# Optimal Transfers with Children's Utility

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Draft: July 2023

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*Abstract* This paper estimates the optimal tax and transfer system when the social planner's objective is to maximize utility of all individuals, including children, and can use household composition as a fixed tag. While existing research has estimated optimal transfer schedules, it has typically done so only in the context of adults, or without considering children's utility as part of the planner's objective function. Given the large extent to which U.S. transfer policy prioritizes redistribution to children, children's consumption needs are of first order importance to optimal transfer policy analysis. We simulate the optimal tax and transfer system for unmarried households accounting for children's consumption, adults' consumption, and adults' labor supply responses on the intensive and extensive margin. We place particular emphasis on estimating the optimal transfers to non-earning households of different compositions, and compare these estimates to expected benefits for non-earners in the United States. We find that current transfers to non-earners are well below optimal for all unmarried households, especially those with children.

# 1 Introduction

In US transfer policy, the tension between preferences for redistribution and concerns about discouraging employment is particularly salient among families with children. Current policy places a large emphasis on redistribution to children - many transfer programs are only available to families with children (TANF, WIC, CTC) or are more generous to children (Medicaid, EITC). However, transfers to the neediest children are moderated by concerns about discouraging the labor force participation of their parents. These concerns have led to many programs targeted to children and families being contingent on employment or earnings, leaving children with non-working parents with limited transfers (Aizer, Hoynes, and Lleras-Muney 2022). TANF usually requires work to receive benefits, and the EITC and CTC are unavailable to families without earnings.[1]

This paper uses an optimal tax framework that explicitly weights children's consumption against distortions in parents' labor force participation to analyze the tradeoff between these two forces in the context of unmarried adults. We include both extensive margin and intensive margin labor supply responses in the model, which allows us to focus on optimal transfers to non-working families. We calibrate the consumption needs of families with children relative to single adults using equivalence scales, which are widely used in policy to compare well-being across different family types. Under our preferred specification using conservative assumptions, we find that the optimal size of transfer to non-earners is roughly \$12,000 for single adults and roughly \$25,000 for single parents with two children. This is more than twice as generous as the transfers non-earners can expect to receive under current policy. This suggests that policymakers are overweighting concerns about reducing parents' labor force participation or underweighting the needs of households without earnings.

To the best of our knowledge, this paper is the first to include the utility of children as part of the planner's function in a way that allows estimation of the optimal transfer to non-earners, an important policy parameter. Prior work has considered children by consid-

[1]For a detailed analysis of shifts in the demographic distribution of benefits over time, see Moffitt 2015.

ering the impact of parents' resources on their future ability (Gelber and Weinzierl 2016; Ahmadi-Renani 2021), including them as consumption goods in parent's utility (Kurnaz 2021), and/or considering costs of raising children that reduce parents' consumption (Blundell and Shephard 2012). All of these approaches add children to the planner's problem in ways that do not directly consider their utility from consumption, leading us to believe all of these approaches potentially underestimate the optimal redistribution to families. Including children's utility from consumption in the social planner's objective function allows us to derive the optimal transfer system under the assumption that redistribution to children is primarily motivated by wanting to provide resources to individuals who cannot provide for themselves.

While some of the existing work comes relatively close to considering children's utility as part of the planner's function (see Cremer, Dellis, and Pestieau 2003, which includes altruistic parents), this paper makes two further contributions. First, we include extensive margin labor supply responses, which allows us to estimate the optimal demogrant. Because labor market exit is the primary concern countering a large demogrant, adding the extensive margin to the model is crucial to generate sensible demogrant estimates. We do this by generalizing Saez's (2002) model for optimal taxes and transfers with the intensive and extensive margin to allow for multiple types of families. Second, we derive a utility function for the family that is consistent with the equivalence scales commonly used in policy analysis. By deriving family utility to be consistent with equivalence scales, the results of our model will represent optimal transfers under a set of transparent assumptions about tradeoffs between families which are consistent with what the government already uses in studying poverty. While other work has used equivalence scales to modify adult consumption to reflect the presence of children (for example: Ahmadi-Renani 2021; Blundell, Dias, and Shaw 2016; Blundell, Costas-Dias, et al. 2021), we are unaware of prior work that extrapolates children's consumption, utility, and marginal utility from equivalence scales.

# 2 Model

## 2.1 Model Framework

We develop an optimal tax model that distinguishes between households of different sizes and allows adults to adjust their labor supply along both the extensive and intensive margins in response to the tax schedule. Family size is treated as a fixed tag, such that the government can observe the number of children in the household and set different tax/transfer schedules for families of different sizes.[2] We model households as being run by a single, altruistic decision maker – for this reason, we focus on unmarried adults. Adults vary in skill (represented by wages), fixed costs of work, and the number of children in their household. Following the Saez 2002 framework, adults choose from a discrete set of possible earnings levels, each of which is associated with a net tax or transfer amount set by the social planner.

## 2.2 Household Problem

The relevant unit in this paper is the family, consisting of individual members who are either adults ($A$), or children ($K$). The utility of the family is the sum of the utilities of consumption of each of its members, minus a disutility of earning income:

$$u_F(I) = u_A(c_A) + K u_K(c_K) - v_{w,x}(z) \tag{1}$$

$u_A$ is the adult's utility as a function of their consumption $c_A$ and $u_K$ is each child's utility as a function of their consumption $c_K$. $K$ is the total number of children in the household. The utility cost for the family to earn income $z$ is represented by $v_{w,x}(z)$ and will vary with the adult's skill level, represented by their wage, $w$, and a fixed cost of work, $x$. We assume the disutility of earning income is additively separable from utility of consumption.

[2]In general, there is limited empirical evidence that low-income women adjust their childbearing in response to transfer programs, even those explicitly aimed at reducing births (Horvath-Rose, Peters, and Sabia 2008; Kearney 2004; Joyce et al. 2004). Furthermore, qualitative research suggests that childbearing among low-income women is primarily driven by non-economic factors (Edin and Kefalas 2005)

We derive a household utility function that is consistent with the functional form of equivalence scales used by policymakers. For single adult families, these equivalence scales generally take the form:

$$s(K) = \begin{cases} 1 & K = 0 \\ (1 + pK)^F & K \geq 1 \end{cases} \tag{2}$$

Where $p$ represents the resource needs of a child relative to an adult and $F$ represents the economies of scale in consumption for a family.

We apply the interpretation of equivalence scales used by Betson (1990) and formalized as an "indifference scale" by Browning et al (2013). An adult in a household with $K$ kids with income $y$ would need income $\frac{y}{s(K)}$ to achieve the same standard of living as a single adult living alone. For example, the Census Bureau's equivalence scale for a family with one adult and two children is $s(K = 2) = 1.79$. This means that an adult with two children with an income of \$30,000 has the same standard of living as a single childless adult with an income of $\frac{\$30{,}000}{1.79} = \$16,760$.[3]

To derive a form for $u_F$ that is consistent with an equivalence scale of this form, we need to make some assumptions about the utility of children. We make two assumptions:

**Assumption 1** *The family's allocation of consumption between members satisfies the first order condition* $u'_A(c^*_A) = u'_K(c^*_K)$.

**Assumption 2** $c^*_K = pc^*_A$ *when the family is optimally allocating consumption.*

Assumption 1 is relatively innocuous; it assumes the adult in a household is an altruistic parent who maximizes the total utility of all members of the household. Given that we do not include married couples in our analysis, it is reasonable to treat the parent as a single

[3] Equivalence scales don't adjust for whether income comes from labor (which carries a disutility of earning income) or from non-labor income. Therefore, we interpret "standard of living" as the adult's utility from consumption, not including any disutility of earning income.

altruistic decision maker for the whole household, rather than allowing for bargaining to occur between members of the household.

Assumption 2 says that it is optimal to allocate each child a fixed proportion of adult consumption, regardless of family income. We make this assumption because equivalence scales are a function of household composition but not income, which implies that resource needs of children relative to adults do not vary with income. Evidence from Betson 1990 using the Consumer Expenditure Survey shows that the share of spending on kids is relatively constant across family incomes, at least for families with $75,000 or less, suggesting that A2 is a reasonable assumption.

Assumption 2 constrains the functional form of the child's utility function and simplifies the household problem into a two-step decision, where the parent first chooses how to allocate consumption between members of the household, then chooses how much income to earn. Applying A1 and A2 and integrating allows us to rewrite the child's utility of consumption $u_K$ as a scaled version of the adult's utility of consumption $u_A$ (scaled up or down by an additive constant):

$$u_K(c_K) = p u_A\left(\frac{c_K}{p}\right) \tag{3}$$

Equivalence scales allow families to have economies of scale in consumption, so the family's combined individual consumption $c_A + Kc_K$ may be greater than their after-tax income $I$. We assume the family takes its economies of scale as exogenous. We also assume economies of scale vary with family size but not income, again because equivalence scales do not vary with income. To determine the relationship between the family's income and their combined consumption, we need to return to the definition of the equivalence scale. Under the definition of the equivalence scale, an adult in a family with $K$ kids and after-tax income $I$ has the same utility from consumption as a single childless adult with income $\frac{I}{s(K)}$, implying the adult's consumption $c_A = \frac{I}{s(K)}$. Therefore, in a family with after-tax income income $I$ the adult will consume $c_A = \frac{I}{s(K)}$ and each child will consume $c_K = pc_A = \frac{pI}{s(K)}$, for total family consumption of $(1 + pK)\frac{I}{s(K)}$.

Inserting the functional form of children's utility from equation 3 and these values for consumption as a function of income into the household utility function (equation 1), we can write out the household's problem for its choice of earnings $z$.

$$\max_z \; (1 + pK)u_A\left(\frac{I}{s(K)}\right) - v_{w,x}(z) \tag{4}$$

$$\text{subject to } I = z - T$$

Solving the household problem implies that the marginal utility of after-tax income $I$ for a family is

$$MUI_F = \frac{1 + pK}{s(K)}u'_A\left(\frac{I}{s(K)}\right) \tag{5}$$

Note that since costs of work are additively separable from utility from consumption, the household's marginal utility is a function of its size and after-tax income, but not wages or fixed costs of work.

## 2.3 Social Planner Problem

The social planner's problem extends the discrete optimal tax model in Saez 2002 with intensive and extensive labor supply responses to allow for two types of families. The social planner chooses a tax schedule to maximize a utilitarian social welfare function given a fixed revenue constraint. The tax schedule $T$ is a set of net tax levels $T_{z,k}$ for each discrete earnings level $z$ and family composition $k$.

$$\max_T \sum_k \int_w \int_x U_{w,x}(z(T), T_{z,k}, k) f_{k,w,x} dx dw \tag{6}$$

$$\sum_k \sum_z h_{z,k}(T)T_{z,k} = H \tag{7}$$

Households vary by number of children $k$, wages $w$, and fixed costs of work $x$. The distribution of underlying types is represented by $f$. Each household's utility is a function of their earnings $z$, number of children $k$, tax amount $T_{z,k}$, and costs of earning income (which depend on wages $w$ and fixed costs of work $x$). Based on the tax schedule $T$, households choose a discrete earnings level $z$. This generates a realized earnings distribution $h$, which is a function of the tax schedule. Under this realized earnings distribution, the government must raise an average revenue of $H$ per household.

The social planner's first order condition with respect to the tax amount at an individual earnings level $Z$ and $K$ children is

$$\frac{d\mathcal{L}}{dT_{Z,K}} : 0 = \frac{dU_{Z,K}}{dT_{Z,K}} h_{Z,K} + \lambda \left[ \sum_{z} \frac{dh_{z,K}}{dT_{Z,K}} T_{z,K} + h_{Z,K} \right] \tag{8}$$

Alternatively, the first order condition can be written as

$$g_{Z,K} = 1 - \frac{1}{h_{Z,K}} \sum_{z} \frac{dh_{z,K}}{d(Z - T_{Z,K})} T_{z,K}, \text{ where } g_{Z,K} = \frac{MU_{Z,K}}{\lambda} \tag{9}$$

The left hand size of equation 9 represents the utility loss (gain) from decreasing (increasing) the after-tax incomes of households with $K$ kids earning income $Z$, scaled to a dollar value by the marginal value of public funds $\lambda$. The right hand size of the equation represents the revenue gain (loss) from increasing (decreasing) $T_{Z,K}$, which is a combination of the mechanical effect of tax changes and the fiscal externality from labor supply responses. At the optimal tax schedule, the utility loss (gain) from a tax increase (decrease) on any group should be exactly offset by the revenue gain (loss).

The fiscal externality generated by labor supply responses to changes in the tax schedule appears in the $\frac{dh}{dT}T$ terms and reflects how revenue changes as the realized income distribution $h$ changes. To make the fiscal externality term concrete, we assume a family in earning group $z$ under the current tax system has limited options in their choice of work. They can move into an adjacent earning group $z + 1$ or $z - 1$ (intensive margin response) or can leave the labor force (extensive margin response). Under this assumption, for a given number of kids $K$, the fraction of the population in earning group $z$ is not a function of the entire tax schedule – it is only a function of $T_{z,K}$, $T_{z-1,K}$, $T_{z+1,K}$ and $T_{0,K}$.

This allows us to define mobility elasticities, which represent how the earnings distribution changes with respect to a change in the tax schedule:

$$\eta_{z,k} = \frac{dh_{z,k}}{d(I_{z,k} - I_{0,k})} \frac{I_{z,k} - I_{0,k}}{h_{z,k}} \tag{10}$$

$$\zeta_{z,k} = \frac{dh_{z,k}}{d(I_{z,k} - I_{z-1,k})} \frac{I_{z,k} - I_{z-1,k}}{h_{z,k}} \tag{11}$$

Empirically, these terms are derived from intensive and extensive margin labor supply elasticities.[4] The intensive margin mobility elasticity determines what share of earnings group $z$ will move down to income group $z-1$ when $T_z$ is increased. The extensive margin mobility elasticity determines what share of earnings group $z$ will leave the labor force and move to zero earnings when $T_z$ is increased.

Applying these assumptions to the first order conditions and rearranging, we get that at the optimal tax schedule,

$$\frac{T_{Z,K} - T_{Z-1,K}}{I_{Z,K} - I_{Z-1,K}} = \frac{1}{\zeta_{Z,K} h_{Z,K}} \sum_z h_{z,K} \left[ \left(1 - \frac{MUI_{z,K}}{MVPF}\right) - \eta_{z,K} \frac{T_{z,K} - T_{0,K}}{I_{z,K} - I_{0,K}} \right] \text{ for } Z > 0 \tag{12}$$

For all combinations of $Z$, $K$, $Z \neq 0$, and

$$(1 - g_{0,K}) h_{0,K} = -\sum_z \eta_{z,K} h_{z,K} \frac{T_{z,K} - T_{0,K}}{I_{z,K} - I_{0,K}} \text{ for } Z = 0 \tag{13}$$

These first order conditions are identical to those in Saez 2002, except everything is now indexed by the number of kids $K$. The earnings distribution, labor supply elasticities, and

[4]The intensive margin elasticity $\zeta$ in our model is slightly different from the classic earnings elasticity $\epsilon$. In the model, we translate between the two such that $\zeta_z(I_z - I_{z-1}) = \epsilon_z I_z$, as in Saez 2002.

marginal utility of income are all allowed to vary by the number of children $K$. The main difference in the model used in this paper versus in Saez 2002 comes from the marginal utility of income term. In this model, the marginal utility of income will not only influence redistribution between families with different earnings levels, but also between different family types. As the marginal utility of income for a family with children increases relative to the marginal utility of income for a childless adult (driven by the equivalence scale $s(K)$ and number of children $K$), the planner will prefer larger transfers to families with children.

# 3 Simulation of the Optimal Tax System

## 3.1 Model Calibration

### 3.1.1 Equivalence Scale

For our baseline model we use a simplified version of the equivalence scales used by the Census Bureau, which originates in Betson 1996. Betson estimates p and F using data on how much households spend on adults and children across household sizes and income levels. Our baseline model adopts a simplified version of the parameters used by Census: $p = 0.5$, and $F = 0.7$ (Short 2011). The actual equivalence scale used by Census and derived in Betson 1996 assumes the first child in a single parent family has 0.8 times the consumption of an adult, while all other children have 0.5 times the consumption of an adult.[5] We simplify the scale so that each additional child has identical resource needs. Using our simplified scale yields $s(2) = 1.62$ compared to the full version, which yields $s(2) = 1.79$. The simplification thus reduces the incentive to transfer to families relative to the full Census version.

[5]This appears to be an attempt to reflect differences in economies of scale between single and married families, rather than an indication that there are actual differences in consumption needs between the first child and subsequent children.

### 3.1.2 Marginal Utility of After-Tax Income

The marginal utility of after-tax income for families depends on the functional form of the adult's utility function. We simulate the model using a CRRA utility function for adults. The household's marginal utility thus takes the form

$$MUI_F = \frac{1 + pK}{s(K)} \left( \frac{I}{s(K)} \right)^{-\theta} \tag{14}$$

Our baseline specification uses a log utility function ($\theta = 1$). Note that in this specification, the equivalence scale term s(K) drops out of the expression for marginal utility, so marginal utility depends on the resource needs of children relative to adults (p) but not the economy of scale parameter (F). Intuitively, economies of scale affect the family's marginal utility in two offsetting ways - they allow the family to consume more at a given income (which decreases their marginal utility of income) and they increase the consumption generated by giving the family an extra dollar of income (which increases their marginal utility of income). Under log utility, these exactly offset each other, and the family's marginal utility of income does not depend on F.

### 3.1.3 Labor supply responses

We choose labor supply elasticity estimates near the upper bound of the empirical literature. This assumption should lead to conservative estimates of the optimal demogrant by allowing transfers to have relatively high labor supply disincentives. We calibrate the extensive margin labor supply elasticity for single parents based on the literature regarding single mother responses to expansion of the Earned Income Tax Credit (Hoynes and Patel 2018; Bastian and Jones 2021; Eissa and Liebman 1996; Meyer and Rosenbaum 2001; Chetty, Friedman, and Saez 2013). The largest of these estimates is an extensive margin elasticity of roughly 0.5, which is what we use in our baseline model.[6] We calibrate the extensive margin elasticity of

[6] Hoynes and Patel 2018 study how single mothers responded to the EITC expansions in the 1990s and estimate an extensive margin elasticity of 0.53 in their preferred specification. Bastian and Jones 2021 use

childless adults to be 0.3 based on the results of the Paycheck Protection RCT, which offered childless adults an earnings bonus equivalent to an EITC expansion (Miller et al. 2018). We assume that only those earning $30,000 or less respond along the extensive margin.[7]

We calibrate the intensive margin elasticity to 0.33 using the unified estimate from Chetty 2012. Many studies of individual tax reforms, including those focused on the EITC, estimate intensive margin responses well below this level. It is possible that responses to smaller reforms are dampened by optimization frictions and that larger reforms would elicit larger responses, especially over the long term. We prefer Chetty's estimate for our baseline specification because it scales up intensive margin responses to account for optimization frictions.

### 3.1.4 Initial conditions

Initializing the model requires three objects: the current income distribution, the tax schedule that generated the current income distribution, and the target average revenue per single adult household.

We calibrate the current income distribution based on individual earnings (wage and salary, self-employment, and farm income) of unmarried adults in the pooled 2018-2020 March Current Population Surveys. We exclude students and those over age 60. We divide households into 14 income groups and two size groups – those without children and those with children.[8] Single parent families have an average of 1.8 children each. We round this up and calibrate the marginal utilities of single parent families based on a having two children.

We represent the current tax and transfer system using a simple linear approximation with a $8,400 lump sum transfer and a 35% marginal tax rate.[9] The simulation results

variation from a broad range of EITC expansions over time and estimate an extensive margin elasticity of 0.33. Chetty, Friedman, and Saez 2013 calculate extensive margin elasticities implied by earlier studies. They find that the Eissa and Liebman 1996 study of the EITC expansion in 1986 implies and extensive margin elasticity of 0.30, and the Meyer and Rosenbaum 2001 study of EITC expansions and welfare cuts in the 1990s implies an extensive margin elasticity of 0.43.

[7]Sensitivity to the highest earning group with a positive extensive margin response is show in Appendix Figure A2.

[8]Households are assigned the median earnings in each income group. Children are identified from the number of the adult's own children living in the same household as them.

[9]The marginal tax rate is calculated by a linear approximation of the current system, with the lump sum

Table 1: Initial income distribution

| Pre-tax earnings ($1,000) | Childless adults | Single parents |
|---|---|---|
| 0 | 0.153 | 0.049 |
| 3.6 | 0.049 | 0.014 |
| 11 | 0.047 | 0.016 |
| 16.3 | 0.042 | 0.017 |
| 21 | 0.052 | 0.019 |
| 25 | 0.038 | 0.014 |
| 30 | 0.046 | 0.015 |
| 35 | 0.045 | 0.017 |
| 40 | 0.048 | 0.016 |
| 47.3 | 0.058 | 0.018 |
| 55 | 0.034 | 0.011 |
| 64 | 0.047 | 0.014 |
| 80 | 0.048 | 0.014 |
| 125 | 0.047 | 0.014 |
| Share of sample | 0.754 | 0.246 |

*Notes*: Income distribution estimates are from pooling the 2018-2020 March CPS. The sample is unmarried adults, restricted to those age 18-60 and excluding students. Single parents are adults with own children in household. The earnings level is based on total reported wage, self-employment, and farm earnings of the adult. Bins were chosen so there are a roughly equal number of households in each bin. Estimates are weighted using the March supplemental weights. The final row denotes the total share of the sample in each family type.

are robust to using a more detailed approximation of the current tax system (see Appendix Figure A3).

Finally, we calibrate the target government revenue ($H$) under the assumption that the government wants to hold the total revenue it currently collects from single adult households constant. We calibrate $H$ to be $3,400, which is the roughly the average tax revenue in our CPS sample, net spending on transfer programs.

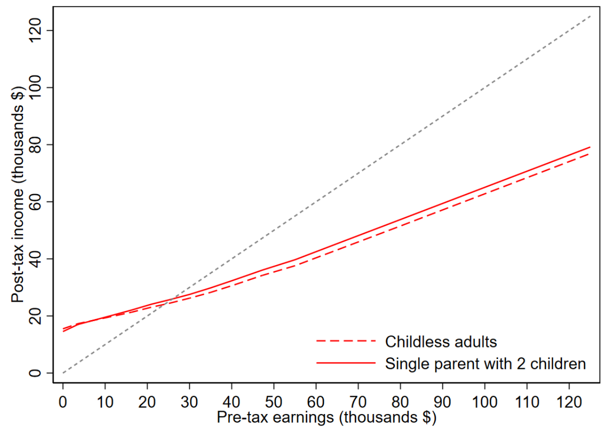
## 3.2 Baseline Results

We begin by presenting the optimal tax schedule excluding children's utility from the social planner's problem. To do so, we assume the planner only weights the utility of the adult in

transfer set so the revenue generated by the linear approximation roughly equals that observed in the data.

the household. Other characteristics, such as the initial income distributions and elasticities of labor supply, are still allowed to differ by household type.[10] The resulting optimal tax schedule is shown in Figure 1:

Figure 1: Optimal tax schedule, excluding childrens' utility

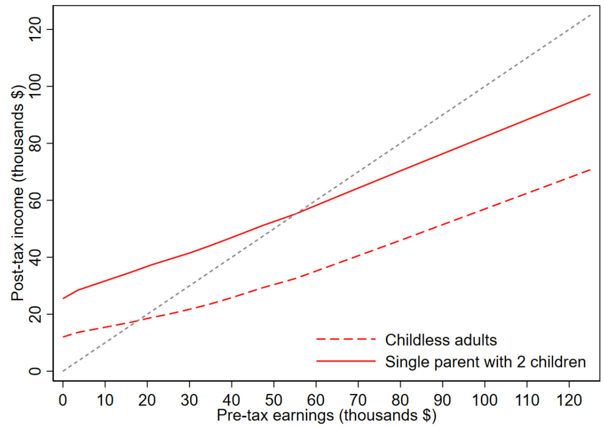



*Notes*: The y-axis denotes pre-tax earnings. The x-axis denotes post-tax income, calculated as the pre-tax earnings plus the optimal tax or transfer amount. The gray dashed line represents the 45 degree line, with observations falling above this line denoting pre-tax earnings levels with net transfers and observations below denoting earnings levels with net taxes. This model represents our baseline specification *excluding* children's utility. The parameters are $H = \$3,400$, $s(2) = 1$, $\theta = 1$, $\eta_{parent} = 0.5$, $\eta_{childless} = 0.3$, $\epsilon = 0.33$.

Without allowing for children's utility in the planner objective function, the optimal tax schedule for unmarried adults and single parents are very similar. The optimal demogrant is roughly \$15,000 for both family types (\$15,504 for childless adults and \$14,549 for single parents), with net transfers until pre-tax earnings reach roughly \$25,000. These results are similar to those in Saez 2002, which accounts for extensive margin labor supply responses but models all adults as unmarried and childless (albeit scaled up to reflect current earnings distributions). Since the marginal utilities of income are identical across family types when we exclude children's utility (and because $\theta = 1$), the difference in the optimal schedules here only reflects differences in the extensive margin labor supply elasticities between childless adults (0.3) and adults with children (0.5) and differences in the underlying initial income

[10] We allow single parents to have lower levels of consumption than childless adults with the same income, but their marginal utilities are equal under log utility.

Figure 2: Optimal tax schedule, baseline specification




*Notes*: The x-axis denotes pre-tax earnings. The y-axis denotes post-tax income, calculated as the pre-tax earnings plus the optimal tax or transfer amount. The gray dashed line represents the 45 degree line, with observations falling above this line denoting pre-tax earnings levels with net transfers and observations below denoting earnings levels with net taxes. This model represents our baseline specification. The parameters are $H = \$3,400$, $s(2) = 1.62$, $\theta = 1$, $\eta_{parent} = 0.5$, $\eta_{childless} = 0.3$, $\epsilon = 0.33$.

distributions.

Figure 2 shows the optimal tax schedule for childless adults and single parents with the planner maximizing the sum of family utility. Accounting for children's utility from consumption substantially changes the optimal tax system for single parents. Under this schedule, single parents (with an assumed 2 children) would receive a demogrant of \$25,482 and receive net transfers until pre-tax earnings reach roughly \$55,000. The demogrant for childless adults would decrease somewhat relative to the case with identical marginal utilities, down to \$12,011. The planner is able to fund this large increase in transfers to single parents without a large decrease in transfers to childless adults because of the large number of childless adults relative to single parents. Only one quarter of single adults in the sample have children.

Under the optimal system, the unemployment rate is 25.4% for childless adults and 20.6% for single parents, relative to a baseline of 20.3% for childless adults and 19.7% of single parents in our approximation of the current income distribution.

Figure 3: Marginal tax rates under optimal tax schedule


*Notes*: The x-axis denotes pre-tax earnings. The y-axis denotes the marginal tax rate on moving from one income level to the next under the optimal system. The marginal tax rates in this figure represent those under our baseline specification, with parameters $H = \$3,400$, $s(2) = 1.62$, $\theta = 1$, $\eta_{parent} = 0.5$, $\eta_{childless} = 0.3$, $\epsilon = 0.33$.

Figure 3 shows the marginal tax rates on moving from one income level to the next under the optimal system. The marginal tax rate on moving from zero earnings to the first earnings level is distinctly lower than the marginal tax rate on moving from the first earnings level to the second, to encourage labor force participation (Jacquet et al. 2013). Marginal tax rates do not fall below zero in this specification. Marginal rates for childless adults are consistently higher than those for single parents at the same income level, indicating there is some net redistribution from childless adults to single parents.

## 3.3 Sensitivity Analysis

We estimate the optimal tax system under a range of parameters to test how sensitive the optimal demogrant values are to the initial parameter choices. We focus here on how the optimal demogrant values move in response to different choices of redistributive preferences and equivalence scales. We also show that changing assumptions about extensive margin labor supply elasticities of single parents to alternate values based on the empirical literature has little impact. Robustness to other modeling decisions (approximation of the current tax system, childless adult extensive margin elasticity, and maximum earnings threshold for extensive margin responses) is shown in the appendix.

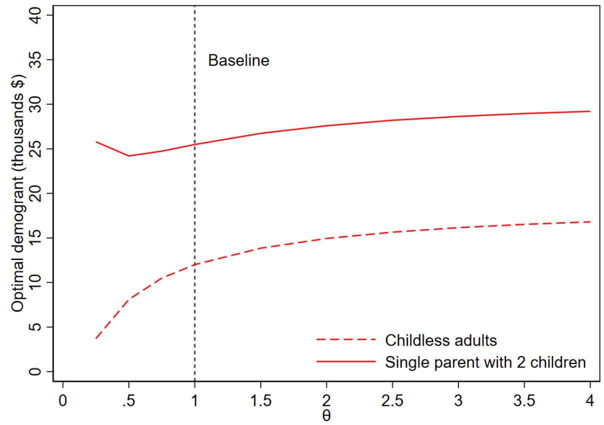
### 3.3.1 Redistributive Preferences

The baseline model assumes the adult's utility function has a concavity of $\theta = 1$, which corresponds to the conventionally used logarithmic benchmark. This parameter drives the amount of redistribution the government wants to do. In our utilitarian set up, the amount of redistribution the social planner wants to do is entirely driven by the concavity of the utility function. A welfarist social planner may have even stronger redistributive preferences and place additional weight on the utility of low-income households. A higher $\theta$ is a good approximation for either a more concave utility function or stronger redistributive preferences on the part of the government.

This benchmark level of redistributive preference may not be a good reflection of actual social preferences. Inverse optimum exercises suggest that while $\theta = 1$ was a fair representation of redistributive preferences prior to TRA86, the tax system in recent history implies lower redistributive preferences (Lockwood and Weinzierl 2016). However, whether tax policy accurately reflects society's true preferences remains an open question, so our baseline model keeps the conventional assumptions of redistributive preferences.

Figure 4 show how the optimal demogrant changes as $\theta$ increases. Increasing $\theta$ primarily increases the level of redistribution within a household type from higher income families to lower income ones. This is seen in the increasing demogrants for both parents and childless adults as $\theta$ increases over the range where $\theta \geq 1$. However, changing $\theta$ also affects the optimal amount of redistribution between household types. The social planner has two motives for redistributing from childless adults to families. The first is that each member of the family consumes less than a childless adult with the same income, giving the family a higher marginal utility of consumption and motivating redistribution towards them. The magnitude of this redistributive motive is governed by $\theta$ - as $\theta$ increases, the social planner

Figure 4: Sensitivity of optimal demogrants to theta




*Notes*: The x-axis denotes the value of redistributive parameter $\theta$, with higher values of $\theta$ indicating higher preferences for redistribution. The y-axis denotes the optimal transfer to non-earning households. The vertical dashed line denotes the baseline value of $\theta = 1$. The remaining parameters are fixed at $H = \$3,400$, $s(2) = 1.62$, $\eta_{parent} = 0.5$, $\eta_{childless} = 0.3$, $\epsilon = 0.33$.

will optimally redistribute more toward families. The second motive is that families have economies of scale - giving an additional dollar of income to a family generates more than an additional dollar of consumption, giving the social planner more "bang for their buck." At low levels of $\theta$ ($\theta \leq 1$), the economies of scale within families becomes very important, and the redistribution towards families from childless adults becomes large enough offset the lower demogrant that would be otherwise be implied by lower $\theta$s.

### 3.3.2 Equivalence Scales

The equivalence scale used as the baseline in this paper, the simplified Census scale, implies that the ratio of marginal utility of income for a family of one adult and two children to the marginal utility of a single adult, both with income $I$, is

$$\frac{MUI_{K=2}}{MUI_{K=0}} = \frac{(1 + .5 * 2)^{1-.7+.7\theta}}{(1 + .5 * 0)^{1-.7+.7\theta}} \tag{15}$$

This assumption enters the optimal tax solution via the welfare weights $g = \frac{MU}{MVPF}$. Figure 5 shows how the optimal demogrant amounts change as the relative marginal utilities change through different choices of equivalence scales.[11] Each ratio of marginal utilities, and thus ratio of welfare weights, has an equivalence scale that rationalizes it. Under our baseline assumptions about the equivalence scale the implied ratio of marginal utilities between family types, and thus welfare weights, is 2.

Under the baseline specification, the demogrant for a single parent family is 2.1 times that of a childless adult. Under the equivalence scale used by the Congressional Budget Office ($\sqrt{\text{family size}}$), the demogrant for a single parent family is \$33,293, more than 3 times the demogrant for a childless adult (\$9,704).[12] Note that in the case where families with and without children have the same marginal utility of income ($\frac{MUF}{MUS} = 1$, equivalent to model shown in Figure 1), the demogrant for childless adults is slightly higher than the demogrant for families with children. This result stems from the lower extensive margin labor supply elasticity for childless adults than for single parents. However, this is outweighed by even small differences in marginal utility between household types ($\frac{MUF}{MUS} > 1$).

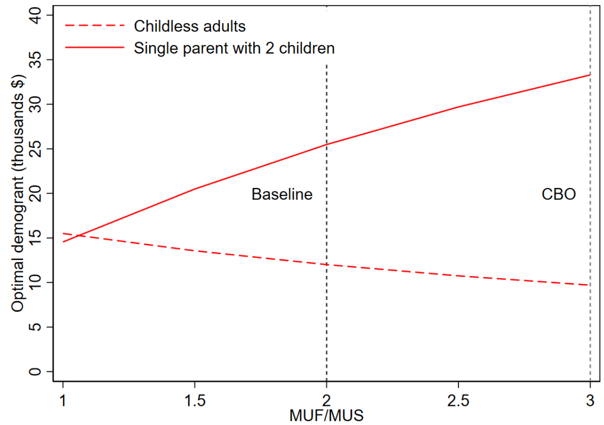
### 3.3.3 Elasticities

The main argument for limited transfers to non-earners is concern about discouraging labor force participation. Our baseline model assumes an extensive margin labor supply elasticity of 0.5 for single parents, taken from the upper end of estimates of the labor supply responses to the EITC. Figure 6 shows how the optimal demogrant changes under different assumptions of single parents' extensive margin elasticity, holding childless adults' extensive margin elasticity fixed at the baseline value of 0.3. Although increasing the elasticity of single parents decreases the optimal demogrant to those families, the magnitude of the change is fairly small. Under the unrealistically low assumption of an elasticity of 0.1, the optimal demogrant for single parent families is \$29,013, while at an unrealistically high elasticity of 0.7 the optimal demogrant is \$4,625 (16%) lower, at \$24,389. Within the range of elasticities

[11] In the case of a welfarist social planner, this could also be driven by the government putting different relative weights on the utility of families with children vs those without.

[12] CBO uses this equivalence scale to measure the distribution of income, taxes, and transfers across income groups (CBO 2021).

Figure 5: Sensitivity of optimal demogrants to equivalence scale




*Notes*: The x-axis denotes the ratio of marginal utility for a single parent (MUF) with two children to the marginal utility of a childless adult (MUS). Different values of $\frac{MUF}{MUS}$ can be rationalized under different assumptions of the equivalence scale. The y-axis denotes the optimal transfer to non-earning households. The left-most vertical dashed line represents the ratio of marginal utilities implied by our baseline model with $s(2) = 1.62$, which is 2. The right-most dashed vertical line represents the $\frac{MUF}{MUS}$ implied by CBO's equivalence scale. The remaining parameters are fixed at $H = \$3,400$, $\theta = 1$, $\eta_{parent} = 0.5$, $\eta_{childless} = 0.3$, $\epsilon = 0.33$.

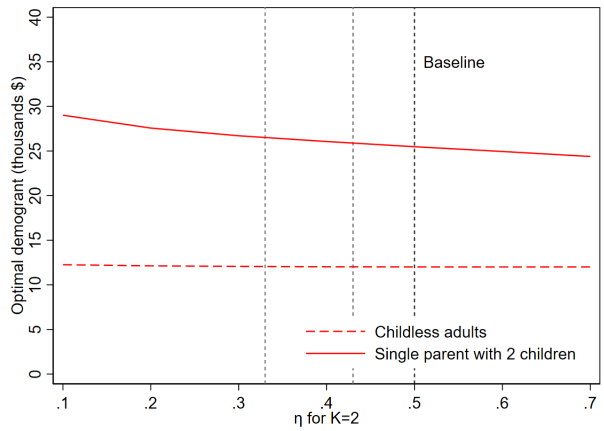
suggested by the literature (0.3 to 0.5), the optimal demogrant for single parent families only varies by $1,200 (4.6%).[13]

# 4 Comparison to Current Policy

We compare our estimates of the optimal transfer system to estimates of cash and near-cash transfers that families can expect to receive under the current transfer system. Given that two of the main programs for families without earnings (TANF and housing assistance) have limited funding, statutory benefit amounts are not a good proxy for the actual benefits a non-earning family can expect to receive. Federal TANF funding is fixed at 1996 nominal levels, and funding for housing assistance is capped by Congress annually. Both TANF and housing assistance only serve roughly a quarter of eligible households, and states are given

[13]We also conduct this exercise varying childless adults' elasticities, holding single parent elasticities fixed (Appendix Figure A1). We find qualitatively similar results over a range of feasible extensive margin elasticities from the literature.

Figure 6: Sensitivity of optimal demogrants to single parent extensive margin labor supply elasticity




*Notes*: The x-axis denotes the extensive margin elasticity for single parents. The y-axis denotes the optimal transfer to non-earning households. The black vertical dashed line denotes the baseline value of $\eta_{parent} = 0.5$. The gray vertical dashed lines denote alternate single parent elasticities from the literature, 0.33 and 0.43. The remaining parameters are fixed at $H = \$3,400$, $s(2) = 1.62$, $\theta = 1$, $\eta_{childless} = 0.3$, $\epsilon = 0.33$.

flexibility in how they allocate these limited resources.[14]

Limited program resources and variation in how programs are administered between states creates a large amount of heterogeneity in transfer amounts received within an income level and household structure.[15] Modeling this heterogeneity is outside the scope of this paper, so we estimate the average transfer payment a family at each income level can expect to receive. We use two approaches to estimate the expected transfer to non-earners. The first uses data from the Current Population Survey to estimate the dollar value of cash and cash-like transfers received by household structure and income level. The second uses statutory benefit amounts to non-earners, scaled by estimates of the share of eligible families that receive benefits.

[14] 24.9% of eligible families receive TANF benefits (Giannarelli 2019) and 25% of eligible families receive housing subsidies (*America's Rental Housing 2020* 2020)

[15] For example, for data on how access to TANF benefits varies within and between states, see *Temporary Assistance for Needy Families (TANF) at 26* 2022

## 4.1 Current Population Survey Estimates

We estimate net transfers by earnings level and family size by pooling the March 2018-2020 CPS and using supplemental poverty measure units. The advantage of this approach is that it allows us to approximate the entire tax/transfer schedule under current policy, rather than just the transfer to non-earners. The disadvantage is that transfers to non-earning households may be underestimated due to underreporting of transfer program participation and misclassification of low-income households (Meyer, Mok, et al. 2015).

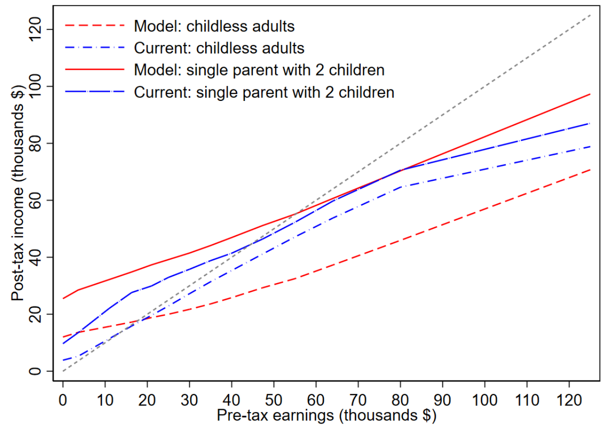
Figure 7 shows the resulting estimates of average transfers by earnings level and presence of children in blue, plotted against the optimal system in our baseline simulation in red.[16] Transfer income includes income from welfare/public assistance, SNAP, school lunch programs, WIC, housing subsidies, energy subsidies, SSI, the EITC, and disability and survivor's benefits, minus net state and federal taxes. This set of transfer programs is in line with the transfers used in calculating the supplemental poverty measure (Short 2011).

The transfer a non-earning childless adult can expect to receive using this calculation is \$3,871, well below the optimal amount of \$12,011. The transfer an average non-earning single parent family can expect to receive is \$9,674. This is well below half the optimal demogrant of \$25,482 for single parent families.

There are two main drawbacks of using the CPS to estimate the current transfer system. The first is concerns about underreporting of benefits on surveys (Meyer, Mok, et al. 2015), which would bias our estimates of the generosity of the current system downwards. The second concern is with identifying the non-earning population. While wage income is a reasonably proxy for individuals with no income, some of the non-wage earners could have very high income or wealth from other sources that makes them ineligible for cash and

[16] Average taxes and transfers under current law are estimated using supplemental poverty measure (SPM) units with one adult age 18-60 who is not a student. Pre-tax earnings are measured from wages, farm, and self-employment income of the adult. Since transfer income is measured by SPM unit, it can only accurately be measured for childless adults and single parents that live alone. Adults that live with other adults (i.e. extended family or unmarried partners) are included in the optimal tax model, but not in estimates of average taxes/transfers under current law.

Figure 7: Comparison of optimal tax schedule with current policy




*Notes*: The x-axis denotes pre-tax earnings. The y-axis denotes post-tax income, calculated as the pre-tax earnings plus the tax or transfer amount. The gray dashed line represents the 45 degree line, with observations falling above this line denoting pre-tax earnings levels with net transfers and observations below denoting earnings levels with net taxes. Results reflect the model with baseline specifications of $H = \$3,400$, $s(2) = 1.62$, $\theta = 1$, $\eta_{parents} = 0.5$, $\eta_{childless} = 0.3$, $\epsilon = 0.33$. Estimates of the current tax and transfer system come from supplemental poverty measure units with a single adult age 18-60 (not in school) in the pooled 2018-2020 March CPS. Pre-tax earnings are total wage, farm, and self-employment income. The tax and transfer amounts include reported income from welfare/public assistance, SNAP, school lunch programs, WIC, housing subsidies, energy subsidies, SSI, the EITC, and disability and survivor's benefits, minus net state and federal taxes.

cash-like transfers. Including these individuals in the estimate of the transfer to non-earners will also bias our estimate of current transfers to low-income households downwards. As an alternative approach that mitigates these concerns, we consider statutory benefit amounts.

## 4.2 Statutory Benefits to Non-earners

Our second approach focuses on estimating the value of the transfers non-earning families receive in expectation using statutory benefit amounts. We scale these benefit amounts by estimates of coverage to reflect that the full benefits are not available to all eligible individuals. For these estimates we focus on the four main programs that determine eligibility primarily based on income (as opposed to programs targeted at specific demographic groups like infants or the disabled). These programs are TANF, SNAP, school lunch subsidies, and housing subsidies.

We assume households can expect to receive 100% of the entitlement program benefits they are income-eligible for (SNAP and school lunch), but scale non-entitlement program benefits (TANF and housing assistance) by estimates of the share of eligible households that receive benefits. Low levels of program receipt among eligible households reflect some combination of household decisions to take up programs and policy decisions to ration benefits. These are not cleanly separable, since states may reduce take-up by increasing the costs associated with getting and keeping benefits, such as frequent redetermination periods, lifetime limits, or long wait times (see Parolin 2021 for more examples in the TANF setting). Therefore, the share of households that receive benefits is the best available proxy for the average benefits a household could expect to receive.

Table 2 shows what these statutory benefit amounts and benefit coverage rates imply for the current value of the demogrant.

Table 2: Expected demogrant from statutory benefit amounts

| | Childless adult | Single parent with 2 kids |
|---|---|---|
| Annual SNAP | NA | 6,048 |
| *SNAP coverage rate* | - | *1* |
| Annual TANF | NA | 5,688 |
| *TANF coverage rate* | - | *0.25* |
| Annual school lunch | NA | 663 |
| *School lunch coverage rate* | - | *1* |
| Annual housing | 9,738 | 13,614 |
| *Housing coverage rate* | *0.25* | *0.25* |
| Expected demogrant | 2,435 | 11,531 |

*Notes*: Maximum SNAP monthly benefits were $192 for a single, childless adult and $504 for a 3 person household in 2018 (USDA 2017). However, SNAP has work requirements for able-bodied adults without dependents, so a single childless adult that is not working and is not categorically eligible (due to disability or age) is not eligible for SNAP benefits. Maximum TANF benefits for a 3-person household vary by state. In our calculations we take the average maximum monthly benefit across all states as of July 2019, which is $474. The data come from Tables II.A.4 and II.A.5 of the July 2019 Welfare Rules Databook. The annual value of school lunch is Census' estimate of the value of a full school year of lunches in 2020 (Shrider 2021). We calculate the value of housing benefits by averaging HUD data on fair market rents in October 2018, weighted by 2010 county population. We use studio rents for childless adults and 2-bedroom rents for single parents. The TANF coverage rate comes from Giannarelli 2019, and the housing coverage rate comes from *America's Rental Housing 2020* 2020.

These estimates are slightly higher than the values estimated from the CPS. To some extent, this may reflect the lower coverage rates reported in the CPS than the estimates used here. However, the CPS and statutory estimates are qualitatively similar in magnitude.

If families were able to receive the full statutory benefit amount for these programs, the demogrant for childless adults would be $9,738 and the demogrant for a single parent with two children would be $26,013. These amounts are more similar to the optimal amounts under our baseline specification.

# 5 Discussion

This model motivates redistribution toward families with children using the utility generated from children's consumption, but redistribution toward families could also be motivated by positive externalities from investment in children. A growing body of literature finds that transfers to low-income children can increase educational achievement, health, and earnings, which has positive effects on the government's budget (Hoynes and Patel 2018). Certain programs pay for themselves on the margin – in many cases, an additional dollar of program spending on children generates more than an additional dollar of government revenue over the long term (Hendren and Sprung-keyser 2020). Including these positive externalities would increase the optimal amount of redistribution to low-income families with children.

We do not explicitly model childcare costs, which may impact parents' labor supply responses to tax changes or working families' consumption levels. The simplest way to model childcare costs is as part of the disutility of work. In this case, the impact of childcare on parents' labor supply decisions is captured in their labor supply elasticities, and would have no impact on the marginal utility of families relative to childless adults. If we assume existing empirical estimates of labor supply elasticity capture parents' response inclusive of concerns on childcare cost, then our model should capture childcare via allowing a higher labor supply elasticity for single parents.

Another way childcare costs could enter the model is through the family's budget constraint, where these costs would reduce the income available for consumption (as in Blundell and Shephard 2012). In this case, childcare costs would reduce working families' consumption relative to non-working families and childless adults. This would increase the optimal amount of redistribution to working families relative to other households. If childcare is a component of children's consumption, it may be captured in our assumptions about how families allocate consumption between adults and children. However, to the extent that non-working parents engage in home production of childcare, we may underestimate the resources of non-working families relative to working families, which would cause us to overestimate the optimal transfer to non-working families.

This paper focuses on single adults because single parents are the recipients of most transfers. Including married households in the model would allow us to estimate the optimal amount of redistribution between unmarried and married households, rather than just the optimal amount of redistribution within single adult headed households. If married households are on average better off than unmarried households, including them in the model would increase the resources available to transfer to unmarried households. Including married households in the model would require making assumptions about how joint labor supply decisions respond to changes in the tax system.[17] Applying equivalence scales to married households would also require stronger assumptions. Equivalence scales imply that the allocation of resources in the household does not depend on total income or who earned in that income, which abstracts away from any bargaining that occurs between adults in the household.

[17]Kleven, Kreiner, and Saez 2009 assume one spouse (the primary earner) responds only on the intensive margin and the other spouse (the secondary earner) responds on the extensive margin.

# 6 Conclusion

We model the optimal tax and transfer system for unmarried adults, accounting for the presence of children in the household. We account for labor supply responses along both the extensive and intensive margins, which allows us to model the tradeoff between the benefits of increasing resources to children in non-earning households and the costs of potentially distorting their parents' labor force participation. We calibrate the value of providing additional income to families relative to childless adults using the assumptions that Census uses to compare the well-being of households of different sizes in poverty measurement and policy analysis. In our preferred specification with conservative assumptions, we estimate that the optimal transfer to a single parent family with no earnings (assuming they have two children) is roughly $25,000. The optimal transfer to a single childless adult with no earnings is roughly $12,000.

We compare these estimates of the optimal tax and transfer schedule to transfers households can expect to receive under current policy, accounting for incomplete benefit coverage. For both single parent families and single childless adults, current policy offers lower transfers to the lowest-earning households than is optimal. Single parent families without earnings receive expected transfers below $12,000 under current policy, less than half the optimal amount. Single childless adults without earnings receive expected transfers less than $4,000, about one-quarter of the optimal demogrant in our model. Given how much less generous the current system is to non-earners than optimal, the weight current policy places on inducing families to work, relative to providing resources to non-earners,seems to be misplaced.

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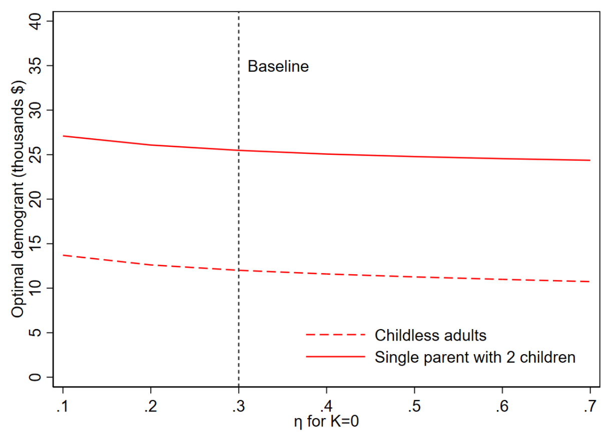
# Appendix

## Robustness to extensive margin labor supply response assumptions

Figure A1 shows how the optimal demogrants change as we vary the extensive margin labor supply elasticity for childless adults. We hold fixed the extensive margin labor supply elasticity for single parents and intensive margin labor supply elasticity at our baseline values of 0.5 and 0.33, respectively. Even if childless adults' extensive margin responses are larger than those found in the empirical literature, the results are qualitatively similar to our baseline specification.

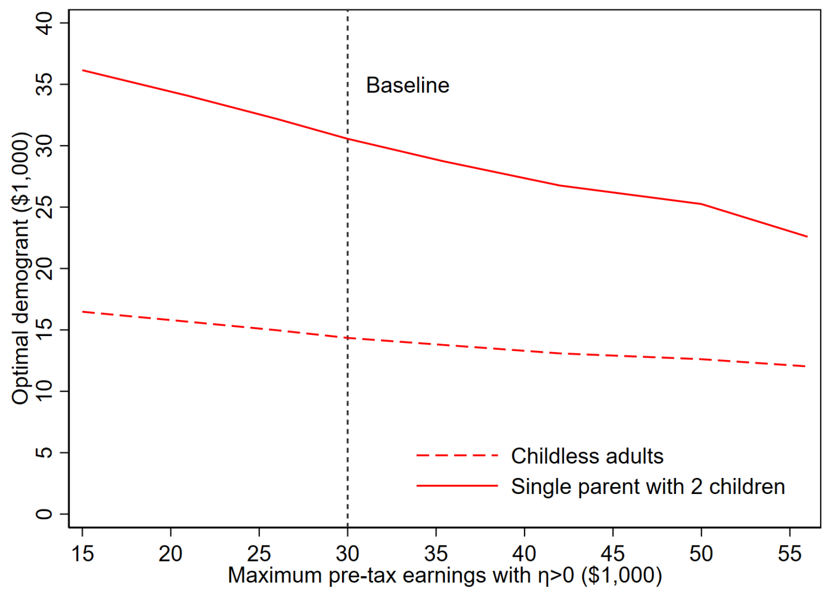
Figure A1: Sensitivity of optimal demogrants to childless adult extensive margin labor supply elasticity




*Notes*: The x-axis denotes the extensive margin elasticity for childless adults. The y-axis denotes the optimal transfer to non-earning households. The black vertical dashed line denotes the baseline value of $\eta_{childless} = 0.3$. The remaining parameters are fixed at $H = \$3,400$, $s(2) = 1.62$, $\theta = 1$, $\eta_{parent} = 0.5$, $\epsilon = 0.33$.

Figure A2 shows how the optimal demogrants change as we vary our assumption about which earnings groups respond to the tax system by entering or leaving the labor force. In our baseline specification, we assume that adults earning more than $30,000 respond to the tax/transfer system on the intensive margin, but not on the extensive margin. Even if we allow adults earning up to $55,000 to respond along the extensive margin, the optimal demogrants for both single adults and families with children are well above the expected demogrant under current policy.

Figure A2: Sensitivity of optimal demogrant to extensive margin earnings threshold

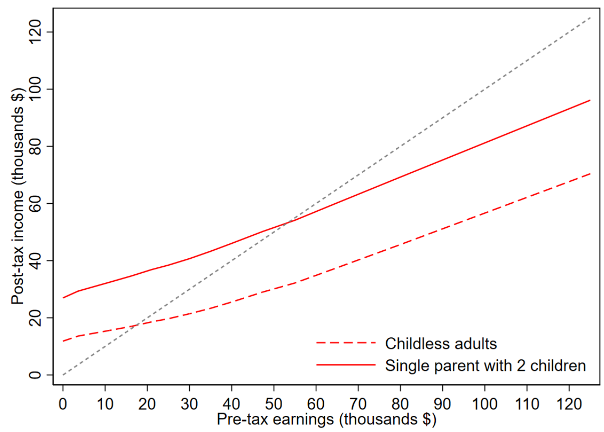



*Notes*: The x-axis denotes the maximum pre-tax earnings level assumed to have a positive extensive margin elasticity. The y-axis denotes the optimal transfer to non-earning households. The black vertical dashed line denotes the baseline value of extensive margin elasticities up to $30,000 in pre-tax earnings. The remaining parameters are fixed at $H = \$6,000$, $s(2) = 1.62$, $\theta = 1$, $\eta_{parent} = 0.5$, $\eta_{childless} = 0.3$, $\epsilon = 0.33$.

## Robustness to current tax schedule assumptions

Figure A3 shows the optimal tax schedule under an alternate assumption about the current tax system that generated the current income distribution. Instead of using a linear approximation of the current tax system we use the detailed approximation of the current tax/transfer system from the CPS (shown in figure 7). Including this additional detail about the current tax/transfer system has minimal impact on the results.

Figure A3: Sensitivity of optimal transfers to initial tax system




*Notes*: The x-axis denotes pre-tax earnings. The y-axis denotes post-tax income, calculated as the pre-tax earnings plus the optimal tax or transfer amount. The gray dashed line represents the 45 degree line, with observations falling above this line denoting pre-tax earnings levels with net transfers and observations below denoting earnings levels with net taxes. The initializing tax system used was a detailed approximation of the current system, as opposed to a linear approximation. Otherwise, this model represents our baseline specification, with parameters are $H = \$3,400$, $s(2) = 1.62$, $\theta = 1$, $\eta_{parents} = .5$, $\eta_{childless} = .3$, $\epsilon = .33$.