and inequality (90) which rewrites as $p_{1p}^a - p_{1p}^j \leq 0$.

Corollary 3 (Additional Testable Restrictions under a Special Form of Preferences). *Subject to specification (2) of the utility function, revealed preference imply a testable restriction in addition to (75-90):*

$$p_{1n}^a - p_{1n}^j \geq 0. \tag{91}$$

Subject to (91), inequalities (77), (80), (83), (84), (86), (87), (89), and (90) are redundant.

Proof. Subject to specification (2) of the utility function, $\pi_{0r,1n} = 0$ by Corollary 2. System (74) simplifies accordingly. In particular, the second equation writes $p_{1n}^a - p_{1n}^j = \pi_{1n,1r} p_{1n}^a$. Letting $\pi_{1n,1r} = 0$ we obtain restriction (91). Redundancy of inequalities (77), (80), (83), (84), (86), (87), (89), and (90) is easily verified. For instance, inequality (77) is implied by (75) and (91). \square

6 Bounds on the Response Margins

Derivation of Bounds

The *identified set* Ξ of response probabilities consists of the set of vectors $\boldsymbol{\pi}$ obeying (74) that satisfy the usual adding up and non-negativity conditions of probability distributions.³ The upper and lower bounds on each of the response probabilities correspond to vertices of the identified set Ξ since a solution to any linear programming problem has to occur at one of the vertices of the problem's constraint space (see Murty, 1983). Accordingly, to obtain the set of possible solutions to the linear programming problem

$$\max_{\boldsymbol{\pi}} \boldsymbol{\pi}'\boldsymbol{\lambda} \text{ subject to } \boldsymbol{\pi} \in \Xi,$$

we enumerated all vertices of the convex polytope defined by the intersection of the hyperplane defined by the equations in (74) with the hypercube defined by the unit constraints on the parameters. In practice, this amounted to setting all possible choices of four of the nine parameters in (74) to 0 or 1 and solving for the remaining five parameters. There were $\binom{9}{4} = 126$ different possible choices of four parameters and $2^4 = 16$ different binary arrangements those parameters could take, yielding 2016 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 third equation in (74). Such restrictions reduced the problem to solving the system at a manageable number of vertices. We then enumerated the set of minima and maxima each parameter could achieve across the relevant solutions. After eliminating dominated solutions, we arrived at the stated bounds.

Lists of Bounds

The analytical expressions for the bounds on the response probabilities are presented below. The symbol (*) is placed next to a solution, or a term, that is redundant subject to the specification of the utility function given in (2).

Simple Response Margins

$$\max \left\{ 0, \frac{(p_{2n}^a - p_{2n}^j)}{p_{2n}^a} \right\} \leq \pi_{2n,1r} \leq \min \left\{ \begin{array}{l} 1, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{2n}^a}, \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{2n}^a}, (*) \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{1n}^a - p_{1n}^j)}{p_{2n}^a}, (*) \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{2n}^a}, (*) \\ \frac{(p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{2n}^a} (*) \end{array} \right\}.$$

³Here this means that $\pi \in [0, 1]^9$ and $\pi_{0r,1n} + \pi_{0r,1r} + \pi_{0r,2u} + \pi_{0r,2n} + \pi_{0r,0n} \leq 1$.

$$\begin{aligned}
& \max \left\{ 0, \frac{(p_{0n}^a - p_{0n}^j)}{p_{0n}^a} \right\} \leq \pi_{0n,1r} \leq \min \left\{ \begin{array}{l} 1, \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{0p}^a - p_{0p}^j)}{p_{0n}^a}, \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0n}^a}, \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0n}^a}, \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0n}^a}, \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{0n}^a}, (*) \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0n}^a}, (*) \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0n}^a}, (*) \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0n}^a} (*) \end{array} \right\} \\
& \max \left\{ 0, \frac{(p_{2p}^a - p_{2p}^j)}{p_{2p}^a} \right\} \leq \pi_{2u,1r} \leq \min \left\{ \begin{array}{l} 1, \\ \frac{(p_{2p}^a - p_{2p}^j) + (p_{0p}^a - p_{0p}^j)}{p_{2p}^a}, \\ \frac{(p_{2p}^a - p_{2p}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{2p}^a}, \\ \frac{(p_{2p}^a - p_{2p}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{2p}^a}, \\ \frac{(p_{2p}^a - p_{2p}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{2p}^a}, \\ \frac{(p_{2p}^a - p_{2p}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{2p}^a}, (*) \\ \frac{(p_{2p}^a - p_{2p}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{0n}^a - p_{0n}^j)}{p_{2p}^a}, (*) \\ \frac{(p_{2p}^a - p_{2p}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{2p}^a}, (*) \\ \frac{(p_{2p}^a - p_{2p}^j) + (p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{2p}^a} (*) \end{array} \right\} \\
& \max \left\{ 0, \frac{(p_{0p}^a - p_{0p}^j) - p_{0n}^j - p_{2p}^j - p_{2n}^j - p_{1n}^j (*)}{p_{0p}^a} \right\} \leq \pi_{0r,1r} \leq \min \left\{ \begin{array}{l} \frac{(p_{0p}^a - p_{0p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2p}^a - p_{2p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2p}^a - p_{2p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2p}^a - p_{2p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a} (*) \end{array} \right\}
\end{aligned}$$

$$\begin{aligned}
& \max \left\{ 0, \frac{(p_{2n}^j - p_{2n}^a)}{p_{0p}^a} \right\} \leq \pi_{0r,2n} \leq \min \left\{ \begin{array}{l} \frac{p_{2n}^j}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2p}^a - p_{2p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, (*) \end{array} \right\}. \\
& \max \left\{ 0, \frac{(p_{2p}^j - p_{2p}^a)}{p_{0p}^a} \right\} \leq \pi_{0r,2u} \leq \min \left\{ \begin{array}{l} \frac{p_{2p}^j}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, (*) \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, (*) \end{array} \right\}. \\
& \max \left\{ 0, \frac{(p_{0n}^j - p_{0n}^a)}{p_{0p}^a} \right\} \leq \pi_{0r,0n} \leq \min \left\{ \begin{array}{l} \frac{p_{0n}^j}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2p}^a - p_{2p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a} \end{array} \right\}.
\end{aligned}$$

$$\max \left\{ 0, \frac{(p_{1n}^j - p_{1n}^a)}{p_{0p}^a} (*) \right\} \leq \pi_{0r,1n} \leq \min \left\{ \begin{array}{l} \frac{p_{1n}^j}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a}, \\ \frac{(p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2n}^a - p_{2n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a} \end{array} \right\}.$$

$$\max \left\{ 0, \frac{(p_{1n}^a - p_{1n}^j)}{p_{1n}^a} \right\} \leq \pi_{1n,1r} \leq \min \left\{ \begin{array}{l} 1, \\ \frac{(p_{1n}^a - p_{1n}^j) + (p_{0p}^a - p_{0p}^j)}{p_{1n}^a}, \\ \frac{(p_{1n}^a - p_{1n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j)}{p_{1n}^a}, \\ \frac{(p_{1n}^a - p_{1n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{1n}^a}, \\ \frac{(p_{1n}^a - p_{1n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{1n}^a}, \\ \frac{(p_{1n}^a - p_{1n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2p}^a - p_{2p}^j)}{p_{1n}^a}, \\ \frac{(p_{1n}^a - p_{1n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{0n}^a - p_{0n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{1n}^a}, \\ \frac{(p_{1n}^a - p_{1n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j) + (p_{2n}^a - p_{2n}^j)}{p_{1n}^a} \end{array} \right\}.$$

Composite Response Margins

$$\pi_{0r,n} \geq \max \left\{ 0, -\frac{(p_{0n}^a - p_{0n}^j) + (p_{2n}^a - p_{2n}^j) + (p_{1n}^a - p_{1n}^j) (*)}{p_{0p}^a} \right\},$$

$$\pi_{0r,n} \leq \min \left\{ \frac{p_{0n}^j + p_{2n}^j + p_{1n}^j (*)}{p_{0p}^a}, \frac{(p_{0p}^a - p_{0p}^j)}{p_{0p}^a}, \frac{(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a} \right\}.$$

$$\pi_{p,n} \geq \max \left\{ 0, -\frac{(p_{0n}^a - p_{0n}^j) + (p_{2n}^a - p_{2n}^j) + (p_{1n}^a - p_{1n}^j) (*)}{p_{0p}^a + p_{1p}^a + p_{2p}^a} \right\},$$

$$\pi_{p,n} \leq \min \left\{ \frac{p_{0n}^j + p_{2n}^j + p_{1n}^j (*)}{p_{0p}^a + p_{1p}^a + p_{2p}^a}, \frac{(p_{0p}^a - p_{0p}^j)}{p_{0p}^a + p_{1p}^a + p_{2p}^a}, \frac{(p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0p}^a + p_{1p}^a + p_{2p}^a} \right\}.$$

$$\pi_{n,p} \geq \max \left\{ 0, \frac{(p_{0n}^a - p_{0n}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j)}{p_{0n}^a + p_{1n}^a + p_{2n}^a} \right\},$$

$$\pi_{n,p} \leq \min \left\{ \begin{array}{l} 1, \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j)}{p_{0n}^a + p_{1n}^a + p_{2n}^a}, \\ \frac{(p_{0n}^a - p_{0n}^j) + (p_{1n}^a - p_{1n}^j) + (p_{2n}^a - p_{2n}^j) + (p_{0p}^a - p_{0p}^j) + (p_{2p}^a - p_{2p}^j)}{p_{0n}^a + p_{1n}^a + p_{2n}^a} \end{array} \right\}.$$

$$\pi_{0,1+} = \frac{(p_{0n}^a - p_{0n}^j) + (p_{0p}^a - p_{0p}^j)}{p_{0p}^a + p_{0n}^a}.$$

7 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 $\{ub_1, ub_2, \dots, ub_K\}$. We know that:

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

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 $\widehat{\underline{ub}} \equiv \min \{\widehat{ub}_1, \widehat{ub}_2, \dots, \widehat{ub}_K\}$ as an estimate of \underline{ub} . This estimator is consistent by continuity of probability limits. We can then form a corresponding consistent estimator $\widehat{\pi} \equiv \min \{\widehat{\underline{ub}}, 1\}$ of $\bar{\pi}$.

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

$$P(\underline{ub} \leq \widehat{\underline{ub}} + r) = 0.95, \quad (92)$$

as such an r implies:

$$\begin{aligned}P\left(\pi \leq \min \left\{\widehat{\underline{ub}} + r, 1\right\}\right) &\geq P\left(\bar{\pi} \leq \min \left\{\widehat{\underline{ub}} + r, 1\right\}\right) \\ &= P\left(\bar{\pi} \leq \min \left\{\widehat{\underline{ub}} + r, 1\right\} \mid \underline{ub} \leq \widehat{\underline{ub}} + r\right) 0.95 \\ &\quad + P\left(\bar{\pi} \leq \min \left\{\widehat{\underline{ub}} + r, 1\right\} \mid \underline{ub} > \widehat{\underline{ub}} + r\right) 0.05 \\ &\geq P\left(\bar{\pi} \leq \min \left\{\widehat{\underline{ub}} + r, 1\right\} \mid \underline{ub} \leq \widehat{\underline{ub}} + r\right) 0.95 \\ &= 0.95\end{aligned}$$

with the first inequality binding when $\pi = \bar{\pi}$. The last line follows because $\underline{ub} \leq \widehat{\underline{ub}} + r$ implies $\min \{\underline{ub} + r, 1\} \leq \min \{\widehat{\underline{ub}} + r, 1\}$.

We can rewrite (92) as:

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

or equivalently

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

It is well known that the limiting distribution of $\max \left\{\underline{ub} - \widehat{ub}_1, \underline{ub} - \widehat{ub}_2, \dots, \underline{ub} - \widehat{ub}_K\right\}$ 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:

$$P\left(\max \left\{ub_1 - \widehat{ub}_1, \dots, ub_K - \widehat{ub}_K\right\} \leq r\right) \leq P\left(\max \left\{\underline{ub} - \widehat{ub}_1, \dots, \underline{ub} - \widehat{ub}_K\right\} \leq r\right), \quad (93)$$

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

$$P\left(\max \left\{ub_1 - \widehat{ub}_1, \dots, ub_K - \widehat{ub}_K\right\} \leq r'\right) = .95. \quad (94)$$

From (93),

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

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 (94) (see Proposition 10.7 of Kosorok, 2008). That is, by computing the 95th percentile of:

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

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

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

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 re-weighting, 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:

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

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

8 Extending the Baseline Model to Allow for State $2r$

The Issue

In Section 4 of this Appendix we restrict a woman's preferences when $FPL_i < \bar{E}_i$. Specifically, **A.7** in Assumption 1 states that for all offers (W, H) such that $E \equiv WH \in (FPL_i, \bar{E}_i]$:

$$U_i^a(H, C^a(E, 1, E), 1, 0, 0) < U_i^a(H, C_i^a(E, 0, E), 0, 0, 0).$$

Thus, **A.7** in Assumption 1 implicitly establishes a *local* lower bound on the stigma disutility at earning levels in $(FPL_i, \bar{E}_i]$ and it guarantees that woman i does not report earnings above FPL_i while on welfare under regime a when $FPL_i < \bar{E}_i$. That is, state $2r$ is dominated under regime a subject to **A.7** in Assumption 1 and Assumption 2. Without **A.7** in Assumption 1, participation in welfare may decrease or increase utility (other things equal). The number of observations in our control sample corresponding to alternatives compatible with state $2r$ is tiny. Nevertheless, it is of pedagogical interest to consider what additional responses emerge if we do not rule out such choices *a priori*, that is, when we do not impose **A.7** in Assumption 1.

A Roadmap of the Results: Table A3 and Figure A1

Table A3 catalogs the allowed and disallowed responses when **A.7** in Assumption 1 is not imposed. The possible states are $\mathcal{S} \cup \{2r\}$. Accordingly, all but the last row and last column of Table A3 appear also in Table 3. The last row of Table A3 corresponds to the responses of a woman who under regime a has earnings in the range $(FPL_i, \bar{E}_i]$, is on assistance, and truthfully reports her earnings to the welfare agency (state $2r$).

The presentation of the results is organized as follows. Proposition 3 pertains to the disallowed pairings of states in Table A3. Corollary 4 derives additional restricted pairings when the utility function is of the special form given in (2). Proposition 4 pertains to the allowed pairings of states in Table A3. Interestingly, dispensing with **A.7** in Assumption 1 enables the emergence of flows out of the labor force, which were absent in the model of Section IV of the paper (and correspondingly Section 4 of this Appendix). Figure A1 uses the special form of the utility function in (2) to illustrate these flows and Corollary 5 formalizes the observation, born out in Figure A1, that labor market constraints on job offers are essential to the emergence of these flows.

Propositions

With reference to Section 4 in this Appendix, all Lemmas and Corollaries hold but for Lemma 1 which hinges on **A.7** in Assumption 1. Proposition 1, Corollary 2, and Proposition 2 in Section 4 are superseded by the following propositions and corollary.

Proposition 3 (Restricted Pairings). *Given Assumption 1 but for **A.7**, and Assumptions 2-4, the pairings of states corresponding to the “-” entries in Table A3 cannot occur and the pairings of states $(1r, 1r)$ and $(1u, 1r)$ must occur.*

Proof. We proved the entries in the first 7 rows and 7 columns of Table A3 in Propositions 1 and Proposition 2. State $2r$ is not defined under regime j (Assumption 2) which proves the “-” entries in Table A3 rows 1 through 7 and column 8. We are thus left to prove the disallowed pairings in row 8 and columns 1 through 7 of Table A3. No woman pairs state $2r$ under regime a with state $1u$ under regime j because $1u$ is dominated by state $1r$ under j (Lemma 2). \square

Corollary 4 (Additional Restricted Pairings under Utility Specification (2)). *Given Assumption 1 but for A.7, and Assumptions 2-4, and subject to specification (2) of the utility function, the pairings of states $(0r, 1n)$ and $(2r, 1n)$ are disallowed.*

Proof. To enhance readability we employ the symbol $[s \succsim^t s']$ to signify that under regime t an alternative compatible with state s is weakly preferred to an alternative compatible with state s' . The proof that the pairing of states $(0r, 1n)$ is disallowed is contained in Corollary 2. The proof that the pairings of state $(2r, 1n)$ is disallowed is by contradiction. Suppose there is a woman i who selects an alternative compatible with state $2r$ under regime a entailing earnings $E^k \equiv W^k H^k$ and selects an alternative compatible with state $1n$ under regime j entailing earnings $E^l \equiv W^l H^l$. By Assumption 3, her choice under regime a reveals that

$$[2r \succsim^a 2n] : U_i \left(H^k, E^k - \mu_i + G_i^a \left(E^k \right) - \phi_i \right) \geq U_i \left(H^k, E^k - \mu_i \right),$$

which implies $G_i^a \left(E^k \right) \geq \phi_i$. Her choice under regime j reveals that

$$[1n \succsim^j 1r] : U_i \left(H^l, E^l - \mu_i \right) \geq U_i \left(H^l, E^l - \mu_i + \bar{G}_i - \phi_i \right),$$

which implies $\bar{G}_i \leq \phi_i$. Thus, optimality implies $\bar{G}_i \leq \phi_i \leq G_i^a \left(E^k \right)$ which yields a contradiction because $G_i^a \left(E \right) < \bar{G}_i$ for all $E \in \left(FPL_i, \bar{E}_i \right]$ including E^k . \square

Proposition 4 (Unrestricted Pairings). *Given Assumption 1 but for A.7, and Assumptions 2-4, the non “-” entries in Table A3 correspond to pairings of states that are allowed.*

Proof. The entries in the first 7 rows and 7 columns Table A3 were proven in Propositions 1 and Proposition 2. We are left to prove the allowed pairings in row 8 and columns 1 through 7 of Table A3. To prove that the pairs in collection

$$\left\{ \left(2r, s^j \right) \mid s^j \in \{0n, 1n, 2n, 0r, 1r, 2u\} \right\} \quad (95)$$

are allowed it suffices to provide examples where six women occupy the same state $s^a = 2r$ under regime a but occupy state $s^j \in \{0n, 1n, 2n, 0r, 1r, 2u\}$ under regime j . This also proves that no pairing in collection (95) is constrained to occur. When providing these examples we consider the specification of the utility function given in (3). Finally, we assume that woman i receives either one or two job offers, that is, either $K_i = 1$ or $K_i = 2$. To enhance readability we employ the symbol $[s \succsim^t s']$ to signify that under regime t an alternative compatible with state s is weakly preferred to an alternative compatible with state s' .

1. Pairings $(2r, 0n)$, $(2r, 0r)$, and $(2r, 2u)$ are allowed.

Consider three women i' , i'' , and i''' with preferences represented by (3) with $v(x) = x$. Let $K_i = 1$ for $i \in \{i', i'', i'''\}$. Assume that all three women's job offer entails earnings in $\in \left(FPL_i, \bar{E}_i \right]$. That is, $E_i^k \equiv W_i^k H_i^k \in \left(FPL_i, \bar{E}_i \right]$ for $i \in \{i', i'', i'''\}$. Let

(a) woman $i = i'$ be such that $\alpha_i = W_i^k$, $\mu_i = 0$, and

$$\eta_i^a \geq \kappa_i \geq \bar{G}_i - \phi_i \geq \bar{G}_i - G_i^a \left(E_i^k \right),$$

(b) woman $i = i''$ be such that $\alpha_i = W_i^k$, $\mu_i = 0$, and

$$\kappa_i \geq \bar{G}_i - \phi_i \geq \eta_i^j \geq \eta_i^a \geq \bar{G}_i - G_i^a \left(E_i^k \right),$$

(c) woman $i = i'''$ be such that $\alpha_i = W_i^k$, $\mu_i = 0$, and

$$\bar{G}_i - G_i^a(E_i^k) \leq \eta_i^a \leq \kappa_i \leq \min \left\{ \eta_i^j, \bar{G}_i - \phi_i \right\}.$$

All women choose to earn and truthfully report earnings in $(FPL_i, \bar{E}_i]$ on assistance under regime a . We now show that woman i' chooses an alternative compatible with state $0n$ under regime j , woman i'' chooses an alternative compatible with state $0r$ under regime j , and woman i''' chooses an alternative compatible with state $2u$ under regime j . For all women, the choice of the alternative compatible with state $2r$ under regime a reveals (Assumption 3) that this alternative yields as much utility as the available alternatives compatible with states $\{0r, 0n, 2n, 2u\}$. Thus, for $i \in \{i', i'', i'''\}$:

$$[2r \succsim^a 0r] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq \bar{G}_i - \phi_i - \eta_i^a, \quad (96)$$

$$[2r \succsim^a 0n] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq 0, \quad (97)$$

$$[2r \succsim^a 2n] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq E_i^k - \alpha_i H_i^k, \quad (98)$$

$$[2r \succsim^a 2u] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k. \quad (99)$$

It is easy to verify that descriptions (1a), (1b), and (1c) are compatible with optimality under regime a for woman i' , i'' , and i''' respectively, that is, with (96)-(99). No woman selects an alternative compatible with state $2r$ under regime j because it is not defined.

Woman i' prefers not working off assistance (state $0n$) to the available alternatives compatible with states $\{0r, 2n, 2u\}$ under regime j because, by description (1a), we have $\eta_i^j \geq \bar{G}_i - \phi_i$ (recall $\eta_i^j \geq \eta_i^a$ by **A.4** in Assumption 1) which implies (100); $\alpha_i = W_i^k$ which implies (101); and $\kappa_i \geq \bar{G}_i - \phi_i$ and $\alpha_i = W_i^k$ which imply (102):

$$[0n \succsim^j 0r] : 0 \geq \bar{G}_i - \phi_i - \eta_i^j, \quad (100)$$

$$[0n \succsim^j 2n] : 0 \geq E_i^k - \alpha_i H_i^k, \quad (101)$$

$$[0n \succsim^j 2u] : 0 \geq E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k. \quad (102)$$

Woman i'' prefers not working on assistance (state $0r$) to the available alternatives compatible with states $\{0n, 2n, 2u\}$ under regime j because, by description (1b), we have $\bar{G}_i - \phi_i \geq \eta_i^j$ which implies (103); $\bar{G}_i - \phi_i \geq \eta_i^j$ and $\alpha_i = W_i^k$ which imply (104); and $\kappa_i \geq \eta_i^j$ which implies (105):

$$[0r \succsim^j 0n] : \bar{G}_i - \phi_i - \eta_i^j \geq 0, \quad (103)$$

$$[0r \succsim^j 2n] : \bar{G}_i - \phi_i - \eta_i^j \geq E_i^k - \alpha_i H_i^k, \quad (104)$$

$$[0r \succsim^j 2u] : \bar{G}_i - \phi_i - \eta_i^j \geq E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k. \quad (105)$$

Woman i''' prefers earning E_i^k on assistance and under-report (state $2u$) to the available alternatives compatible with states $\{0n, 0r, 2n\}$ under regime j because, by description (1c), we have $\bar{G}_i - \phi_i \geq \kappa_i$ and $\alpha_i = W_i^k$ which imply (106); $\eta_i^j \geq \kappa_i$ and $\alpha_i = W_i^k$ which imply (107); and $\bar{G}_i - \phi_i \geq \kappa_i$ and $\alpha_i = W_i^k$ which imply (108):

$$[2u \succsim^j 0n] : E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k \geq 0, \quad (106)$$

$$[2u \succsim^j 0r] : E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k \geq \bar{G}_i - \phi_i - \eta_i^j, \quad (107)$$

$$[2u \succsim^j 2n] : E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k \geq E_i^k - \alpha_i H_i^k. \quad (108)$$

2. Pairing $(2r, 1r)$ is allowed.

Consider woman i with preferences represented by (3) with $v(x) = x$. Let $K_i = 2$. Assume that her first job offer entails earnings in $(FPL_i, \bar{E}_i]$ and her second job offer entails earnings in range 1. That is, $E_i^k \equiv W_i^k H_i^k \in (FPL_i, \bar{E}_i]$ and $E_i^l \equiv W_i^l H_i^l \in (0, FPL_i]$. Let

(a) woman i be such that $W_i^k > \alpha_i = W_i^l$, $\mu_i = 0$, and

$$\max \left\{ \begin{array}{l} \bar{G}_i - G_i^a(E_i^k) - \eta_i^a, \\ G_i^a(E_i^l) - G_i^a(E_i^k) \end{array} \right\} \leq H_i^k (W_i^k - \alpha_i) \leq \bar{G}_i - G_i^a(E_i^k) \leq \min \{ \bar{G}_i - \phi_i, \kappa_i \}.$$

Woman i chooses to earn and truthfully report earnings in $(FPL_i, \bar{E}_i]$ on assistance under regime a . We now show that she chooses an alternative compatible with state $1n$ under regime j . The choice of the alternative compatible with state $2r$ under regime a reveals (Assumption 3) that this alternative yields as much utility as the available alternatives compatible with states $\{0r, 0n, 1n, 1r, 1u, 2n, 2u\}$. Thus:

$$[2r \succsim^a 0r] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq \bar{G}_i - \phi_i - \eta_i^a, \quad (109)$$

$$[2r \succsim^a 0n] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq 0, \quad (110)$$

$$[2r \succsim^a 1n] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq E_i^l - \alpha_i H_i^l, \quad (111)$$

$$[2r \succsim^a 1r] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq E_i^l + G_i^a(E_i^l) - \phi_i - \alpha_i H_i^l, \quad (112)$$

$$[2r \succsim^a 1u] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq E_i^l + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^l, \quad (113)$$

$$[2r \succsim^a 2n] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq E_i^k - \alpha_i - H_i^k, \quad (114)$$

$$[2r \succsim^a 2u] : E_i^k + G_i^a(E_i^k) - \phi_i - \alpha_i H_i^k \geq E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k. \quad (115)$$

It is easy to verify that description (2a) is compatible with optimality under regime a for woman i , that is, with (109)-(115). Woman i does not select an alternative compatible with state $2r$ under regime j because it is not defined; she does not select an alternative compatible with state $1u$ under regime j because it is dominated. Woman i prefers earning and truthfully report E_i^l on assistance (state $1r$) to the available alternatives compatible with states $\{0n, 0r, 1n, 2n, 2u\}$ under regime j because, by description (2a), we have $\bar{G}_i - \phi_i \geq 0$ and $W_i^l = \alpha_i$ which imply (116); $\eta_i^j \geq 0$ and $W_i^l = \alpha_i$ which imply (117); $\bar{G}_i - \phi_i \geq 0$ which implies (118); $\bar{G}_i - \phi_i \geq H_i^k (W_i^k - \alpha_i)$ and $W_i^l = \alpha_i$ which imply (119); and $\kappa_i \geq H_i^k (W_i^k - \alpha_i)$ and $W_i^l = \alpha_i$ which imply (120):

$$[1r \succsim^j 0n] : E_i^l + \bar{G}_i - \phi_i - \alpha_i H_i^l \geq 0, \quad (116)$$

$$[1r \succsim^j 0r] : E_i^l + \bar{G}_i - \phi_i - \alpha_i H_i^l \geq \bar{G}_i - \phi_i - \eta_i^j, \quad (117)$$

$$[1r \succsim^j 1n] : E_i^l + \bar{G}_i - \phi_i - \alpha_i H_i^l \geq E_i^l - \alpha_i H_i^l, \quad (118)$$

$$[1r \succsim^j 2n] : E_i^l + \bar{G}_i - \phi_i - \alpha_i H_i^l \geq E_i^k - \alpha_i H_i^k, \quad (119)$$

$$[1r \succsim^j 2u] : E_i^l + \bar{G}_i - \phi_i - \alpha_i H_i^l \geq E_i^k + \bar{G}_i - \phi_i - \kappa_i - \alpha_i H_i^k. \quad (120)$$

3. Pairing $(2r, 1n)$ is allowed.

Consider woman i with preferences represented by (3) with $v(x)$ convex. Let $K_i = 2$. Assume that her first job offer entails earnings in $(FPL_i, \bar{E}_i]$ and her second job offer entails earnings in range 1. That is, $E_i^k \equiv W_i^k H_i^k \in (FPL_i, \bar{E}_i]$ and $E_i^l \equiv W_i^l H_i^l \in (0, FPL_i]$. Let

(a) woman i be such that $\alpha_i > 0$, $\mu_i = 0$ and⁴

$$\begin{aligned} \max \left\{ \begin{array}{l} v(E_i^l + \bar{G}_i) - v(E_i^l), \\ \left[\begin{array}{l} v(E_i^k + \bar{G}_i - \kappa_i) - v(E_i^l) \\ -\alpha_i(H_i^k - H_i^l) \end{array} \right] \end{array} \right\} &\leq \phi_i \leq \min \left\{ \begin{array}{l} v(E_i^k + G_i^a(E_i^k)) - v(E_i^k), \\ \left[\begin{array}{l} v(E_i^k + G_i^a(E_i^k)) - v(E_i^l) \\ -\alpha_i(H_i^k - H_i^l) \end{array} \right] \end{array} \right\}, \\ v(E_i^k) - v(E_i^l) &\leq \alpha_i(H_i^k - H_i^l) \leq \min \left\{ \begin{array}{l} \left[\begin{array}{l} v(E_i^k + G_i^a(E_i^k)) \\ -v(E_i^l + G_i^a(E_i^l)) \end{array} \right], \\ \left[\begin{array}{l} v(E_i^k + G_i^a(E_i^k)) \\ -v(E_i^l + \bar{G}_i - \kappa_i) \end{array} \right] \end{array} \right\}, \\ \alpha_i H_i^l &\leq v(E_i^l) - v(0), \\ \alpha_i H_i^k &\leq v(E_i^k + G_i^a(E_i^k)) - v(\bar{G}_i) + \eta_i^a, \\ v(E_i^k + \bar{G}_i - \kappa_i) &\leq v(E_i^k + G_i^a(E_i^k)). \end{aligned}$$

Woman i chooses to earn and truthfully report earnings in $(FPL_i, \bar{E}_i]$ on assistance under regime a . We now show that she chooses an alternative compatible with state $1n$ under regime j . The choice of the alternative compatible with state $2r$ under regime a reveals (Assumption 3) that this alternative yields as much utility as the available alternatives compatible with states $\{0r, 0n, 1n, 1r, 1u, 2n, 2u\}$. Thus:

$$[2r \succ^a 0r] : v(E_i^k + G_i^a(E_i^k)) - \phi_i - \alpha_i H_i^k \geq v(\bar{G}_i) - \phi_i - \eta_i^a, \quad (121)$$

$$[2r \succ^a 0n] : v(E_i^k + G_i^a(E_i^k)) - \phi_i - \alpha_i H_i^k \geq v(0), \quad (122)$$

$$[2r \succ^a 1n] : v(E_i^k + G_i^a(E_i^k)) - \phi_i - \alpha_i H_i^k \geq v(E_i^l) - \alpha_i H_i^l, \quad (123)$$

$$[2r \succ^a 1r] : v(E_i^k + G_i^a(E_i^k)) - \phi_i - \alpha_i H_i^k \geq v(E_i^l + G_i^a(E_i^l)) - \phi_i - \alpha_i H_i^l, \quad (124)$$

$$[2r \succ^a 1u] : v(E_i^k + G_i^a(E_i^k)) - \phi_i - \alpha_i H_i^k \geq v(E_i^l + \bar{G}_i - \kappa_i) - \phi_i - \alpha_i H_i^l, \quad (125)$$

$$[2r \succ^a 2n] : v(E_i^k + G_i^a(E_i^k)) - \phi_i - \alpha_i H_i^k \geq v(E_i^k) - \alpha_i H_i^k, \quad (126)$$

$$[2r \succ^a 2u] : v(E_i^k + G_i^a(E_i^k)) - \phi_i - \alpha_i H_i^k \geq v(E_i^k + \bar{G}_i - \kappa_i) - \phi_i - \alpha_i H_i^k. \quad (127)$$

It is easy to verify that description (3a) is compatible with optimality under regime a for woman i , that is, with (121)-(127). Woman i does not select an alternative compatible with state $2r$ under regime j because it is not defined; she does not select an alternative compatible with state $1u$ under regime j because it is dominated. Woman i prefers earning E_i^l off assistance (state $1n$) to the available alternatives compatible with states $\{0n, 0r, 1r, 2n, 2u\}$ under regime j because, by description (3a), we have $\alpha_i H_i^l \leq v(E_i^l) - v(0)$ which implies (128); $\alpha_i H_i^l \leq v(E_i^l) - v(0)$ which by convexity, and since $\eta_i^j \geq 0$, implies $\alpha_i H_i^l \leq v(E_i^l + \bar{G}_i) - v(\bar{G}_i) + \eta_i^j$ which along with $\phi_i \geq v(E_i^l + \bar{G}_i) - v(E_i^l)$ imply (129); $\phi_i \geq v(E_i^l + \bar{G}_i) - v(E_i^l)$ which implies (130); $v(E_i^k) - v(E_i^l) \leq \alpha_i(H_i^k - H_i^l)$ which implies (131); and $\phi_i \geq v(E_i^k + \bar{G}_i - \kappa_i) - v(E_i^l) - \alpha_i(H_i^k - H_i^l)$ which implies (132):

$$[1n \succ^j 0n] : v(E_i^l) - \alpha_i H_i^l \geq v(0), \quad (128)$$

$$[1n \succ^j 0r] : v(E_i^l) - \alpha_i H_i^l \geq v(\bar{G}_i) - \phi_i - \eta_i^j, \quad (129)$$

$$[1n \succ^j 1r] : v(E_i^l) - \alpha_i H_i^l \geq v(E_i^l + \bar{G}_i) - \phi_i - \alpha_i H_i^l, \quad (130)$$

$$[1n \succ^j 2n] : v(E_i^l) - \alpha_i H_i^l \geq v(E_i^k) - \alpha_i H_i^k, \quad (131)$$

$$[1n \succ^j 2u] : v(E_i^l) - \alpha_i H_i^l \geq v(E_i^k + \bar{G}_i - \kappa_i) - \phi_i - \alpha_i H_i^k. \quad (132)$$

⁴Convexity of $v(\cdot)$ enables the conditions imposed. For instance, the first condition requires $v(E_i^k + G_i^a(E_i^k)) - v(E_i^k) \geq v(E_i^l + \bar{G}_i) - v(E_i^l)$ which cannot hold unless v is convex.

□

Corollary 5 (Additional Restricted Pairings in the absence of Labor Market Constraints). *Suppose that there are no hours constraints, that is, let $\Theta_i = \{(W_i(H), H) | H \in (0, \bar{H}_i)\}$ in Assumption 3 and suppose that wages are continuous and weakly increasing in hours worked and utility is a weakly decreasing function of hours worked. Then, given Assumption 1 but for **A.7**, and Assumptions 2-4, no woman pairs state $2r$ under regime a with states $\{0n, 0r\}$ under regime j .*

Proof. We show that no woman pairs state $2r$ under regime a with state $0n$ under regime j ; the proof that no woman pairs state $2r$ under regime a with state $0r$ under regime j is similar. The proof is by contradiction. Suppose that there is a woman i who selects an alternative compatible with state $2r$ under regime a , entailing earnings $E^k \equiv W(H^k)H^k \in (FPL_i, \bar{E}_i]$ and selects an alternative compatible with state $0n$ under j . By Assumption 3, her choice under regime a reveals that

$$[2r \succsim^a 0n] : U_i(H^k, E^k + G_i^a(E^k), 1, 0, 0) \geq U_i(0, 0, 0, 0, 0). \quad (133)$$

Because there are no hour constraints and because program rules are such that $\bar{E}_i < FPL_i + \bar{G}_i$, there exists a job offer $(W(H^l), H^l)$ such that $E^l \equiv W(H^l)H^l$ is in range 1 and $E^l + \bar{G}_i = E^k + G_i^a(E^k)$. Hence, $H^k \geq H^l$ because wages are weakly increasing in hours. Thus, $U_i(H^l, E^l + \bar{G}_i, 1, 0, 0) \geq U_i(H^k, E^k + G_i^a(E^k), 1, 0, 0)$ because utility is weakly decreasing in hours worked for given (C, D, Z, R) by assumption. Together with (133), this means that

$$U_i(H^l, E^l + \bar{G}_i, 1, 0, 0) \geq U_i(0, 0, 0, 0, 0). \quad (134)$$

If inequality (134) holds strictly, a contradiction ensures because this shows that no alternative compatible with state $0n$ can be optimal under regime j (it is dominated by an alternative compatible with state $1r$). If inequality (134) holds as an equality, woman i is indifferent between earning (and truthfully reporting) E^k and not working off assistance under regime a . By Assumption 4, if the woman resolved an indifference situation against not working off assistance under regime a , she will also resolve an indifference situation against not working off assistance under regime j . This contradicts her selecting not to work off assistance over earning (and truthfully reporting) E^l on assistance under j . □

Remark 6 (Flows out of the Labor Force: Figure A1). Corollary 5 shows that labor market constraints on job offers are essential to the emergence of flows out of the labor force. Figure A1 bears out this point by showing a pairing of state $2r$ under AFDC with state $0n$ under JF which may emerge only in the presence of labor market constraints. To ease the graphical representation, we use the special form of the utility function in (2). Specifically, Figure A1 portrays a woman who receives two job offers entailing earnings (E^1, E^2) that are both in range 2 and such that $E^1 \in (FPL_i, \bar{E}_i]$. 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 E^1 , is on assistance, and truthfully reports her earnings (an allocation compatible with state $2r$). 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 (an allocation compatible with state $0n$). However, if earning constraints were absent she would be better off by earning below the FPL on assistance and truthfully reporting her earnings (an allocation compatible with state $1r$).

Proposition 5. Define $\pi_{s^a, s^j} \equiv P\left(S_i^j = s^j | S_i^a = s^a\right)$. Given Assumption 1 but for **A.7**, and Assumptions 2-4, the system of equations describing the impact of the JF reform on observable state probabilities is:

$$\begin{aligned}
p_{0n}^j - p_{0n}^a &= -\pi_{0n,1r} p_{0n}^a + \pi_{0r,0n} p_{0p}^a + \pi_{2r,0n} q_{2r}^a \\
p_{1n}^j - p_{1n}^a &= -\pi_{1n,1r} p_{1n}^a + \pi_{0r,1n} p_{0p}^a + \pi_{2r,1n} q_{2r}^a \\
p_{2n}^j - p_{2n}^a &= -\pi_{2n,1r} p_{2n}^a + \pi_{0r,2n} p_{0p}^a + \pi_{2r,2n} q_{2r}^a \\
p_{0p}^j - p_{0p}^a &= -(\pi_{0r,0n} + \pi_{0r,2n} + \pi_{0r,1r} + \pi_{0r,1n} + \pi_{0r,2u}) p_{0p}^a + \pi_{2r,0r} q_{2r}^a \\
p_{2p}^j - p_{2p}^a &= \pi_{0r,2u} p_{0p}^a - \pi_{2u,1r} p_{2p}^a - (\pi_{2r,0n} + \pi_{2r,1n} + \pi_{2r,2n} + \pi_{2r,0r} + \pi_{2r,1r} - \pi_{2u,1r}) q_{2r}^a
\end{aligned} \tag{135}$$

Proof. By definition $\pi_{s^a, s^j} \equiv P\left(S_i^j = s^j | S_i^a = s^a\right)$, Table A3, and a simple application of the law of total probability. \square

Remark 7. Given Assumption 1 but for **A.7**, and Assumptions 2-4, bounds on the response probabilities

$$\boldsymbol{\pi}' \equiv [\pi_{0n,1r}, \pi_{0r,0n}, \pi_{2n,1r}, \pi_{0r,2n}, \pi_{0r,1r}, \pi_{0r,1n}, \pi_{1n,1r}, \pi_{0r,2u}, \pi_{2u,1r}, \pi_{2r,0n}, \pi_{2r,1n}, \pi_{2r,0n}, \pi_{2r,02n}, \pi_{2r,0r}, \pi_{2r,1r}]'. \tag{136}$$

are implied by system (135) and $0 \leq q_{2r}^a \leq \frac{3}{14,784}$. Because $\frac{3}{14,784} \approx 0$, the numerical bounds on $\boldsymbol{\pi} \equiv [\pi_{0n,1r}, \pi_{0r,0n}, \pi_{2n,1r}, \pi_{0r,2n}, \pi_{0r,1r}, \pi_{0r,1n}, \pi_{1n,1r}, \pi_{0r,2u}, \pi_{2u,1r}]'$ (Section VII equation (10) of the paper) are indistinguishable from those obtained when **A.7** is maintained.

9 Extending the Baseline Model to Incorporate FS and Taxes

We begin with some additional notation and definitions that supersede those from Section 4 in this Appendix. All lemmas, corollaries, and propositions supersede those from Section 4 in this Appendix.

Notation, Definitions, and Assumptions

Notation 1 (Policy Regimes). Throughout, we use a to refer to the JF reform’s control welfare and FS policy and j to refer to 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 $m \in \{w, f, wf\}$ where “ w ” refers to welfare only, “ f ” refers to FS only, and “ wf ” refers to welfare joint with FS.

Definition 15 (Program Participation, Earnings and Reported Earnings). Let D^f , D^w , and D^{wf} be indicators for a 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 $\mathbf{D} \equiv (D^w, D^f, D^{wf})$. Let E denote a woman’s earnings. Earnings are the product of hours worked, H , and an hourly wage rate W . Let E^r denote earnings reported to the relevant assistance agency. Let $Z \equiv Z(\mathbf{D}, E^r) = \mathbf{1}[E^r = 0](D^w + D^{wf})$ be an indicator for zero reported earnings by a welfare recipient. Let $R \equiv R(E, \mathbf{D}, E^r) = \mathbf{1}[E^r < E](D^w + D^{wf} + D^f)$ be an indicator for under-reporting by a recipient of welfare and / or FS assistance.

Definition 16 (Transfer and Tax Functions). Throughout, we use $G^t(\cdot)$, $F^t(\cdot)$, and $T(\cdot)$ to refer to, respectively, the welfare transfer function, the FS transfer function, and the federal income tax function (inclusive of the EITC). These functions are defined as follows.

1. **Welfare Transfer Functions.** For any reported earning level E^r , the regime-dependent welfare transfers are

$$G_i^a(E^r) = \mathbf{1}[E^r \leq \bar{E}_i] (\bar{G}_i - \mathbf{1}[E^r > \delta_i] (E^r - \delta_i) \tau_i), \quad (137)$$

$$G_i^j(E^r) = \mathbf{1}[E^r \leq FPL_i] \bar{G}_i. \quad (138)$$

The parameter $\delta_i \in \{90, 120\}$ gives woman i ’s fixed disregards, the parameter $\tau_i \in \{.49, .73\}$ governs her proportional disregard, $\bar{E}_i \equiv \bar{G}_i / \tau_i + \delta_i$ is woman i ’s break-even earnings level under regime a (i.e. the level at which welfare benefits are exhausted), and \bar{G}_i is the welfare base grant amount. \bar{E}_i , \bar{G}_i , and FPL_i vary across women due to differences in AU size.

2. **Food Stamps (FS) Transfer Functions.**

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

$$F_i^a(E^r) = F_i(E^r, 0), \quad (139)$$

$$F_i^j(E^r) = F_i(E^r, 0), \quad (140)$$

$$F_i^{a,wf}(E^r) = F_i(E^r, G_i^a(E^r)) \mathbf{1}[G_i^a(E^r) > 0], \quad (141)$$

$$F_i^{j,wf}(E^r) = F_i(0, \bar{G}_i) \mathbf{1}[E^r \leq FPL_i], \quad (142)$$

where $F_i(\cdot, \cdot)$ is the standard FS formula, as described next. Let $\mathbf{1}[elig_i]$ denote the eligibility for FS. Then, for any pair of reported earnings and welfare transfer, denoted (E^r, G) , the FS transfer is:

$$F_i(E^r, G) = \max \left\{ \bar{F}_i - \tau_1^f \chi_i(E^r, G), 0 \right\} \mathbf{1}[elig_i], \quad (143)$$

with

$$\chi_i(E^r, G) \equiv \max \left\{ E^r + G - \tau_2^f \min \{ E^r, FPL_i \} - \beta_{1i}^f - \beta_{2i}^f(E^r, G), 0 \right\}, \quad (144)$$

where \bar{F}_i is the maximum FS transfer; $\tau_1^f \chi_i(E^r, G)$ is 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 $\beta_{2i}^f(E^r, G)$ is the excess shelter deduction as a function of earnings plus the welfare transfer. The variation in $(\beta_{1i}^f, \beta_{2i}^f(\cdot))$ across women with the same earnings and welfare transfer is due to differences in actual medical, shelter, and child care expenses. The variation in $F_i(\cdot, \cdot)$ across women is due to differences in AU size. To simplify notation let $\bar{F}_i \equiv F_i(0, \bar{G}_i)$. We remark that $\bar{F}_i \equiv F_i(0, 0)$. The eligibility indicator $\mathbf{1}[elig_i]$ reflects categorical eligibility, when FS is taken up jointly with welfare, or the so called FS's gross and net income tests, when FS is taken up alone, namely:

$$\mathbf{1}[elig_i] = \begin{cases} 1 & \text{if } G > 0 \\ \mathbf{1}[E^r \leq \tau_3^f FPL_i] \mathbf{1}[\chi_i(E^r, 0) \leq FPL_i] & \text{if } G = 0 \end{cases}, \quad (145)$$

where τ_3^f is a multiplier factor. The parameters $(\tau_1^f, \tau_2^f, \tau_3^f)$ take values (0.30, 0.20, 1.3).⁵

3. Earned Income Tax Credit (EITC) and Federal Income Tax Functions.

For any earning level E , earnings inclusive of one-twelfth 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 are given by:

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

The parameters $(\tau^l, \tau^m) = (0.062, 0.0145)$ give the payroll and medicare tax rates, $I_i(E)$ is amount of (gross) federal income taxes, and $EITC_i(E)$ is the amount of the earned income tax credit. Specifically, the earned income tax function $EITC_i(\cdot)$ is given by⁶

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

The parameters $(\tau_{1i}^e, \tau_{2i}^e)$ give a woman i 's phase-in and phase-out rates. The parameters $(\bar{E}_{1i}^e, \bar{E}_{2i}^e)$ 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 by⁷

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

⁵During the JF demonstration project, $\tau_1^f = 0.30$, $\tau_2^f = 0.20$ and $\tau_3^f = 1.3$. The JF experimental policy effectively sets $\tau_2^f = 1$ when FS is taken up jointly with welfare. This explains why we write the FS transfer as in (142), that is, as the standard 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 the JF experimental policy, a woman with earnings above FPL_i may not receive both welfare and FS because such earnings disqualify her from welfare.

⁶This function is time varying. We dispense with the time subscript for simplicity.

⁷This function is time varying. We dispense with the time subscript for simplicity.

where Y_i^I is the woman's taxable income which is given by her earnings net of the personal exemption 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 $(\tau_1^I, \tau_2^I, \tau_3^I, \tau_4^I, \tau_5^I)$ give the marginal tax rates and the parameters $(y_0^I, y_1^I, y_2^I, y_3^I, y_4^I, y_5^I)$ give the tax brackets with $y_0^I \equiv 0$ and $y_5^I \equiv \infty$.

Definition 17 (Consumption). Consider a tuple (E, \mathbf{D}, E^r) . Under regime t , woman i 's consumption equivalent corresponding to (E, \mathbf{D}, E^r) is

$$C_i^t(E, \mathbf{D}, E^r) \equiv T_i(E) + \left(G_i^t(E^r) + F_i^{t, wf}(E^r) \right) D^{wf} + F_i^t(E^r) D^f + G_i^t(E^r) D^w. \quad (146)$$

We refer to $C_i^t = C_i^t(E, \mathbf{D}, E^r)$ as consumption. Below, when the consumption associated with a triple (E, \mathbf{D}, E^r) and calculated according to (146) does not vary across regimes we omit the superscript t , and we omit the subscript i when it does not vary across women.

Definition 18 (State). Consider a tuple (E, \mathbf{D}, E^r) . The "state" corresponding to (E, \mathbf{D}, E^r) is defined by the function:

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

Remark 8 (State: Excluded States). 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 19 (Job Offers). As in Definition 6.

Definition 20 (Alternative). An alternative is a wage, hours of work, program participation indicators, and earning report tuple (W, H, \mathbf{D}, E^r) .

Definition 21 (Sub-alternative). A sub-alternative is a wage, hours of work, and program participation indicators tuple (W, H, \mathbf{D}) .

Definition 22 (Alternative Compatible with a State). We say that an alternative (W, H, \mathbf{D}, E^r) is compatible with state s for woman i , if letting $E \equiv WH$, $s = s(E, \mathbf{D}, E^r)$.

Definition 23 (Alternative Compatible with a State and Available). We say that an alternative (W, H, \mathbf{D}, E^r) is compatible with state s and available for woman i if (W, H, \mathbf{D}, E^r) is compatible with state s and $(W, H) \in \Theta_i \cup (0, 0)$.

Definition 24 (Utility Function). Define $U_i^t(H, C, \mathbf{D}, Z, R)$ as the utility woman i derives from the tuple (H, C, \mathbf{D}, Z, R) under regime $t \in \{a, j\}$. Below, when the utility of a tuple (H, C, \mathbf{D}, Z, R) does not vary across policy regimes we omit the superscript t .

Definition 25 (Attractiveness of States). We say that a state s is:

1. no better under regime j than under regime a if, for any alternative (W, H, \mathbf{D}, E^r) compatible with state s , and letting $E \equiv WH$, $C_i^t \equiv C_i^t(E, \mathbf{D}, E^r)$, $Z \equiv Z(\mathbf{D}, E^r)$, and $R \equiv R(E, \mathbf{D}, E^r)$,

$$U_i^j(H, C_i^j, \mathbf{D}, Z, R) \leq U_i^a(H, C_i^a, \mathbf{D}, Z, R) \text{ all } i.$$

2. no worse under regime j than under regime a if, for any alternative (W, H, \mathbf{D}, E^r) compatible with state s , and letting $E \equiv WH$, $C_i^t \equiv C_i^t(E, \mathbf{D}, E^r)$, $Z \equiv Z(\mathbf{D}, E^r)$, and $R \equiv R(E, \mathbf{D}, E^r)$,

$$U_i^j(H, C_i^j, \mathbf{D}, Z, R) \geq U_i^a(H, C_i^a, \mathbf{D}, Z, R) \text{ all } i.$$

3. We say that a state s is equally attractive under regimes j and a if, for any alternative (W, H, \mathbf{D}, E^r) compatible with state s , and letting $E \equiv WH$, $C_i^t \equiv C_i^t(E, \mathbf{D}, E^r)$, $Z \equiv Z(\mathbf{D}, E^r)$, and $R \equiv R(E, \mathbf{D}, E^r)$,

$$U_i^j(H, C_i^j, \mathbf{D}, Z, R) = U_i^a(H, C_i^a, \mathbf{D}, Z, R) \text{ all } i.$$

Definition 26 (Collections of States). 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 27 (Welfare Participation State). 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:

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

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 28 (Primitives). Let woman i be described by

$$\theta_i \equiv \left(U_i^a(\cdot, \cdot, \cdot, \cdot, \cdot), U_i^j(\cdot, \cdot, \cdot, \cdot, \cdot), \Theta_i, G_i^a(\cdot), F_i(\cdot, \cdot), T_i(\cdot) \right).$$

Consider a sample of N women with children. The sample women have primitives $\{\theta_i\}_{i=1}^N$, which are *i.i.d.* draws from a joint distribution function $\Gamma_\theta(\cdot)$.

Definition 29 (Response Probabilities). 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 regime t as $q_s^t \equiv P(S_i^t = s)$ where $P(\cdot)$ is a probability measure induced by the distribution function $\Gamma_\theta(\cdot)$. Let π_{s^a, s^j} denote the proportion of women occupying state s^j under regime j among those who occupy state s^a under regime a , that is, $\pi_{s^a, s^j} \equiv P(S_i^j = s^j | S_i^a = s^a)$ where $P(\cdot)$ is also a probability measure induced by the distribution function $\Gamma_\theta(\cdot)$.

Definition 30 (Integrated Response Probabilities). Let $S_{w,i}^t$ denote the welfare-only potential state of a woman i whose potential state under regime t is S_i^t ; that is, $S_{w,i}^t = h(S_i^t)$. Define the proportion of women occupying state $s_w \in \mathcal{S}_w$ under regime t as $p_{s_w}^t \equiv P(S_{w,i}^t = s_w) = \sum_{s \in \mathcal{S}: s_w = h(s)} q_s^t$ where $P(\cdot)$ is a probability measure induced by the distribution function $\Gamma_\theta(\cdot)$. With some abuse of notation (see Definition 29), let $\pi_{s_w^a, s_w^j}$ denote the proportion of women who occupy state s_w^j under regime j among those who occupy state s_w^a under regime a ; that is, $\pi_{s_w^a, s_w^j} \equiv P(S_{w,i}^j = s_w^j | S_{w,i}^a = s_w^a)$ where $P(\cdot)$ is also a probability measure induced by the distribution function $\Gamma_\theta(\cdot)$.

Assumption 5 (Preferences). Woman i 's utility functions $U_i^a(\cdot, \cdot, \cdot, \cdot, \cdot)$ and $U_i^j(\cdot, \cdot, \cdot, \cdot, \cdot)$ satisfy the restrictions:

- A.1** utility is strictly increasing in C ;
- A.2** $U_i^t(H, C, \mathbf{D}, Z, 1) < U_i^t(H, C, \mathbf{D}, Z, 0)$ for all (H, C, \mathbf{D}, Z) such that $D^w + D^{wf} + D^f = 1$;
- A.3** $U_i^t(H, C, \mathbf{D}, 1, R) \leq U_i^t(H, C, \mathbf{D}, 0, R)$ for all (H, C, \mathbf{D}, R) such that $D^w + D^{wf} = 1$ and all $t \in \{a, j\}$; and $U_i^t(H, C, \mathbf{D}, 1, R) = U_i^t(H, C, \mathbf{D}, 0, R)$ for all (H, C, \mathbf{D}, R) such that $D^f = 1$ and all $t \in \{a, j\}$;
- A.4** $U_i^j(H, C, \mathbf{D}, 1, R) \leq U_i^a(H, C, \mathbf{D}, 1, R)$ for all (H, C, \mathbf{D}, R) such that $D^w + D^{wf} = 1$;
- A.5** $U_i^a(H, C, \mathbf{D}, 0, R) = U_i^j(H, C, \mathbf{D}, 0, R)$ for all $(H, C, \mathbf{D}, 0, R)$ such that $D^w + D^f + D^{wf} = 1$;
- A.6** $U_i^a(H, C, \mathbf{D}, 0, 0) = U_i^j(H, C, \mathbf{D}, 0, 0)$ for all (H, C, \mathbf{D}) such that $D^w + D^f + D^{wf} = 0$ and all $t \in \{a, j\}$;
- A.7** $U_i^a(H, C_i^a(E, \mathbf{D}, E), \mathbf{D}, 0, 0) < U_i^a(H, C_i^a(E, \mathbf{0}, E), \mathbf{0}, 0, 0)$ for all (H, W) such that $E \equiv WH \in (FPL_i, \bar{E}_i]$ and $D^w + D^{wf} = 1$ whenever $\bar{E}_i > FPL_i$.

Remark 9 (Preferences: Verbalizing Assumption 5). **A.2** states that under-reporting of earnings to the welfare agency decreases utility; the disutility from under-reporting may vary with the alternative and, in particular, with program mix. **A.3** states that reporting zero earnings to the welfare agency yields a hassle disutility, while reporting zero earnings to the FS agency yields no

hassle disutility; the welfare hassle disutility may vary with the alternative. **A.4** states that regime j 's welfare hassle disutility is no smaller than regime a 's welfare hassle disutility. **A.5** states that the utility value of alternatives entailing FS-only participation is independent of the regime, irrespective of whether earnings are under-reported or reported truthfully. It also states that utility value of alternatives entailing hours and consumption (H, C) and welfare-only participation, or FS and welfare participation, is independent of the regime whenever reported earnings are not zero, irrespective of whether earnings are under-reported or reported truthfully. **A.6** states that the utility value of alternatives entailing no participation in assistance programs is independent of the regime. **A.7** implicitly defines a *local* lower bound on the disutility from stigma associated with welfare assistance (alone or in combination with FS). It says that at earning levels in $(FPL_i, \bar{E}_i]$, the extra consumption due to the transfer income does not suffice to compensate the woman for the welfare stigma disutility she incurs when on welfare assistance under regime a , irrespective of program mix.

Assumption 6 (Welfare-Ineligible Earning Levels). *No woman may be on welfare assistance and truthfully report earnings above FPL_i under regime j or above \bar{E}_i under regime a .*

Assumption 7 (Utility Maximization). *Under regime t woman i makes choices by solving the optimization problem*

$$\max_{(W,H) \in \Theta_i \cup (0,0), \mathbf{D} \in \{0,1\}^3, D^f + D^w + D^{wf} \leq 1, E^r \in [0, WH]} U_i^t (H, C_i^t(WH, \mathbf{D}, E^r), \mathbf{D}, Z(\mathbf{D}, E^r), R(WH, \mathbf{D}, E^r))$$

Assumption 8 (Population Heterogeneity). *The distribution $\Gamma_\theta(\cdot)$ is unrestricted save for the constraints implied by Assumptions 5 and the definition of wage offers (Definition 19).*

Assumption 9 (Breaking Indifference). *Women break indifference in favor of the same alternative irrespective of the regime.*

Assumption 10 (Filing Taxes). *A woman files (does not file) for federal income taxes and the EITC irrespective of the regime.*

Intermediate Lemmas

Lemma 6 (Combined Transfer). *Under both regimes j and a , 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 or the sole FS transfer.*

Proof. The proof that the combined welfare plus FS transfer is no smaller than the sole welfare transfer is trivial: the FS program has no feed-backs on the welfare program (Definition 16, expressions (137)-(138)) and the FS transfer cannot be negative (Definition 16, expression (143)). The proof that the combined welfare plus FS transfer is no smaller than the sole FS transfer is less obvious because the FS transfer is decreasing in the welfare grant which is counted as income (Definition 16, expressions (143)-(144)). Nevertheless, the FS formula in (143) shows that a \$1 increase in the welfare grant (G) leads to a less than \$1 decrease in the FS transfer because $\tau_1^f < 1$ and welfare assistance yields categorical FS eligibility (expression (145)). Thus, a woman whose earnings report makes her eligible for welfare can enjoy a higher transfer income by taking up both welfare and FS as opposed to taking up only FS. \square

Lemma 7 (Combined Transfer as a Function of Reported Earnings). *Under regime a , the combined welfare plus FS transfer is weakly decreasing in reported earnings.*

Proof. For any reported earning E^r , the combined transfer accruing to woman i is a function $B(\cdot)$ defined by $B(E^r) \equiv G_i^a(E^r) + F_i(E^r, G_i^a(E^r))$. Observe: 1) given E^r , the function $G + F_i(E^r, G)$ is weakly increasing in G because a \$1 increase in the welfare grant (G) leads to a less than \$1 decrease in the FS transfer due to $\tau_1^f < 1$ (expression 143); 2) $G_i^a(E^r)$ is weakly decreasing in E^r (expression (137)); 3) given G , $F_i(E^r, G)$ is weakly decreasing in E^r (expressions (143)-(144)). Together these facts imply that $B(\cdot)$ is a weakly decreasing function.⁸ \square

Lemma 8 (States 2rr and 2rn). *Given Assumptions 5, 6, and 7, no woman selects an allocation compatible with states 2rr and 2rn.*

Proof. Under regime j no alternative is compatible with states 2rn and 2rr by Assumption 6. Consider now a woman with $\bar{E}_i \leq FPL_i$ under regime a . By Assumption 6 she may not be on assistance and truthfully report earnings above FPL_i (range 2). Finally, consider a woman with $\bar{E}_i > FPL_i$ under regime a . By Assumption 6 she may not be on assistance and truthfully report earnings above \bar{E}_i . By **A.7** in Assumption 5 she will not truthfully report earnings in $(FPL_i, \bar{E}_i]$ because she can attain a higher utility level by being off welfare assistance (Assumption 7): the extra consumption due to the transfer income does not suffice to compensate the woman for the stigma disutility she incurs when being on welfare assistance. \square

Lemma 9 (Optimal Reporting). *Write woman i 's optimization problem (Assumption 7) as a nested maximization problem:*

$$\max_{(W,H) \in \Theta_i \cup (0,0), \mathbf{D} \in \{0,1\}^3, D^f + D^w + D^{wf} \leq 1} \left[\max_{E^r \in [0, WH]} U_i^t(H, C_i^t(WH, \mathbf{D}, E^r), \mathbf{D}, Z(\mathbf{D}, E^r), R(WH, \mathbf{D}, E^r)) \right]. \quad (147)$$

Focus on the inner maximization problem in (147) for given sub-alternative (W, H, \mathbf{D}) with $D^m = 1$ for $m \in \{f, w, wf\}$. Let $E \equiv WH$ and $E_i^{r,t,m} = E_i^{r,t,m}(W, H)$ denote woman i 's utility maximizing earning report conditional on sub-alternative (W, H, \mathbf{D}) with $D^m = 1$. Given Assumptions 5-10, optimal reporting while on assistance is as follows:

1. Welfare Only

- (a) $E_i^{r,j,w}$ entails either truthful reporting, that is, $E_i^{r,j,w} = E$, or under-reporting such that $E > E_i^{r,j,w} \in [0, FPL_i]$; in particular, state 1un is dominated;
- (b) $E_i^{r,a,w}$ entails either truthful reporting, that is, $E_i^{r,a,w} = E$, or under-reporting such that $E > E_i^{r,a,w} \in [0, \delta_i]$;

2. FS Only

For any $t \in \{a, j\}$, $E_i^{r,t,f}$ entails either truthful reporting, that is, $E_i^{r,t,f} = E$, or under-reporting such that $E > E_i^{r,t,f} \in [0, \min\{\underline{E}_i^f, \bar{E}_i^f\}]$ where \underline{E}_i^f is the highest level of reported earnings such that the FS transfer is unreduced and \bar{E}_i^f is the highest level of reported earnings such the FS's eligibility tests are satisfied;

3. Welfare and FS

⁸If $B(\cdot)$ were differentiable then $\frac{dB(E^r)}{dE^r} = \frac{\partial(G+F(E^r, G))}{\partial G} \frac{dG}{dE^r} + \frac{\partial(G+F(E^r, G))}{\partial E^r} \frac{dE^r}{dE^r}$. To show that $\frac{dB(E^r)}{dE^r} \leq 0$ it would suffice to show that both $\frac{\partial(G+F(E^r, G))}{\partial G} \frac{dG}{dE^r} \leq 0$ and $\frac{\partial(G+F(E^r, G))}{\partial E^r} \leq 0$. The argument in the proof does exactly this without using calculus because neither $G(\cdot)$ nor $F(\cdot, \cdot)$ are differentiable functions.

- (a) $E_i^{r,j,wf}$ entails either truthful reporting, that is, $E_i^{r,j,wf} = E$, or under-reporting such that $E > E_i^{r,j,wf} \in [0, FPL_i]$; in particular, state $1uu$ is dominated;
- (b) $E_i^{r,a,wf}$ entails either truthful reporting, that is, $E_i^{r,a,wf} = E$, or under-reporting such that $E > E_i^{r,a,wf} = 1$ cent, or under-reporting such that $E > E_i^{r,a,wf} \in [0, \underline{E}_i^{wf}]$ where \underline{E}_i^{wf} is the largest level of reported earnings in $[0, \delta_i]$ such that the corresponding FS transfer is \bar{F}_i , that is $\chi_i(\underline{E}_i^{wf}, \bar{G}_i) = 0$ (Definition 144), or, if no such earning level exists in $[0, \delta_i]$, $\underline{E}_i^{wf} = 0$.

Proof. We prove each part of the Lemma in turn.

1. Welfare Only

The proofs of statements a.) and b.) mimic the proof of Lemma 2 with the appropriate adjustments in notation, namely, with $\mathbf{D} = (1, 0, 0)$ in place of $D = 1$, $E_i^{r,t,w}$ in place of $E_i^{r,t}$ for $t \in \{a, j\}$, net of tax earnings $T_i(E)$ in place of gross of tax earnings E , and the references to **A.3** in Assumption 5 in place of the references to **A.3** in Assumption 1.

2. FS Only

The stand-alone FS program rules are invariant to the regime (Definition 16). The utility associated with any alternative compatible with stand-alone FS assistance is also regime invariant (**A.5** in Assumption 5). Thus, the reported earning level that solves the inner maximization problem in (147) is the same for all $t \in \{a, j\}$. Also, it is *either* the true level of earnings *or* the amount - less than the true level of earnings - which maximizes consumption; this is because utility depends on whether a recipient is under-reporting but not the extend of the under-report (Definition 24). To find the reported earning level that maximizes consumption we make three preliminary observations. First, we observe that the threshold level \underline{E}_i^f is strictly positive for all i . To see this consider a woman i who enjoys no deductions other than the standard deduction, namely, $\beta_{1i}^f = \$134$ and $\beta_{2i}^f(0, 0) = 0$. Then, $\chi_i(E^r, 0) = E^r(1 - \tau_2^f) - \134 (expression (144)), hence any report $E^r \leq \$134 / (1 - \tau_2^f) = \167.5 yields her a FS transfer in the (maximal) amount \bar{F}_i . A woman with deductions other than the standard deduction enjoys an even higher threshold level \underline{E}_i^f . Second, we observe that the threshold level \bar{E}_i^f is also strictly positive for all i . To see this observe that \bar{E}_i^f is the smallest level of earnings that engenders ineligibility, formally, $\bar{E}_i^f = \min\{\tau_3^f FPL_i, E'\}$ where E' is such that $\chi_i(E', 0) = FPL_i$. Third, we observe that the threshold level \underline{E}_i^f for a woman with very high deductions may be higher than \bar{E}_i^f . Given E , any report $E^r \in [0, \min\{\underline{E}_i^f, \bar{E}_i^f\}]$ yields the same (maximal) transfer \bar{F}_i hence woman i enjoys consumption in the amount $T_i(E) + \bar{F}_i$. A report $E^r > \min\{\underline{E}_i^f, \bar{E}_i^f\}$ yields transfer $F_i(E^r, 0)$ hence woman i enjoys consumption in the amount $T_i(E) + F_i(E^r, 0)$. Because $F_i(E^r, 0) < \bar{F}_i$ for all $E^r > \min\{\underline{E}_i^f, \bar{E}_i^f\}$, the consumption-maximizing reports are in $[0, \min\{\underline{E}_i^f, \bar{E}_i^f\}]$. In conclusion, depending on the magnitude of woman i 's under-reporting disutility (**A.2** in Assumption 5) and earning level E , either reporting $E_i^{r,t,f} \in [0, \min\{\underline{E}_i^f, \bar{E}_i^f\}]$ *or* truthful reporting, i.e. $E_i^{r,t,f} = E$, solves the inner maximization problem in (147) for all $t \in \{a, j\}$.

3. Welfare and FS

The proof of statement a.) mimics the proof of Lemma 2.I.) with the appropriate adjustments in notation, namely, with $\mathbf{D} = (0, 0, 1)$ in place of $D = 1$, $E_i^{r,j,wf}$ in place of $E_i^{r,j}$, the references **A.3** and **A.5** in Assumption 5 in place of the references to **A.3** and **A.5** in Assumption 1, and the expressions for consumption equal to $T_i(E) + \bar{G}_i + \bar{F}_i$ in place of $E + \bar{G}_i$. In particular, state $1uu$ is dominated in the extended model because under regime j earnings up to FPL_i are fully disregarded in the determination of the combined welfare plus FS transfer (Definition 16, expression 142). Next we prove statement b.).

Consider first a woman i who derives no disutility from hassle under regime a (**A.3** in Assumption 5 holds as an equality). Thus, the utility associated with any alternative compatible with welfare plus FS assistance is regime invariant hence the reported earning level that solves the inner maximization problem in (147) is that which maximizes consumption. Reporting $E^r \in [0, \underline{E}_i^{wf}]$ yields woman i the maximal combined transfer $\bar{G}_i + \bar{F}_i$ with implied consumption $T_i(E) + \bar{G}_i + \bar{F}_i$. A report $E^r > \underline{E}_i^{wf}$ yields a lower transfer (Lemma 7) with implied consumption $T_i(E) + G_i^a(E^r) + F_i(E^r, G_i^a(E^r))$. Thus, depending on the magnitude of woman i 's under-reporting disutility and earning level E , either reporting $E_i^{r,a,wf} \in [0, \underline{E}_i^{wf}]$ or truthful reporting, i.e. $E_i^{r,a,wf} = E$, solves the inner maximization problem in (147).

Next, consider a woman i who derives some disutility from hassle under regime a (**A.3** in Assumption 5 holds as a strict inequality) and such that $\underline{E}_i^{wf} \in (0, \delta_i]$. Reporting $E^r \in (0, \underline{E}_i^{wf}]$ yields her the maximal combined transfer $\bar{G}_i + \bar{F}_i$ while higher reports yield a lower transfer (Lemma 7). Depending on the magnitude of woman i 's under-reporting disutility and earning level E , either reporting $E_i^{r,a,wf} \in (0, \underline{E}_i^{wf}]$ or truthful reporting, i.e. $E_i^{r,a,wf} = E$, solves the inner maximization problem in equation (147). To show this we next consider $\mathbf{D} = (0, 0, 1)$ and five mutually exclusive pairs (W, H) spanning the range of value for $E \equiv WH$. For convenience, we let U_i^t serve as shortcut notation for $U_i^t(H, C_i^t(E, \mathbf{D}, E^r), \mathbf{D}, Z(\mathbf{D}, E^r), R(E, \mathbf{D}, E^r))$. Let (W, H) be:

(a) such that $E = 0$.

Woman i 's cannot over-report her earnings (Assumption 147). Thus, $E_i^{r,a,wf} = E$.

(b) (W, H) such that $E \in (0, \underline{E}_i^{wf}]$.

Woman i 's utility while on welfare and FS depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 0, 1) & \text{if } E^r \in (0, E) \\ [3] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 0, 0) & \text{if } E^r = E \end{cases} .$$

By the characterization of woman i 's preferences we have $[1] < [2]$. By **A.2** in Assumption 5 we have $[2] < [3]$. Thus, truthful reporting solves the inner maximization problem (147), that is, $E_i^{r,a,wf} = E$.

(c) (W, H) such that $E \in (\underline{E}_i^{wf}, \delta_i]$.

Woman i 's utility while on welfare and FS depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 0, 1) & \text{if } E^r \in (0, \underline{E}_i^{wf}] \\ [3] : U_i^a(H, T_i(E) + \bar{G}_i + F_i(E^r, \bar{G}_i), \mathbf{D}, 0, 1) & \text{if } E^r \in (\underline{E}_i^{wf}, E) \\ [4] : U_i^a(H, T_i(E) + \bar{G}_i + F_i(E^r, \bar{G}_i), \mathbf{D}, 0, 0) & \text{if } E^r = E \end{cases} .$$

By the characterization of woman i 's preferences we have $[1] < [2]$. Because the FS transfer $F_i(E^r, \bar{G}_i)$ is strictly decreasing in E^r , $F_i(E^r, \bar{G}_i) < \bar{F}_i$, hence $[3] < [2]$. Thus,

depending on woman i 's utility function, under-reporting disutility (**A.2** in Assumption 5), and earnings E , the inner maximization problem in (147) is solved by $E_i^{r,a,wf} \in (0, \underline{E}_i^{wf}]$ (when $[4] \leq [2]$) or by truthful reporting, $E_i^{r,a,wf} = E$ (when $[4] \geq [2]$).

- (d) (W, H) such that $E \in (\delta_i, FPL_i]$.

Woman i 's utility while on welfare and FS depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 0, 1) & \text{if } E^r \in (0, \underline{E}_i^{wf}] \\ [3] : U_i^a(H, T_i(E) + \bar{G}_i + F_i(E^r, \bar{G}_i), \mathbf{D}, 0, 1) & \text{if } E^r \in (\underline{E}_i^{wf}, \delta_i] \\ [4] : U_i^a(H, T_i(E) + G_i^a(E^r) + F_i(E^r, G_i^a(E^r)), \mathbf{D}, 0, 1) & \text{if } E^r \in (\delta_i, E) \\ [5] : U_i^a(H, T_i(E) + G_i^a(E^r) + F_i(E^r, G_i^a(E^r)), \mathbf{D}, 0, 0) & \text{if } E^r = E \end{cases} .$$

By the characterization of woman i 's preferences we have $[1] < [2]$. The combined transfer $G_i^a(E^r) + F_i(E^r, G_i^a(E^r))$ is strictly decreasing in E^r which implies that $[4] < [3] < [2]$ (Lemma 7). Thus, depending on woman i 's utility function, under-reporting disutility (**A.2** in Assumption 5), and earnings E , the inner maximization problem in (147) is solved by $E_i^{r,a,wf} \in (0, \underline{E}_i^{wf}]$ (when $[5] \leq [2]$) or by truthful reporting, $E_i^{r,a,wf} = E$ (when $[5] \geq [2]$).

- (e) (W, H) such that $E > FPL_i$.

Woman i must be under-reporting (Lemma 8). Her utility while on welfare and FS depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 0, 1) & \text{if } E^r \in (0, \underline{E}_i^{wf}] \\ [3] : U_i^a(H, T_i(E) + \bar{G}_i + F_i(E^r, \bar{G}_i), \mathbf{D}, 0, 1) & \text{if } E^r \in (\underline{E}_i^{wf}, \delta_i] \\ [4] : U_i^a(H, T_i(E) + G_i^a(E^r) + F_i(E^r, G_i^a(E^r)), \mathbf{D}, 0, 1) & \text{if } E^r \in (\delta_i, E) \end{cases} .$$

By the characterization of woman i 's preferences we have $[1] < [2]$. The combined transfer $G_i^a(E^r) + F_i(E^r, G_i^a(E^r))$ is strictly decreasing in E^r which implies that $[4] < [3] < [2]$ (Lemma 7). Thus, the inner maximization problem in (147) is solved by $E_i^{r,a,wf} \in (0, \underline{E}_i^{wf}]$.

Finally, consider a woman i who derives some disutility from hassle under regime a (**A.3** in Assumption 5 holds as a strict inequality) and such that $\underline{E}_i^{wf} = 0$. Depending on woman i 's utility function (in particular her hassle disutility), under-reporting disutility, and earnings E , the inner maximization problem in (147) is solved by $E_i^{r,a,wf} = 1$ cent or by truthful reporting, $E_i^{r,a,wf} = E$. To show this we next consider $\mathbf{D} = (0, 0, 1)$ and four mutually exclusive pairs (W, H) spanning the range of value for $E \equiv WH$. Again, for convenience, we let U_i^t serve as shortcut notation for $U_i^t(H, C_i^t(E, \mathbf{D}, E^r), \mathbf{D}, Z(\mathbf{D}, E^r), R(E, \mathbf{D}, E^r))$. Let (W, H) be:

- (a) (W, H) such that $E = 0$.

Woman i 's cannot over-report her earnings (Assumption 147). Thus, $E_i^{r,a,wf} = E$.

- (b) (W, H) such that $E \in (0, \delta_i]$.

Woman i 's utility while on welfare and FS depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, T_i(E) + \bar{G}_i + F_i(E^r, \bar{G}_i), \mathbf{D}, 0, 1) & \text{if } E^r \in (0, E) \\ [3] : U_i^a(H, T_i(E) + \bar{G}_i + F_i(E^r, \bar{G}_i), \mathbf{D}, 0, 0) & \text{if } E^r = E \end{cases} .$$

The FS transfer $F_i(E^r, \bar{G}_i)$ is strictly decreasing in E^r which implies that $F_i(E^r, \bar{G}_i) \leq \bar{F}_i$ for all $E^r \in (0, E)$ and among these reports that which yields the highest utility is $E^r = 1$ (the smallest possible denomination). Due to rounding of the FS transfer, $F_i(1, \bar{G}_i) = \bar{F}_i \equiv F_i(0, \bar{G}_i)$ hence $[1] < [2]$. Thus, whether the inner maximization problem (147) has solution $E_i^{r,a,wf} = 1$ cent or $E_i^{r,a,wf} = E$ depends on whether the increase in utility derived from the higher consumption ($\bar{F}_i > F_i(E, \bar{G}_i)$ and **A.1** in Assumption 5) more than offsets the decrease in utility derived from under-reporting (**A.2** in Assumption 5) i.e. $[3] < [2]$ or viceversa.

- (c) (W, H) such that $E \in (\delta_i, FPL_i]$.

Woman i 's utility while on welfare and FS depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, T_i(E) + \bar{G}_i + F_i(E^r, \bar{G}_i), \mathbf{D}, 0, 1) & \text{if } E^r \in (0, \delta_i] \\ [3] : U_i^a(H, T_i(E) + G_i^a(E^r) + F_i(E^r, G_i^a(E^r)), \mathbf{D}, 0, 1) & \text{if } E^r \in (\delta_i, E) \\ [4] : U_i^a(H, T_i(E) + \bar{G}_i + F_i(E^r, \bar{G}_i), \mathbf{D}, 0, 0) & \text{if } E^r = E \end{cases} .$$

The combined transfer $G_i^a(E^r) + F_i(E^r, G_i^a(E^r))$ is strictly decreasing in E^r which implies that $[3] < [2]$ (Lemma 7). The FS transfer $F_i(E^r, G_i^a(E^r))$ is also strictly decreasing in E^r which implies that among reports in $(0, \delta_i]$ that which yields the highest utility is $E^r = 1$ cent (the smallest possible denomination). Due to rounding of the FS transfer, $F_i(1, \bar{G}_i) = \bar{F}_i \equiv F_i(0, \bar{G}_i)$ hence $[1] < [2]$. Thus, whether the inner maximization problem (147) has solution $E_i^{r,a,wf} = 1$ cent or $E_i^{r,a,wf} = E$ depends on whether the increase in utility derived from the higher consumption ($\bar{F}_i > F_i(E, \bar{G}_i)$ and **A.1** in Assumption 5) more than offsets the decrease in utility derived from under-reporting (**A.2** in Assumption 5) i.e. $[4] < [2]$ or viceversa.

- (d) (W, H) such that $E > FPL_i$.

Woman i must be under-reporting (Lemma 8). Her utility while on welfare and FS depends on reported earnings as follows:

$$U_i^a = \begin{cases} [1] : U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, \mathbf{D}, 1, 1) & \text{if } E^r = 0 \\ [2] : U_i^a(H, T_i(E) + \bar{G}_i + F_i(E^r, \bar{G}_i), \mathbf{D}, 0, 1) & \text{if } E^r \in (0, \delta_i] \\ [3] : U_i^a(H, T_i(E) + G_i^a(E^r) + F_i(E^r, G_i^a(E^r)), \mathbf{D}, 0, 1) & \text{if } E^r \in (\delta_i, FPL_i) \end{cases} .$$

The combined transfer $G_i^a(E^r) + F_i(E^r, G_i^a(E^r))$ is strictly decreasing in E^r which implies that $[3] < [2]$ (Lemma 7). The FS transfer $F_i(E^r, \bar{G}_i)$ is also strictly decreasing in E^r which implies that among reports in $(0, \delta_i]$ that which yields the highest utility is $E^r = 1$ cent (the smallest possible denomination). Due to rounding of the FS transfer, $F_i(1, \bar{G}_i) = \bar{F}_i \equiv F_i(0, \bar{G}_i)$ hence $[1] < [2]$. Thus, the inner maximization problem (147) has solution $E_i^{r,a,wf} = 1$ cent.

□

Corollary 6 (Optimal Reporting and Policy Invariance). *Given Assumptions 5-10, the utility function associated with any alternative compatible with states $\{1un, 2un, 1uu, 2uu\}$ and entailing optimal reporting is regime invariant.*

Proof. We examine each state in turn.

1. State $1un$

- (a) Consider a woman i and any sub-alternative (W, H, \mathbf{D}) such that letting $E \equiv WH$, E is in range 1, $D^w = 1$, and $E_i^{r,j,w}(W, H) < E$. Thus alternative $(W, H, \mathbf{D}, E_i^{r,j,w}(W, H))$ is compatible with state $1un$ and entails optimal reporting under regime j . Let $C_i^j \equiv C_i^j(E, (1, 0, 0), E_i^{r,j,w}(W, H))$ and $Z_i^j \equiv Z((1, 0, 0), E_i^{r,j,w}(W, H))$. We next show that $U_i^j(H, C_i^j, (1, 0, 0), Z_i^j, 1) = U_i(H, C_i^j, (1, 0, 0), Z_i^j, 1)$. By Lemma 9, $E_i^{r,j,w}(W, H) \in (0, FPL_i]$ or $E_i^{r,j,w}(W, H) \in [0, FPL_i]$ depending on the woman's preferences. In the first case, the utility woman i enjoys is $U_i^j(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$ which equals $U_i(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$ by **A.5** in Assumption 5. In the second case, the utility woman i enjoys is $U_i^j(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$ which also equals $U_i(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$ by **A.5** in Assumption 5 and because she is indifferent between (under-) reports in $(0, FPL_i]$ and reporting zero earnings, that is, $U_i^j(H, T_i(E) + \overline{G}_i, (1, 0, 0), 1, 1) = U_i^j(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$.
- (b) Consider a woman i and any sub-alternative (W, H, \mathbf{D}) such that letting $E \equiv WH$, E is in range 1, $D^w = 1$, and $E_i^{r,a,w}(W, H) < E$. Thus alternative $(W, H, \mathbf{D}, E_i^{r,a,w}(W, H))$ is compatible with state $1un$ and entails optimal reporting under regime a . Let $C_i^a \equiv C_i^a(E, (1, 0, 0), E_i^{r,a,w}(W, H))$ and $Z_i^a \equiv Z((1, 0, 0), E_i^{r,a,w}(W, H))$. We next show that $U_i^a(H, C_i^a, (1, 0, 0), Z_i^a, 1) = U_i(H, C_i^a, (1, 0, 0), Z_i^a, 1)$. By Lemma 9, $E_i^{r,a,w}(W, H) \in (0, \delta_i]$ or $E_i^{r,a,w}(W, H) \in [0, \delta_i]$ depending on the woman's preferences. In the first case, the utility woman i enjoys is $U_i^a(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$ which equals $U_i(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$ by **A.5** in Assumption 5. In the second case, the utility woman i enjoys is also $U_i^a(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1) = U_i(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$ by **A.5** in Assumption 5 and because she is indifferent between (under-) reports in $(0, \delta_i]$ and reporting zero earnings, that is, $U_i^a(H, T_i(E) + \overline{G}_i, (1, 0, 0), 1, 1) = U_i^a(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$.
- (c) In 1.(a) and 1.(b) we have shown that any alternative compatible with state $1un$ and entailing optimal reporting yields regime-invariant consumption $T_i(E) + \overline{G}_i$ and regime-invariant utility level $U_i(H, T_i(E) + \overline{G}_i, (1, 0, 0), 0, 1)$.

2. State $2un$.

The proof that the utility associated with any alternative compatible with state $2un$ and entailing optimal reporting is regime invariant is the same as that for state $1un$ once we let the pair (H, W) be such that $E \equiv WH$ is in range 2 (Lemma 9).

3. State $1uu$

- (a) Consider a woman i and any sub-alternative (W, H, \mathbf{D}) such that letting $E \equiv WH$, E is in range 1, $D^{wf} = 1$, and $E_i^{r,j,wf}(W, H) < E$. Thus alternative $(W, H, \mathbf{D}, E_i^{r,j,wf}(W, H))$ is compatible with state $1uu$ and entails optimal reporting under regime j . Let $C_i^j \equiv C_i^j(E, (0, 0, 1), E_i^{r,j,wf}(W, H))$ and $Z_i^j \equiv Z((0, 0, 1), E_i^{r,j,wf}(W, H))$. We next show that $U_i^j(H, C_i^j, (0, 0, 1), Z_i^j, 1) = U_i(H, C_i^j, (0, 0, 1), Z_i^j, 1)$. By Lemma 9, $E_i^{r,j,wf}(W, H) \in (0, FPL_i]$ or $E_i^{r,j,wf}(W, H) \in [0, FPL_i]$ depending on the woman's preferences. In the first case, the utility woman i enjoys is $U_i^j(H, T_i(E) + \overline{G}_i + \overline{F}_i, (0, 0, 1), 0, 1)$ which equals $U_i(H, T_i(E) + \overline{G}_i + \overline{F}_i, (0, 0, 1), 0, 1)$ by **A.5** in Assumption 5. In the second case, the utility woman i enjoys is $U_i^j(H, T_i(E) + \overline{G}_i + \overline{F}_i, (0, 0, 1), 0, 1)$ which also

equals $U_i(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 0, 1)$ by **A.5** in Assumption 5 and because she is indifferent between (under-) reports in $(0, FPL_i]$ and reporting zero earnings, that is, $U_i^j(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 1, 1) = U_i^j(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 0, 1)$.

- (b) Consider a woman i and any sub-alternative (W, H, \mathbf{D}) such that letting $E \equiv WH$, E is in range 1, $D^{wf} = 1$, and $E_i^{r,a,wf}(W, H) < E$. Thus alternative $(W, H, \mathbf{D}, E_i^{r,a,wf}(W, H))$ is compatible with state $1uu$ and entails optimal reporting under regime a . Let $C_i^a \equiv C_i^a(E, (0, 0, 1), E_i^{r,a,wf}(W, H))$ and $Z_i^a \equiv Z((0, 0, 1), E_i^{r,a,wf}(W, H))$. We next show that $U_i^a(H, C_i^a, (0, 0, 1), Z_i^a, 1) = U_i(H, C_i^a, (0, 0, 1), Z_i^a, 1)$. By Lemma 9, $E_i^{r,a,wf}(W, H) \in (0, \underline{E}_i^{wf}]$ or $E_i^{r,a,wf}(W, H) \in [0, \underline{E}_i^{wf}]$ or $E_i^{r,a,wf}(W, H) = 1$ cent depending on the woman's preferences and \underline{E}_i^{wf} . In the first case, the utility woman i enjoys is $U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 0, 1)$ which equals $U_i(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 0, 1)$ by **A.7** in Assumption 5 (policy invariance). In the second case, the utility woman i enjoys is also $U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 0, 1) = U_i(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 0, 1)$ by **A.5** in Assumption 5 and because she is indifferent between (under-) reports in $(0, \underline{E}_i^{wf}]$ and reporting zero earnings, that is, $U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 1, 1) = U_i^a(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 0, 1)$. In the third case, the utility woman i enjoys is also $U_i(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 0, 1)$ because of the rounding of the FS transfer.
- (c) In 3.(a) and 3.(b) we have shown that any alternative compatible with state $1uu$ and entailing optimal reporting yields regime-invariant consumption $T_i(E) + \bar{G}_i + \bar{F}_i$ and regime-invariant utility level $U_i(H, T_i(E) + \bar{G}_i + \bar{F}_i, (0, 0, 1), 0, 1)$.

4. State $2uu$

The proof that the utility associated with any alternative compatible with state $2uu$ and entailing optimal reporting is regime-invariant is the same as that for state $1uu$ once we let the pair (H, W) be such that $E \equiv WH$ is in range 2 (Lemma 9).

□

Remark 10 (Optimal under-Reporting and Alternatives Considered). In what follows, when considering alternatives compatible with states $\{1un, 1uu, 2un, 2uu\}$, it is without loss of generality that we only focus on alternatives entailing optimal (under-) reporting. No woman would select an alternative compatible with states $\{1un, 1uu, 2un, 2uu\}$ not entailing optimal (under-) reporting (Assumption 7). Additionally, it is without loss of generality that we disregard alternatives compatible with states $\{1un, 1uu\}$ under regime j . No woman would select an alternative compatible with states $\{1un, 1uu\}$ under regime j because they are dominated (Lemma 9, parts I and III).

Lemma 10 (Revealed Preferences). *Consider any pair of states (s^a, s^j) obeying: I) $s^a \neq s^j$; II) state s^a is no worse under regime j than under regime a ; III) state s^j is no better under regime j than under regime a . Then, if Assumptions 7 and 9 hold, no woman will pair states s^a and s^j .*

Proof. The proof is by contradiction. Consider any pair of states (s^a, s^j) satisfying properties I)-III) and suppose that there exists a woman i who pairs states s^a and s^j . By Assumption 7, this means that there exists an alternative (H, W, \mathbf{D}, E^r) that is compatible with state s^a and utility maximizing under regime a ; and an alternative $(H', W', \mathbf{D}', E^{r'})$ that is compatible with state s^j and utility maximizing under regime j . Define $E \equiv WH$ and $E' \equiv W'H'$. Let $C_i^t = C_i^t(E, \mathbf{D}, E^r)$

and $C_i^{tt} = C_i^t(E', \mathbf{D}', E^{r'})$ for all $t \in \{a, j\}$, $Z = Z(\mathbf{D}, E^r)$ and $Z' = Z(\mathbf{D}', E^{r'})$, $R = R(E, \mathbf{D}, E^r)$ and $R' = R(E', \mathbf{D}', E^{r'})$. Thus, the woman choices under regime a and, respectively, j reveal

$$U_i^a(H, C_i^a, \mathbf{D}, Z, R) \geq U_i^a(H', C_i^{a'}, \mathbf{D}', Z', R'),$$

and

$$U_i^j(H', C_i^{j'}, \mathbf{D}', Z', R') \geq U_i^j(H, C_i^j, \mathbf{D}, Z, R).$$

By property II)

$$U_i^j(H, C_i^j, \mathbf{D}, Z, R) \geq U_i^a(H, C_i^a, \mathbf{D}, Z, R).$$

Combining the above three inequalities we have

$$U_i^j(H', C_i^{j'}, \mathbf{D}', Z', R') \geq U_i^j(H, C_i^j, \mathbf{D}, Z, R) \geq U_i^a(H, C_i^a, \mathbf{D}, Z, R) \geq U_i^a(H', C_i^{a'}, \mathbf{D}', Z', R'). \quad (148)$$

If any of the inequalities in (148) is strict, property III) is violated therefore we have a contradiction. If no inequality is strict, (148) rewrites as

$$U_i^j(H', C_i^{j'}, \mathbf{D}', Z', R') = U_i^j(H, C_i^j, \mathbf{D}, Z, R) = U_i^a(H, C_i^a, \mathbf{D}, Z, R) = U_i^a(H', C_i^{a'}, \mathbf{D}', Z', R'). \quad (149)$$

The first equality in (149) means that woman i is indifferent between allocation (H, W, \mathbf{D}, E^r) and $(H', W', \mathbf{D}', E^{r'})$ under regime j . The last equality in (149) means that woman i is indifferent between allocation (H, W, \mathbf{D}, E^r) and $(H', W', \mathbf{D}', E^{r'})$ under regime a . She breaks the indifference in favor of allocation (H, W, \mathbf{D}, E^r) under regime a and in favor of allocation $(H', W', \mathbf{D}', E^{r'})$ under regime j . By Assumption 9 this means that $(H, W, \mathbf{D}, E^r) = (H', W', \mathbf{D}', E^{r'})$ which implies that $s^a = s^j$ which violates property I) therefore we have a contradiction. \square

Lemma 11 (Policy Impact on Attractiveness of States). *Given Assumptions 5-10:*

1. the states in \mathcal{C}_+ are no worse under regime j than under regime a ,
2. the states in \mathcal{C}_- are no better under regime j than under regime a ,
3. the states in \mathcal{C}_0 are equally attractive under regimes j and a .

Proof. We prove each statement in turn.

1. **The states in \mathcal{C}_+ are no worse under j than under regime a .**

The only two states in \mathcal{C}_+ are $1rn$ and $1rr$. The alternatives compatible with these states entail E in range 1, and, respectively, $(D^w, E^r) = (1, E)$ or $(D^{wj}, E^r) = (1, E)$. Thus, the utility function associated with each of these alternatives is invariant to the treatment (**A.5** in Assumption 5). Accordingly, it suffices to show that the consumption associated with any one of these alternatives is not lower under regime j than under regime a , that is, $C_i^j(E, \mathbf{D}, E^r) \geq C_i^a(E, \mathbf{D}, E^r)$ for all (E, \mathbf{D}, E^r) such that $s(E, \mathbf{D}, E^r) \in \mathcal{C}_+$. Consider first state $1rr \in \mathcal{C}_+$ so that $(E, \mathbf{D}, E^r) = (E, (0, 0, 1), E)$. By Lemma 7 part 1), $\bar{G}_i + F_i(E, \bar{G}_i) \geq G_i^a(E) + F_i(E, G_i^a(E))$ for all E in range 1,⁹ thus

$$C_i^j(E, (0, 0, 1), E) = T_i(E) + \bar{G}_i + F_i(E, \bar{G}_i) \geq T_i(E) + G_i^a(E) + F_i(E, \bar{G}_i) = C_i^a(E, (0, 0, 1), E),$$

⁹There are earning levels in range 1 such that a woman is ineligible for the combined FS plus welfare assistance under JF's control policy. This comparison is meaningful only for earnings that are below the more stringent eligibility threshold; above such threshold state $1rr$ is ruled out under JF's control policy.

which verifies the desired inequality. Consider next state $1rn \in \mathcal{C}_+$ so that $(E, \mathbf{D}, E^r) = (E, (1, 0, 0), E)$. Because $\overline{G}_i \geq G_i^a(E)$ for all E in range 1,

$$C_i^j(E, (1, 0, 0), E) = T_i(E) + \overline{G}_i \geq T_i(E) + G_i^a(E) = C_i^a(E, (1, 0, 0), E),$$

which verifies the desired inequality.

2. The states in \mathcal{C}_- are no better under j than under regime a .

The only two states in \mathcal{C}_- are $0rn$ and $0rr$. It suffices to show that the utility associated with any alternative compatible with states $0rn$ and $0rr$ is at least as high under regime a than under regime j . Consider a tuple obeying $s(E, \mathbf{D}, E^r) \in \mathcal{C}_-$. The alternatives compatible with state $0rn$ are such that $(E, \mathbf{D}, E^r) = (0, (1, 0, 0), 0)$ hence $C_i^t(E, \mathbf{D}, E^r) = \overline{G}_i$ all t , $Z(\mathbf{D}, E^r) = 1$, and $R(E, \mathbf{D}, E^r) = 0$. The alternatives compatible with state $0rr$ are such that $(E, \mathbf{D}, E^r) = (0, (0, 0, 1), 0)$ hence $C_i^t(E, \mathbf{D}, E^r) = \overline{G}_i + \overline{F}_i$ all t , $Z(\mathbf{D}, E^r) = 1$, and $R(E, \mathbf{D}, E^r) = 0$. Thus, it suffices to show that

$$U_i^a(0, \overline{G}_i, (1, 0, 0), 1, 0) \geq U_i^j(0, \overline{G}_i, (1, 0, 0), 1, 0),$$

and

$$U_i^a(0, \overline{G}_i + \overline{F}_i, (0, 0, 1), 1, 0) \geq U_i^j(0, \overline{G}_i + \overline{F}_i, (0, 0, 1), 1, 0).$$

Both inequalities hold by **A.4** in Assumption 5 (hassle disutility is no lower under j than under a).

3. The states in \mathcal{C}_0 are equally attractive under regimes j and a .

Write \mathcal{C}_0 as the union of two disjoint collections:

$$\{0nn, 1nn, 2nn, 0nr, 1nr, 2nr, 1nu, 2nu\}, \quad (150)$$

$$\{1un, 2un, 1uu, 2uu\}. \quad (151)$$

The alternatives compatible with states in collection (150) entail no assistance or FS-only assistance. Thus the utility associated with each of these alternatives is invariant to the policy regime (**A.5** and **A.6** in Assumption 5). Accordingly, it suffices to show that the consumption associated with any of these alternatives is the same under regimes j and a . Consider first the alternatives compatible with an off-assistance state $s_i \in \{0nn, 1nn, 2nn\}$ in collection (150). If $s_i \in \{0nn\}$, consumption is zero. If $s_i \in \{1nn, 2nn\}$ consumption equals E . Thus, consumption is the same under either regime. Consider next the alternatives compatible with a FS-only state $s_i \in \{0nr, 1nr, 2nr, 1nu, 2nu\}$ in collection (150). If $s_i \in \{0nr\}$, consumption equals \overline{F}_i . If $s_i \in \{1nr, 2nr\}$, consumption equals $E + F_i(E, 0)$. If $s_i \in \{1nu, 2nu\}$ consumption equals $E + \overline{F}_i$ by optimal reporting (Lemma 9). Thus, consumption is the same under either regime. Finally consider the alternatives compatible with states in collection (151). Given optimal reporting, the utility function associated with all the alternatives compatible with states $\{1un, 2un, 1uu, 2uu\}$ is invariant to the policy regime (Corollary 6). Accordingly, it suffices to show that the consumption associated with any one of these alternatives is the same under regimes j and a . If $s_i \in \{1un, 2un\}$, consumption is $E + \overline{G}_i$ under both regimes. If $s_i \in \{1uu, 2uu\}$, consumption is $E + \overline{G}_i + \overline{F}_i$ under both regimes. Thus, consumption is the same under either regime.

□

Main Propositions

Proposition 6 (Restricted Pairings). *Given Assumptions 5-10, the pairings of states corresponding to the “-” entries in Table A4 are disallowed.*

Proof. States 1un and 1uu are dominated under regime j (Lemma 9). Therefore no woman pairs state s^a with state $s^j \in \{1un, 1uu\}$ for any $s^a \in \mathcal{S}$. Next, by Lemmas 5 and 11, no pairing of state s^a with state s^j can occur for all (s^a, s^j) in the collection

$$\{(s^a, s^j) : s^a \in \mathcal{C}_0 \cup \mathcal{C}_+, s^j \in \mathcal{C}_0 \cup \mathcal{C}_-, s^a \neq s^j\}. \quad (152)$$

It suffices to show that the properties I)-III) of Lemma 10 are met. Property I) holds trivially and properties II) and III) hold by Lemma 11. Therefore no woman selects any of the pairings in (152). \square

Proposition 7 (Unrestricted Pairings). *Given Assumptions 5-10, the pairings of states corresponding to the non “-” entries in Table A4 are allowed.*

Remark 11 (Omitted Proof of Proposition 7). The proof of Proposition 7 would mimic the proof of Proposition 2 in that it would present examples of women who select the pairings corresponding to the non “-” entries in Table A4. We omit the proof of Proposition 7 for two reasons. First, there are 63 allowed pairings in Table A4, which makes the proof exceedingly long. Second, our interest lies in showing that the integrated response matrix of the extended model contains at least as many restrictions as the response matrix of the baseline model (Proposition 9 and Remark 12 below). The proof of Proposition 7 would only serve to confirm the additional result that the integrated response matrix of the extended model contains at most as many restrictions as the response matrix of the baseline model.

Proposition 8 (Response Matrix). *Let Π denote the matrix of response probabilities $\{\pi_{s^a, s^j} : s^a, s^j \in \mathcal{S}\}$. Given Table A4, Π is a 16×16 matrix with the following zero (0) and non-zero (X) entries:*

JF’s Experimental Policy: Earnings / Program Participation State																
Control	0nn	1nn	2nn	0nr	1nr	2nr	1nu	2nu	0rn	1rn	1un	2un	0rr	1rr	1uu	2uu
0nn	X	0	0	0	0	0	0	0	0	X	0	0	0	X	0	0
1nn	0	X	0	0	0	0	0	0	0	X	0	0	0	X	0	0
2nn	0	0	X	0	0	0	0	0	0	X	0	0	0	X	0	0
0nr	0	0	0	X	0	0	0	0	0	X	0	0	0	X	0	0
1nr	0	0	0	0	X	0	0	0	0	X	0	0	0	X	0	0
2nr	0	0	0	0	0	X	0	0	0	X	0	0	0	X	0	0
1nu	0	0	0	0	0	0	X	0	0	X	0	0	0	X	0	0
2nu	0	0	0	0	0	0	0	X	0	X	0	0	0	X	0	0
0rn	X	X	X	X	X	X	X	X	X	X	0	X	X	X	0	X
1rn	0	0	0	0	0	0	0	0	0	X	0	0	0	X	0	0
1un	0	0	0	0	0	0	0	0	0	X	0	0	0	X	0	0
2un	0	0	0	0	0	0	0	0	0	X	0	X	0	X	0	0
0rr	X	X	X	X	X	X	X	X	X	X	0	X	X	X	0	X
1rr	0	0	0	0	0	0	0	0	0	X	0	0	0	X	0	0
1uu	0	0	0	0	0	0	0	0	0	X	0	0	0	X	0	0
2uu	0	0	0	0	0	0	0	0	0	X	0	0	0	X	0	X

Proof. By Definition 29, $\pi_{s^a, s^j} \equiv P(S_i^j = s^j | S_i^a = s^a)$. By Proposition 6, the pairings of states corresponding to the “-” entries in Table A4 are disallowed. Thus, $\pi_{s^a, s^j} = 0$ for any pairing (s^a, s^j) corresponding to a “-” entry in Table A4 because no woman occupies state s^a under regime a and state s^j under regime j . By Proposition 7, the pairings of states corresponding to the non “-” entries in Table A4 are allowed. Thus, $\pi_{s^a, s^j} \neq 0$ for any pairing (s^a, s^j) corresponding to a non “-” entry in Table A4 because some women may occupy state s^a under regime a and state s^j under regime j . \square

Proposition 9 (Integrated Response Matrix). *The matrix of response probabilities over the states in \mathcal{S} , Π , reduces to the following matrix Π_w of response probabilities over the states in \mathcal{S}_w :*

<i>JF's Experimental Policy: Earnings / Program Participation State</i>							
<i>Control</i>	<i>0n</i>	<i>1n</i>	<i>2n</i>	<i>0r</i>	<i>1r</i>	<i>1u</i>	<i>2u</i>
<i>0n</i>	$1 - \pi_{0n,1r}$	0	0	0	$\pi_{0n,1r}$	0	0
<i>1n</i>	0	$1 - \pi_{1n,1r}$	0	0	$\pi_{1n,1r}$	0	0
<i>2n</i>	0	0	$1 - \pi_{2n,1r}$	0	$\pi_{2n,1r}$	0	0
<i>0r</i>	$\pi_{0r,0n}$	$\pi_{0r,1n}$	$\pi_{0r,2n}$	$1 - \pi_{0r,0n} - \pi_{0r,1n} - \pi_{0r,2n} - \pi_{0r,1r} - \pi_{0r,2u}$	$\pi_{0r,1r}$	0	$\pi_{0r,2u}$
<i>1r</i>	0	0	0	0	1	0	0
<i>1u</i>	0	0	0	0	1	0	0
<i>2u</i>	0	0	0	0	$\pi_{2u,1r}$	0	$1 - \pi_{2u,1r}$

where

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

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

$$\pi_{s_w^a, s_w^j} \equiv \Pr(S_{w,i}^j = s_w^j | S_{w,i}^a = s_w^a) = \sum_{s^j \in \mathcal{S}: s_w^j = h(s^j)} \left[\sum_{s^a \in \mathcal{S}: s_w^a = h(s^a)} \Pr(S_i^j = s^j | S_i^a = s^a) \frac{q_{s^a}^a}{p_{s_w^a}^a} \right].$$

□

Remark 12 (Relationship between the Restrictions in the Baseline and in the Extended Model). The response matrix implied by the baseline model has the same zero and unitary entries as the response matrix Π_w implied by the extended model.

10 Finer Earning Ranges

In this section we consider a finer coarsening of earnings than that adopted in the paper (see Section V equation (7) of the paper). Specifically, we partition earnings above the federal poverty level into two sub-ranges. We begin with some definitions that supersede those in Section 4 of this Appendix. We conclude with the analytical bounds for two “opt-in” response probabilities. Proofs are omitted because they closely mimic those accompanying the baseline coarsening approach.

Definition 31 (Earning Ranges). 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 $(FPL_i, 1.2 \times FPL_i]$. Earning range $2''$ refers to the interval $(1.2 \times FPL_i, \infty)$.

Definition 32 (State). Consider the triple (E, D, E^r) . The state corresponding to (E, D, E^r) is defined by the function:

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

Definition 33 (Latent and Observed States). Define $\mathcal{S}^* \equiv \{0n, 1n, 2'n, 2''n, 0r, 1r, 1u, 2'u, 2''u\}$ and $\tilde{\mathcal{S}}^* \equiv \{0n, 1n, 2'n, 2''n, 0p, 1p, 2'p, 2''p\}$ where the mapping between the latent states in \mathcal{S}^* and the observed states in $\tilde{\mathcal{S}}^*$ is:

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

Proposition 10 (Response Matrix). *The matrix of response probabilities over the states in \mathcal{S}^* is:*

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

Proof. Omitted. See proof of Propositions 1 and 2. \square

Corollary 7. *The matrix of response probabilities in Proposition 10 implies the following system of equations describing the impact of the JF reform on observable state probabilities:*

$$\begin{aligned}
p_{0n}^j - p_{0n}^a &= -\pi_{0n,1r} p_{0n}^a + \pi_{0r,0n} p_{0p}^a \\
p_{1n}^j - p_{1n}^a &= -\pi_{1n,1r} p_{1n}^a + \pi_{0r,1n} p_{0p}^a \\
p_{2'n}^j - p_{2'n}^a &= -\pi_{2'n,1r} p_{2'n}^a + \pi_{0r,2'n} p_{0p}^a \\
p_{2''n}^j - p_{2''n}^a &= -\pi_{2''n,1r} p_{2''n}^a + \pi_{0r,2''n} p_{0p}^a \\
p_{0p}^j - p_{0p}^a &= -(\pi_{0r,0n} + \pi_{0r,2'n} + \pi_{0r,2''n} + \pi_{0r,1r} + \pi_{0r,1n} + \pi_{0r,2'u} + \pi_{0r,2''u}) p_{0p}^a \\
p_{2'p}^j - p_{2'p}^a &= \pi_{0r,2'u} p_{0p}^a - \pi_{2'u,1r} p_{2'p}^a \\
p_{2''p}^j - p_{2''p}^a &= \pi_{0r,2''u} p_{0p}^a - \pi_{2''u,1r} p_{2''p}^a
\end{aligned} \tag{153}$$

Proof. By an application of the law of total probability given Definition 33. \square

Corollary 8. *The analytical lower bounds of the response probabilities $\pi_{2'n,1r}$ and $\pi_{2''n,1r}$ are*

$$\begin{aligned}
\pi_{2'n,1r} &\geq \max \left\{ 0, \frac{p_{2'n}^a - p_{2'n}^j}{p_{2'n}^a} \right\}, \\
\pi_{2''n,1r} &\geq \max \left\{ 0, \frac{p_{2''n}^a - p_{2''n}^j}{p_{2''n}^a} \right\}.
\end{aligned}$$

Proof. Omitted. See Section 6 in this Appendix.

□

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

	<i>kidcount</i>				Total
	0	1	2	3	
<i>Inferred AU Size</i>					
1	0.20	0.08	0.04	0.02	0.06
2	0.62	0.84	0.19	0.06	0.46
3	0.14	0.07	0.71	0.17	0.27
4	0.04	0.01	0.06	0.54	0.15
5	0.00	0.00	0.00	0.14	0.04
6	0.01	0.00	0.00	0.05	0.01
7	0.00	0.00	0.00	0.02	0.00
8	0.00	0.00	0.00	0.01	0.00
<i># of monthly observations</i>	3,843	18,228	11,466	10,479	44,016

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 Assistance Unit size is inferred from (rounded) monthly grant amounts. Starting with size 5, the unique correspondence between Assistance Unit 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 (29)	1,086 (30)	105 (36)	930 (32)	751 (30)	179 (42)	1766 (65)	1831 (65)	-65 (84)
Fraction of quarters with positive earnings	0.520 (0.008)	0.440 (0.007)	0.080 (0.010)	0.445 (0.009)	0.349 (0.009)	0.096 (0.012)	0.686 (0.013)	0.647 (0.013)	0.039 (0.017)
Fraction of quarters with earnings below 3FPL (AU size implied by kidcount+1)	0.906 (0.004)	0.897 (0.005)	0.009 (0.006)	0.938 (0.004)	0.940 (0.004)	-0.002 (0.006)	0.837 (0.011)	0.803 (0.011)	0.034 (0.014)
Fraction of quarters on welfare	0.748 (0.007)	0.674 (0.007)	0.074 (0.010)	0.771 (0.008)	0.718 (0.008)	0.053 (0.011)	0.699 (0.014)	0.577 (0.015)	0.122 (0.019)
Average earnings in quarters with any month on welfare	929 (24)	526 (19)	403 (28)	762 (25)	404 (18)	359 (30)	1316 (53)	869 (43)	448 (64)
Fraction of quarters with no earnings and at least one month on welfare	0.363 (0.007)	0.437 (0.007)	-0.074 (0.010)	0.426 (0.009)	0.508 (0.009)	-0.082 (0.012)	0.227 (0.011)	0.272 (0.012)	-0.045 (0.016)
<i># of cases</i>	2,318	2,324		1,630	1,574		688	750	

Notes: Sample covers quarters 1-7 post-random assignment. Sample cases 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: Allowed and Disallowed Responses when Truthful Reporting of Earnings above FPL is Possible under AFDC

State under Jobs First								
State under AFDC	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	Extensive LS (+) Exit Welfare	No Response	Extensive LS (+)	—	Extensive LS (+) Under-reporting	—
1r	—	—	—	—	Intensive LS (+/0/-)	—	—	—
1u	—	—	—	—	Intensive LS (+/0/-) Truthful Reporting	—	—	—
2u	—	—	—	—	Intensive LS (-) Truthful Reporting	—	No Response	—
2r	Extensive LS (-) Exit Welfare (Figure A1)	Intensive 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, that is, when assumption A.8 is not maintained. 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 termed “no response” entail the same behavior under the two policy regimes. 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) state 1u is unpopulated under JF (“—” in cells with a horizontally striped background fill), (b) state 2r is not defined under JF (“—” in cells with gridded background fill), and (c) 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). 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). See Online Appendix for proof.

Table A4: 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	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	Extensive LS (+) Exit Welfare Take Up FS Under-report	Extensive LS (+) Exit Welfare Take Up FS Under-report	No LS Response Exit Welfare, Take Up FS	Extensive LS (+)	—	Extensive LS (+) Under-report	No LS Response Take Up FS	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	Extensive LS (+) Exit Welfare and FS	No LS Response Exit Welfare	Extensive LS (+) Exit Welfare	Extensive LS (+) Exit Welfare	Extensive LS (+) Exit Welfare Under-report FS	Extensive LS (+) Exit Welfare Under-report	No LS Response Exit FS	Extensive LS (+) Exit FS	—	Extensive LS (+) Exit FS Under-report	No Response	Extensive LS (+)	—	Extensive LS (+) Under-report
1rr	—	—	—	—	—	—	—	—	—	Intensive LS (+/0/-) Exit FS	—	—	—	Intensive LS (+/0/-)	—	—
1uu	—	—	—	—	—	—	—	—	—	Intensive LS (+/0/-) Exit FS Truthful report	—	—	—	Intensive LS (+/0/-) Truthful Report	—	—
2uu	—	—	—	—	—	—	—	—	—	Intensive LS (-) Exit FS Truthful report	—	—	—	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 lower bounds on the stigma disutilities rules out states {2rn, 2rr} hence these states are not included in the table. The cells termed “no response” entail the same behavior under the two policy regimes. 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) states 1uu and 1un are unpopulated under JF (“—” in cells with a horizontally striped background fill); and (b) 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). 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). See Online Appendix for proof.

**Table A5: 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 participation 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 Assistance Unit size is one greater than amount implied by baseline kidcount variable. Probabilities are adjusted via propensity score reweighting algorithm.

**Table A6: Probability of Earnings / Participation States
(Alternate Coding of Assistance Unit Size)**

	Exact Size						Two Sizes Up					
	Overall			Overall - Adjusted			Overall			Overall - Adjusted		
	Jobs First	AFDC	Difference	Jobs First	AFDC	Difference	Jobs First	AFDC	Difference	Jobs First	AFDC	Difference
Pr(State=0n)	0.127	0.136	-0.009	0.128	0.135	-0.007	0.127	0.136	-0.009	0.128	0.135	-0.007
				(0.005)	(0.006)	(0.008)				(0.005)	(0.006)	(0.008)
Pr(State=1n)	0.059	0.101	-0.042	0.061	0.098	-0.038	0.095	0.160	-0.065	0.098	0.155	-0.057
				(0.003)	(0.004)	(0.005)				(0.004)	(0.006)	(0.007)
Pr(State=2n)	0.084	0.129	-0.044	0.087	0.124	-0.038	0.048	0.069	-0.021	0.049	0.068	-0.019
				(0.005)	(0.006)	(0.006)				(0.004)	(0.004)	(0.005)
Pr(State=0p)	0.366	0.440	-0.074	0.359	0.449	-0.090	0.366	0.440	-0.074	0.359	0.449	-0.090
				(0.008)	(0.008)	(0.010)				(0.008)	(0.008)	(0.010)
Pr(State=1p)	0.325	0.179	0.146	0.326	0.178	0.147	0.351	0.188	0.163	0.353	0.187	0.166
				(0.007)	(0.005)	(0.008)				(0.007)	(0.005)	(0.009)
Pr(State=2p)	0.039	0.015	0.024	0.040	0.015	0.026	0.013	0.006	0.007	0.013	0.006	0.007
				(0.003)	(0.002)	(0.003)				(0.002)	(0.001)	(0.002)
<i># of quarterly observations</i>	16,226	16,268		16,226	16,268		16,226	16,268		16,226	16,268	

Notes: "Exact Size" codes the Assistance Unit size as 1+kidcount (except when kidcount=0 in which case it is coded as 2). "Two Sizes Up" codes the Assistance Unit size as 2 + value under Exact Size. Sample covers quarters 1-7 post-random assignment during which individual is either always on or always off welfare. Sample cases 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 computed via propensity score reweighting. Standard errors computed using 1,000 block bootstrap replications (resampling at case level).

**Table A7: Point and Set-identified Response Probabilities
(Alternate Codings of Assistant Unit Size)**

Response Type	State Occupied under			Exact Size				Two Sizes up			
				(a) General Specification of Preferences				(a) General Specification of Preferences			
				Estimate	Standard Error	95% CI (naive)	95% CI (conservative)	Estimate	Standard Error	95% CI (naive)	95% CI (conservative)
Detailed	AFDC	JF	Symbol								
	On	1r	$\pi_{0n,1r}$	{0.055, 0.533}		[0.000, 0.651]	[0.000, 0.689]	{0.055, 0.669}		[0.000, 0.789]	[0.000, 0.824]
	1n	1r	$\pi_{1n,1r}$	{0.383, 1.000}		[0.311, 1.000]	[0.311, 1.000]	{0.365, 0.901}		[0.305, 1.000]	[0.305, 1.110]
	2n	1r	$\pi_{2n,1r}$	{0.303, 0.822}		[0.232, 1.000]	[0.232, 1.000]	{0.276, 1.000}		[0.176, 1.000]	[0.176, 1.000]
	0r	0n	$\pi_{0r,0n}$	{0.000, 0.144}		[0.000, 0.179]	[0.000, 0.191]	{0.000, 0.185}		[0.000, 0.219]	[0.000, 0.230]
	"	1n	$\pi_{0r,1n}$	{0.000, 0.135}		[0.000, 0.179]	[0.000, 0.191]	{0.000, 0.185}		[0.000, 0.219]	[0.000, 0.229]
	"	2n	$\pi_{0r,2n}$	{0.000, 0.144}		[0.000, 0.212]	[0.000, 0.264]	{0.000, 0.109}		[0.000, 0.123]	[0.000, 0.178]
	"	1r	$\pi_{0r,1r}$	{0.000, 0.144}		[0.000, 0.179]	[0.000, 0.194]	{0.000, 0.185}		[0.000, 0.219]	[0.000, 0.234]
"	2u	$\pi_{0r,2u}$	{0.057, 0.090}		[0.046, 0.099]	[0.046, 0.138]	{0.016, 0.029}		[0.009, 0.035]	[0.009, 0.077]	
	2u	1r	$\pi_{2u,1r}$	{0.000, 1.000}		[0.000, 1.000]	[0.000, 1.000]	{0.000, 1.000}		[0.000, 1.000]	[0.000, 1.000]
Composite	Not working	Working	$\pi_{0,1+}$	0.167	0.016	[0.136, 0.198]	[0.136, 0.198]	0.167	0.016	[0.136, 0.198]	[0.136, 0.198]
	Off welfare	On welfare	$\pi_{n,p}$	{0.231,0.412}		[0.189,0.450]	[0.189,0.453]	{0.231,0.463}		[0.189,0.503]	[0.189,0.503]
	On welfare	Off welfare	$\pi_{p,n}$	{0.000,0.101}		[0.000,0.126]	[0.000,0.130]	{0.000,0.129}		[0.000,0.154]	[0.000,0.158]
	On welfare, not working	Off welfare	$\pi_{0r,n}$	{0.000,0.144}		[0.000,0.179]	[0.000,0.186]	{0.000,0.185}		[0.000,0.219]	[0.000,0.226]
Detailed				(b) Restricted Specification of Preferences				(b) Restricted Specification of Preferences			
	0r	1n	$\pi_{0r,1n}$	0				0			
	1n	1r	$\pi_{1n,1r}$	0.383	0.044	[0.297, 0.469]	[0.297, 0.469]	0.365	0.036	[0.294, 0.437]	[0.294, 0.437]

Notes: "Exact Size" codes the Assistance Unit size as 1+kidcount (except when kidcount=0 in which case it is coded as 2). "Two Sizes Up" codes the Assistance Unit size as 2 + value under Exact Size. Number of state refers to earnings level, with 0 indicating no earnings, 1 indicating earnings below 3 times the monthly FPL, 2 indicating earnings above 3FPL, and 1+ indicating positive earnings. The letter "n" indicates welfare nonparticipation, the letter "r" indicates welfare participation with truthful reporting of earnings, the letter "u" indicates welfare participation with under-reporting of earnings, the letter "p" indicates welfare participation (irrespective of reporting). Composite response probabilities are linear combination of the detailed response probabilities (see Section 6 for the exact expressions). Estimates inferred from probabilities in Table 5, see text for formulas. 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 Online Appendix for details. Panel a refers to the general specification of preferences (expression (3) in the paper). Panel b refers to the restricted specification (expression (4) in the paper). Panel b omits all response probabilities whose estimates are the same as in Panel a.

**Table A8: Probability of Earnings / Participation States
(Finer Earning Ranges)**

	Overall			Overall - Adjusted		
	Jobs First	AFDC	Difference	Jobs First	AFDC	Difference
Pr(State=0n)	0.127	0.136	-0.009	0.128 (0.005)	0.135 (0.005)	-0.007 (0.008)
Pr(State=1n)	0.076	0.130	-0.055	0.078 (0.004)	0.126 (0.005)	-0.048 (0.006)
Pr(State=2'n)	0.021	0.032	-0.011	0.022 (0.002)	0.031 (0.002)	-0.010 (0.003)
Pr(State=2''n)	0.047	0.067	-0.020	0.048 (0.003)	0.065 (0.004)	-0.017 (0.005)
Pr(State=0p)	0.366	0.440	-0.074	0.359 (0.008)	0.449 (0.008)	-0.090 (0.010)
Pr(State=1p)	0.342	0.185	0.157	0.343 (0.007)	0.184 (0.005)	0.159 (0.009)
Pr(State=2'p)	0.010	0.003	0.006	0.010 (0.001)	0.003 (0.001)	0.007 (0.001)
Pr(State=2''p)	0.012	0.006	0.006	0.013 (0.002)	0.006 (0.001)	0.007 (0.002)
<i># of quarterly observations</i>	16,226	16,268		16,226	16,268	

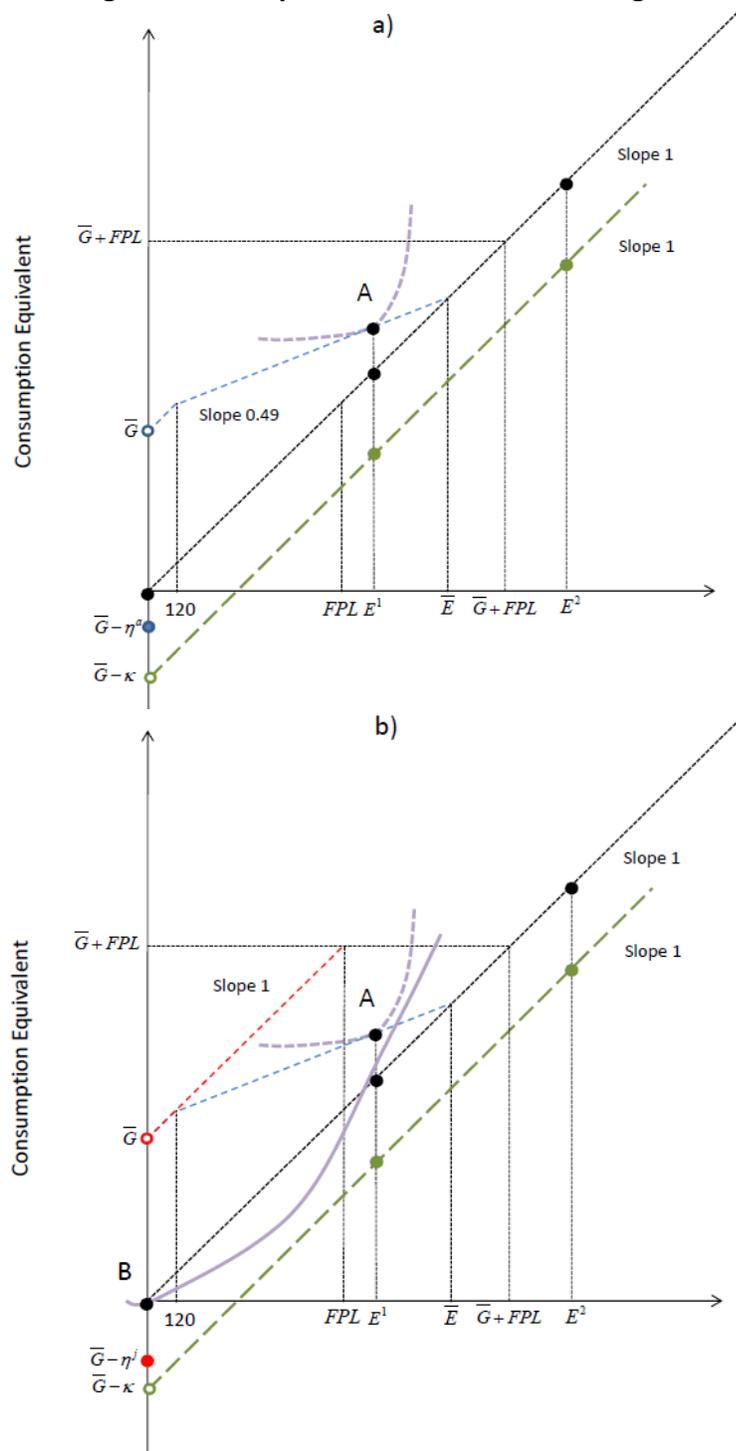
Notes: Sample covers quarters 1-7 post-random assignment during which individual is either always on or always off welfare. Sample cases with kidcount missing are excluded. Number of state refers to earnings level, with 0 indicating no earnings, 1 indicating earnings below 3 times the monthly FPL, 2' indicating earnings between 3FPL and 1.2 x 3FPL, and 2'' indicating earnings above 1.2 x FPL. 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 propensity score reweighting. Standard errors computed using 1,000 block bootstrap replications (resampling at case level).

Table A9: Fraction of Months on Welfare by Experimental Status and Age of Youngest Child (Alternate Age Categories Comparison).

Age of Youngest Child at Baseline:	16 or 17	14 or 15
AFDC	0.279 (0.207)	0.463 (0.196)
JF	0.395 (0.116)	0.508 (0.199)
Difference	0.116 (0.116)	0.045 (0.051)
Difference in Differences	0.071 (0.077)	

Notes: Sample consists of 7,098 case-months: 21 months of data on each of 338 cases with age of youngest child between the ages of 14 and 17. Table gives regression-adjusted fraction of case-months that women participated in welfare by experimental status and age of youngest child at baseline. Robust standard errors computed using clustering at case level.

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 consumption equivalent (vertical axis) plane. The consumption equivalent 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. Labor market constraints are imposed in the form of two earnings offers (E_i^1 and E_i^2), both in range 2 (above the FPL). The wage rate is assumed fixed. Because of the labor market constraints, and the fact that a woman may always choose not to work, the only alternatives available are those identified by a solid circular symbol. Vertical lines represent the same earnings levels depicted in Figure 1 but for a situation in which the earnings level at which welfare assistance is exhausted under AFDC (\bar{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 earning E_i^1 and reports truthfully to the welfare agency (point A). She would make the same choice even in the absence of earnings constraints. Under JF, earning E_i^1 on assistance (and reporting truthfully) 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 through point A lies below the (dashed) JF segment in range 1 (earning levels below FPL).