Online Appendix

(not for publication)

1 Transfers to Households in the United States

In this section of the Appendix, we provide a brief description of various means-tested programs.

1.1 The Earned Income Tax Credit

The EITC is a fully-refundable tax credit that subsidizes low-income working families. The EITC is a fraction of a family's earnings until earnings reach a certain threshold. Then, it stays at a maximum level, and when the earnings reach a second threshold, the credit starts to decline so that the individual does not receive any credit beyond a certain earnings level. The maximum credits, income thresholds, and the rate at which the credits decline depend on the household's tax filing status (married vs. single) and the number of children. By design, the EITC only benefits working families, and families with children receive a much larger credit than workers without qualifying children. For 2019, households with earnings up to 41,000 to 56,000 qualified for the EITC. For a married couple or a single parent with two children, the maximum credit, which applied for earnings around 15 to 20,000$, was 5828$ (a subsidy of more than 25%). The maximum credit for households without children was much smaller, only 529$. In 2019 about 25 million taxpayers received an average EITC of $2,476.[1]

1.2 Child-Related Transfers

Child Tax Credit The CTC provides households a tax credit for each child, independent of parents' childcare expenditures and labor market status. Until the 2017 Tax Cuts and Jobs Act (TCJA), the CTC started at $1,000 per qualified children under age 17 and stayed at this level up to a household income of $75,000 for singles and $110,000 for married couples. Beyond this limit, the credit declines by 5% for each dollar earned until it is completely phased out when the household income is $115,000 for singles and $150,000 for married couples. The 2017 tax reform increased the maximum credit to 2000$ per child and allowed households with much higher income to qualify for the maximum credit ($200,000 for single parents and $400,000 for married couples). The CTC is partly refundable: if the credit exceeds taxes owed, taxpayers can receive up to $1,400 per child, known as the additional child tax credit (ACTC). To qualify for the ACTC, a household must have minimum

[1] See https://www.eitc.irs.gov/eitc-central/about-eitc/about-eitc for further details.

earnings of 2500$.[2]

The Child and Dependent Care Tax Credit The Child and Dependent Care Tax Credit (CDCTC) is a non-refundable tax credit that allows parents to deduct a fraction of their childcare expenses from their tax liabilities. To qualify for the tax credit, both parents must work. The maximum qualified childcare expenditure is $3,000 per child, with an overall maximum of $6,000. Parents receive a fraction of qualifying expenses as a tax credit. This fraction starts at 35%, remains at this level up to a household income of $15,000, and then declines with household income. The lowest rate, which applies to families with a total household income above $43,000, is 20%.[3] Since the CDCTC is not refundable, only households with positive tax liabilities benefit from it.

Childcare Subsidies The main program that provides childcare subsidies for low-income families in the US is the Child Care Development Fund (CCDF). The program was created as part of the 1996 welfare reform and consolidated an array of programs. To qualify for a subsidy, parents must be employed, in training, or in school. The program targets low-income households. In 2010, 1.7 million children (ages 0-13) were served by the CCDF, which is about 5.5% of all children (ages 0-13) in the US, and the average income of those receiving a subsidy was about $20,000 (28% of the mean household income) - Guner, Kaygusuz, and Ventura (2020). Families receiving assistance must make a co-payment, which is about 25% of childcare costs, while the remaining 75% constituted the subsidy.

1.3 Welfare System

Another group of means-tested programs consist of programs provide cash or in-kind transfers to poor households, and that are routinely identified with "welfare" system in the US.

Temporary Assistance to Needy Families The TANF was created by the 1996 welfare reform and replaced the Aid to Families with Dependent Children program (AFDC). Under TANF, the federal government provides a block grant to the states, which use them to operate their own programs. To receive federal funds, states must also spend some of their own dollars. The TANF provides monthly cash payments to families, which differ significantly across states. The average maximum monthly payments for a family of three was 462$ in 2018. The most and least generous states' payments were 170$ (Mississippi) and 1039$ (New Hampshire).[4] In contrast to the AFDC, the TANF has a 5-year life-time

[2] See https://www.irs.gov/newsroom/the-child-tax-credit-benefits-eligible-parents and https://www.taxpolicycenter.org/briefing-book/what-child-tax-credit for further details.

[3] See http://www.taxpolicycenter.org/briefing-book and https://www.irs.gov/uac/Ten-Things-to-Know-About-the-Child-and-Dependent-Care-Credit.

[4] The Urban Institute's Welfare Rules Database, TANF Policy Tables, Table II.A.4 https://wrd.urban.org/wrd/tables.cfm. See also Congressional Research Service (2020).

participation limit and a stronger emphasis on encouraging recipients to work. As a result, less than 50 percent of TANF spending goes to cash assistance (CBO 2013). The rest pays for various services for low-income families with children, including child care, transportation to work, and other types of work-related assistance.

Supplemental Nutrition Assistance Program The SNAP is a federal program that supports low-income households through electronic benefit transfer cards that can be used to buy food. To be eligible, household income, before any of the program's deductions, must be at or below 130 percent of the poverty line. For a family of three in 2021, this is $1,810 a month (about $28,200 a year). A family of three with no income receives the maximum benefit of 535$ a month. Maximum benefits are reduced by 30% for each dollar of monthly household income. On average, SNAP households received about $246 a month in the fiscal year 2020 (Center on Budget and Policy Priorities, 2020).

Supplemental Nutrition Program for Women, Infants, and Children (WIC) Pregnant, postpartum, and breast-feeding women, infants, and children up to age 5 are eligible to the WIC if they are poor and an appropriate professional determines them to be at nutritional risk. An applicant who already receives SNAP, Medicaid, or TNAF is automatically considered income-eligible for WIC. Applicants who receive no other relevant means-tested benefits must have a gross household income at or below 185 percent of the federal poverty level (currently $37,296 annually for a family of three) to qualify. WIC provided an average value of $61.24 in food per participant per month in the fiscal year 2016 (Center on Budget and Policy Priorities, 2017).

Supplemental Security Insurance The SSI is a federal program that provides monthly cash assistance to disabled, blind, or elderly who have little or no income and few assets. The monthly maximum Federal amounts for 2021 are $794 for an eligible individual, $1,191 for a qualified individual with an eligible spouse. In 2019, 79% of payments were for disabled individuals under age 65 (Social Security Administration, 2020).

Housing Subsidies Several federal programs provide rental assistance to families with low income. These programs are administered by the Department of Housing and Urban Development and the U.S. Department of Agriculture and take two forms: i) Public Housing and ii) Vouchers. In 2017, about 4.6 million households (3.8% of all households in the U.S.) received some form of federal rental assistance (Mazzara 2017). The amount of aid can be substantial. Guner, Rauh, and Ventura (2021) calculate that households at the bottom decile of the income distribution receive about $7,000 per year (about $5,000 for the second and third lowest deciles).

2 Equilibrium

In this section of the Appendix, we define a stationary equilibrium for the model economy. For all j, let $M_j(x, z) = M(x, z)$ denote the fraction of marriages between age-j, type-x females and age-j, type-z males, and let $\phi_j(x) = \phi(x)$ and $\Phi_j(x) = \Phi(x)$ be the fraction of single type-z males and the fraction of single type-x females, respectively. The fraction of type-z males and type-x females are then given by

$$\Omega(z) = \sum_{x \in X} M(x, z) + \omega(z), \tag{1}$$

and

$$\Phi(x) = \sum_{z \in Z} M(x, z) + \phi(x). \tag{2}$$

Let let $\mathcal{S}^M \equiv (x, z, \theta, \boldsymbol{\upsilon}, q, b)$ be the vector of states that *do not change* along the life-cycle for married households, with $\boldsymbol{\upsilon} = (\upsilon^M_{f,x}, \upsilon^M_{m,z})$. For married couples, also summarize the pair of persistent shocks by $\boldsymbol{\eta} \equiv (\eta^M_{f,x}, \eta^M_{m,z})$. Similarly, let $\mathcal{S}^S_f \equiv (x, \upsilon^S_{f,x}, b)$ and $\mathcal{S}^S_m \equiv (z, \upsilon^S_{m,z})$ be the vector of exogenous variables for single females and single males, respectively. In equilibrium, factor markets clear. The aggregate state of the economy consists of distribution of households over their types, labor productivity shocks, assets, labor market experience, and human capital levels. Let the function $\psi^M_j(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M)$ denote the number of married individuals of age j with assets a, human capital level h, female labor market experience e, current persistent shocks $\boldsymbol{\eta}$, and exogenous state $\mathcal{S}^M$. The function $\psi^S_{f,j}(a, h, e, \eta^S_{f,x}, \mathcal{S}^S_f)$, for single females, and the function $\psi^S_{m,j}(a, \eta^S_{m,z}, \mathcal{S}^S_m)$, for single males, are defined similarly. Note that household assets, a, and female human capital levels, h, are continuous decisions. Let $a \in A \ = [0, \overline{a}]$ and $H = [0, \overline{h}]$ be the sets of possible assets and female human capital levels. Let the set for possible values of the market experience be denoted by $E = [0, \overline{e}]$. By construction, $M(x, z)$, the number of married households of type (x, z), must satisfy for all j

$$M(x, z) = \sum_{\theta, \boldsymbol{\upsilon}, q, b} \int_{A \times H} \psi^M_j(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M) dh \ da \ de \ d\boldsymbol{\eta}.$$

Similarly, the fraction of single females and males must be consistent with the corresponding measures $\psi^S_{f,j}$ and $\psi^S_{m,j}$, i.e. for all ages, we have

$$\phi(x) = \sum_{\upsilon, b} \int_{A \times H \times E} \psi^S_{f,j}(a, h, e, \eta, \mathcal{S}^S_f) dh \ da \ de \ d\eta,$$

and

$$\omega(z) = \sum_{\upsilon} \int_A \psi^S_{m,j}(a, \eta, \mathcal{S}^S_m) da \ d\eta.$$

For married couples, let $\lambda_b^M(x,z)$ be the fraction of type-(x,z) couples who have childbearing type b (where $b \in \{0,1,2\}$ denotes no children, early childbearing and late childbearing, respectively), with $\sum_b \lambda_b^M(x,z) = 1$. Similarly, let $\lambda_b^S(x)$ be the fraction of type-x single females who have childbearing type b, with $\sum_b \lambda_b^S(x) = 1$. Let the decision rules associated with the dynamic programming problems outlined in Section 4.5 of the paper be denoted by $a_m^S(a, \eta_{m,z}^S, \mathcal{S}_m^S, j)$ and $l_m^S(a, \eta_{m,z}^S, \mathcal{S}_m^S, j)$ for single males, by $a_f^S(a, h, e, \eta_{f,x}^S, \mathcal{S}_f^S, j)$ and $l_f^S(a, h, e, \eta_{f,x}^S, \mathcal{S}_f^S, j)$ for single females, and by $a^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M, j)$, $l_f^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M, j)$ and $l_m^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M, j)$ for married couples. Finally, let the functions $\mathfrak{h}^S(a, h, e, \eta, \mathcal{S}_f^S, j)$ and $\mathfrak{h}^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M, j)$ describe the next period's human capital for a single and married female, respectively. They are defined as

$$\mathfrak{h}^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M, j) = \mathcal{H}(x, h, l_f^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M, j), e),$$

and

$$\mathfrak{h}^S(a, h, e, \eta, \mathcal{S}_f^S, j) = \mathcal{H}(x, h, l_f^S(a, h, e, \eta, \mathcal{S}_f^S, j), e),$$

where $\mathcal{H}$ is the human capital accumulation function. Let $\chi\{.\}$ denote the indicator function. Summarize the transition functions for persistent shocks by $\Gamma^M(\boldsymbol{\eta}'|\boldsymbol{\eta})$, $\Gamma_f^S(\eta'|\eta)$ and $\Gamma_m^S(\eta'|\eta)$ and the initial draws for permanent shocks by $\Pi^M(\boldsymbol{\upsilon})$, $\Pi_f^S(\upsilon)$, and $\Pi_m^S(\upsilon)$.

In equilibrium, the distribution functions $\psi_j^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M)$, $\psi_{f,j}^S(a, h, e, \eta_{f,x}^S, \mathcal{S}_f^S)$, and $\psi_{m,j}^S(a, \eta_{m,z}^S, \mathcal{S}_m^S)$ must obey the following recursions:

Married agents

$$\begin{aligned} \psi_j^M(a', h', e', \boldsymbol{\eta}', \mathcal{S}^M) &= \int \Gamma^M(\boldsymbol{\eta}'|\boldsymbol{\eta}) \psi_{j-1}^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M) \times \\ \chi\{a^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M, j-1) &= a',\ \mathfrak{h}^M(a, h, e, \mathcal{S}^M, \boldsymbol{\eta}, j-1) = h'\} dh\ da\ de\ d\boldsymbol{\eta}, \end{aligned} \tag{3}$$

for $j > 1$ with

$$e' = \begin{cases} e, \text{ if } l_f^M(a, h, e, \boldsymbol{\eta}, \mathcal{S}^M, j-1) = 0 \\ e+1, \text{ otherwise} \end{cases}.$$

For $j = 1$,

$$\psi_1^M(a, e, h, \boldsymbol{\eta}, \mathcal{S}^M) = \begin{cases} M(x,z)\lambda_b^M(x,z)\pi_\theta \Pi^M(\boldsymbol{\upsilon})(\zeta(q|z) \text{ if } a = 0, e = 0, \boldsymbol{\eta} = \mathbf{0},\ h = \varpi_m(x,1), \\ 0, \text{ otherwise} \end{cases},$$

where $\varpi_m(x,1)$ is a function that maps female types their initial human capital, $\zeta(q|z)$ is the fraction of households that draw q (given z), and π_θ is the probability of drawing θ.

Single female agents

$$\begin{aligned} \psi_{f,j}^S(a', h', e', \eta', \mathcal{S}_f^S) &= \int \Gamma_f^S(\eta'|\eta) \psi_{f,j-1}^S(a, h, e, \eta, \mathcal{S}_f^S) \times \\ \chi\{a_f^S(a, h, e, \eta, \mathcal{S}_f^S,\ j-1) &= a',\ \mathfrak{h}^S(a, h, e, \eta, \mathcal{S}_f^S, j-1) = h'\} dh\ da\ de\ d\boldsymbol{\eta}, \end{aligned} \tag{4}$$

for $j>1$, with again

$$e'=\left\{\begin{array}{l} e,\text{ if } l_f^S(a,h,e,\eta_{f,x}^S,\mathcal{S}_f^S,j-1)=0 \\ e+1,\text{ otherwise}\end{array}\right. ,$$

and

$$\psi_{f,1}^S(a,h,e,\eta,\mathcal{S}_f^S)=\left\{\begin{array}{l} \phi(x)\Pi_f^S(\upsilon)\lambda_b^S(x)\text{ if } e=0,\eta=0,\ h=\varpi_f(x,1) \\ 0,\text{ otherwise}\end{array}\right. .$$

Single male agents

$$\psi_{m,j}^S(a,\eta,\mathcal{S}_m^S)=\int\Gamma_f^S(\eta'|\eta)\psi_{m,j-1}^S(a,\eta,\mathcal{S}_m^S)\chi\{a_m^S(a,\eta,\mathcal{S}_m^S,j-1)=a'\}da\ d\eta, \tag{5}$$

for $j>1$, and

$$\psi_{m,1}^S(a,\eta,\mathcal{S}_m^S)=\left\{\begin{array}{l} \varpi_m(z,1)\Pi_m^S(\upsilon)\text{ if } a=0,\ \eta=0 \\ 0,\text{ otherwise}\end{array}\right. .$$

Given distribution functions $\psi_j^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M)$, $\psi_{f,j}^S(a,h,e,\eta_{f,x}^S,\mathcal{S}_f^S)$, and $\psi_{m,j}^S(a,\eta_{m,z}^S,\mathcal{S}_m^S)$, the aggregate capital stock is given by

$$\begin{aligned} K &= \sum_j\mu_j[\sum_{\mathcal{S}^M}\int a\psi_j^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M)dh\ da\ de\ d\boldsymbol{\eta}+\sum_{\mathcal{S}_m^S}\int a\psi_{m,j}^S(a,\eta,\mathcal{S}_m^S)da\ d\eta \\ &+ \sum_{\mathcal{S}_f^S}\int a\psi_{f,j}^S(a,h,e,\eta,\mathcal{S}_f^S)dh\ da\ de\ d\eta]. \end{aligned} \tag{6}$$

The skilled labor input, L_s, is given by

$$\begin{aligned} L_s &= \sum_j\mu_j[\sum_{\mathcal{S}^M:x=s}\int(h\exp(\nu+\eta)l_f^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M,j)\psi_j^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M)dh\ da\ de\ d\boldsymbol{\eta} \\ &+ \sum_{\mathcal{S}^M:z=s}\int(\varpi(z,j)\exp(\nu+\eta)l_m^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M,j)\psi_j^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M)dh\ da\ de\ d\boldsymbol{\eta} \\ &+ \sum_{\mathcal{S}_m^S:z=s}\int\varpi(z,j)\exp(\nu+\eta)l_m^S(a,\eta,\mathcal{S}_m^S,j)\psi_{m,j}^S(a,\eta,\mathcal{S}_m^S)da\ d\eta \\ &+ \sum_{\mathcal{S}_f^S:x=s}\int h\exp(\nu+\eta)l_f^S(a,h,e,\eta,\mathcal{S}_f^S,j)\psi_{f,j}^S(a,h,e,\eta,\mathcal{S}_f^S)dh\ da\ de\ d\eta]. \end{aligned} \tag{7}$$

In turn, the (total) unskilled labor input, is given by

$$
\begin{aligned}
L_u &= \sum_j \mu_j [\sum_{\mathcal{S}^M : x=u} \int (h \exp(\nu+\eta) l_f^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M,j) \psi_j^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M) dh\ da\ de\ d\boldsymbol{\eta} \\
&+ \sum_{\mathcal{S}^M : z=u} \int (\varpi(z,j) \exp(\nu+\eta) l_m^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M,j) \psi_j^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M) dh\ da\ de\ d\boldsymbol{\eta} \\
&+ \sum_{\mathcal{S}_m^S : z=u} \int \varpi(z,j) \exp(\nu+\eta) l_m^S(a,\eta,\mathcal{S}_m^S,j) \psi_{m,j}^S(a,\eta,\mathcal{S}_m^S) da\ d\eta \qquad (8) \\
&+ \sum_{\mathcal{S}_f^S : x=u} \int h \exp(\nu+\eta) l_f^S(a,h,e,\eta,\mathcal{S}_f^S,j) \psi_{f,j}^S(a,h,e,\eta,\mathcal{S}_f^S) dh\ da\ de\ d\eta],
\end{aligned}
$$

Furthermore, unskilled labor used in the production of goods, $L_{u,g}$, equals the total supply of unskilled labor net of its usage in the production of childcare services:

$$
\begin{aligned}
L_{u,g} &= L_u - [\sum_{\mathcal{S}^M} \mu_j \int \chi\{l_f^M\} D(x,z,b,j) \psi_j^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M,j) dh\ da\ de\ d\boldsymbol{\eta} \\
&+ \sum_{\mathcal{S}_f^S} \mu_j \int \chi\{l_f^S\} D(x,b,j) \psi_{f,j}^S(a,h,e,\eta,\mathcal{S}_f^S,j) dh\ da\ de\ d\eta].
\end{aligned}
$$

In equilibrium, total taxes must cover government expenditures, G, total government spending and total transfers, TR, i.e.,

$$
\begin{aligned}
G + TR &= \sum_j \mu_j [\sum_{\mathcal{S}^M} \int T^M(I,\mathcal{K}(.)) \psi_j^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M) dh\ da\ de\ d\boldsymbol{\eta} \qquad (9) \\
&+ \sum_{\mathcal{S}_m^S} \int T^S(I,0) \psi_{m,j}^S(a,\eta,\mathcal{S}_m^S)\ da\ d\eta \\
&\quad + \sum_{\mathcal{S}_f^S} \int T^S(I,\mathcal{K}(.)) \psi_{f,j}^S(a,e,h,\eta,\mathcal{S}_f^S)\ dh\ da\ de\ d\eta] + \tau_k r K,
\end{aligned}
$$

where I represents a household's total income and $\mathcal{K}$ the number of children as as defined in the description of the individual and household problems in Section 4.5 of the paper. The aggregate transfers are given by

$$
\begin{aligned}
TR &= \sum_j \mu_j [\sum_{\mathcal{S}^M} \int TR^M(I,\mathcal{K}(.),D) \psi_j^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M) dh\ da\ de\ d\boldsymbol{\eta} \\
&+ \sum_{\mathcal{S}_m^S} \int TR_m^S(I) \psi_{m,j}^S(a,\eta,\mathcal{S}_m^S)\ da\ d\eta \\
&+ \sum_{\mathcal{S}_f^S} \int TR_f^S(I,\mathcal{K}(.),D) \psi_{f,j}^S(a,e,h,\eta,\mathcal{S}_f^S)\ dh\ da\ de\ d\eta],
\end{aligned}
$$

where D stands for childcare expenditures, as defined in Section 4.5 of the paper.

Finally, the social security budget must balance

$$\begin{aligned}
& \sum_{j\geq J_R} \mu_j [\sum_{\mathcal{S}^M} \int p^M(x,z)\psi_j^M(a,h,e,\mathbf{0},\mathcal{S}^M)dh\ da\ de + \sum_{\mathcal{S}_f^S} \int p_f^S(x)\psi_{f,j}^S(a,e,h,0,\mathcal{S}_f^S)dh\ da\ de \\
& + \sum_{\mathcal{S}_m^S} \int p_m^S(z)\psi_{m,j}^S(a,0,\mathcal{S}_m^S)\ da] \qquad (10) \\
= \ & \tau_p[w_s L_s + w_u L_u].
\end{aligned}$$

Equilibrium Definition For a given government consumption level G, social security benefits $p^M(x,z)$, $p_f^S(x)$ and $p_m^S(z)$, tax functions $T^S(.)$, $T^M(.)$, a payroll tax rate τ_p, a capital tax rate τ_k, transfer function $TR_f^S(.)$, $TR_m^S(.)$, $TR^M(.)$, and an exogenous demographic structure represented by $\Omega(z)$, $\Phi(x)$, $M(x,z)$, and μ_j, a *stationary equilibrium* consists of prices r and (w_s, w_u), aggregate capital (K), aggregate labor $(L_s, L_u, L_{u,g})$, household decision rules $a_m^S(a,\eta_{m,z}^S,\mathcal{S}_m^S,j)$ and $l_m^S(a,\eta_{m,z}^S,\mathcal{S}_m^S,j)$ for single males, by $a_f^S(a,e,h,\eta_{f,x}^S,\mathcal{S}_f^S,j)$ and $l_f^S(a,e,h,\eta_{f,x}^S,\mathcal{S}_f^S,j)$ for single females, and by $a^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M,j)$, $l_f^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M,j)$ and $l_m^M(a,h,e,\boldsymbol{\eta},\mathcal{S}^M,j)$ for married couples., and distribution functions $\psi_j^M(a,e,h,\boldsymbol{\eta},\mathcal{S}^M)$, $\psi_{f,j}^S(a,e,h,\eta_{f,x}^S,\mathcal{S}_f^S)$, and $\psi_{m,j}^S(a,\eta_{m,z}^S,\mathcal{S}_m^S)$, such that

1. Given tax and transfer rules, and factor prices, the decisions of households are optimal.
2. Factor prices are competitively determined; i.e. $w_s = \frac{\partial F(K,L_g)}{\partial L_s}$, $w_u = \frac{\partial F(K,L_g)}{\partial L_{u,g}}$ and $r = \frac{\partial F(K,L_g)}{\partial K} - \delta_k$.
3. Factor markets clear; i.e. equations (6) and (7) hold.
4. The functions ψ_j^M, $\psi_{f,j}^S$, and $\psi_{m,j}^S$ are consistent with individual decisions, i.e. they are defined by equations (3), (4), and (5).
5. The government and social security budgets are balanced; i.e. equations (9) and (10) hold.

3 Parameter Values

In this section of the Appendix, we provide details on how we assign parameter values to the endowment, preference, and technology parameters of the benchmark economy. To this end, we use aggregate as well as cross-sectional data from multiple sources.

Heterogeneity The model period is a year. Individuals start their life at age 25 as workers and work for forty years, corresponding to ages 25 to 64. The first model period ($j = 1$) corresponds to age 25, while the first model period of retirement ($j = J_R$) corresponds to age 65. After working 40 periods, individuals retire at age 65 and live until age 80 ($J = 56$). The population grows at the annual rate of 1.1%, the average values for the U.S. economy between 1960-2000.

There are 2 education types of males. Each type corresponds to an educational attainment level: *less than college* (u), and *college or more* (s). We use the March Supplement of the CPS from 1980 to 2006 to calculate age-efficiency profiles for each male type as detailed in Section 3 of the paper. Within a skill group, efficiency levels correspond to mean weekly wage rates, which we construct using annual wage and salary income and weeks worked, normalized by the mean weekly wages for all males and females between ages 25 and 64. Figure A1 (left panel) shows the third degree polynomials that we fit to the raw wage data. In the quantitative exercises, the male efficiency units, $\varpi_m(z, j)$, correspond to these fitted values.

There are also 2 education types for females. Table A1 reports the initial (age 25) efficiency levels for females together with the initial male efficiency levels and the corresponding gender wage gap. We use the initial efficiency levels for females to calibrate their initial human capital levels, $h_1 = \varpi_f(x, 1)$. After age 25, the human capital level of females evolves endogenously according to

$$h' = \mathcal{H}(x, h, l, e) = \exp\left[\ln h + \alpha_x^e \chi(l) - \delta_x(1 - \chi(l))\right], \quad x \in X = \{u, s\},$$

where e stands for labor market experience and $\chi(.)$ is an indicator function that is 1 if hours worked are positive and zero otherwise. Parameter α_x^e is experience-skill growth rate and δ_x stands for the depreciation rate.

We calibrate the values for δ_x and α_x^e as follows. First, we select α_x^e so that if a female of a particular type works in every period, her wage profile has exactly the same shape as a male of the same type. This procedure takes the initial gender differences as given, and assumes that the wage growth rate for a female who works full time will be the same as for a male worker with the same level of experience; hence, it sets α_x^e values equal to the growth rates of male wages at each age. Figure A1 (right panel) shows the calibrated values for α_x^e. We then select two values of δ_x so that we match the level of gender gap for skilled and unskilled women by age 25-35 as closely as possible.[5]

[5] We target the gender gap in hourly wages *all* married females in the model. We impute wages for females who do not participate using a standard Heckman (1979) selection correction. For the population equation for wages, we assume a standard Mincer equation, i.e. log wages of women depend on years of education, age, and age squared. For the selection equation, we assume that the probability of participation in the labour market for a female depends on her marital status, number of children younger than age 5, and the variables in the population equation.

Demographics We determine the distribution of individuals by productivity types for each gender, i.e. $\Omega(z)$ and $\Phi(x)$, using data from the 2008 American Community Survey (ACS). For this purpose, we consider all household heads or spouses who are between ages 30 and 39 and for each gender calculate the fraction of population in each education cell. For the same age group, we also construct $M(x, z)$, the distribution of married working couples, as shown in Table A2. Given the fractions of individuals in each education group, $\Phi(x)$ and $\Omega(z)$, and the fractions of married households, $M(x, z)$, in the data, we calculate the implied fractions of single households, $\omega(z)$ and $\phi(x)$, from accounting identities (1) and (2). The resulting values are reported in Table A3. About 75% of households in the benchmark economy consist of married households, while the rest (about 25%) are single. Since we assume that the distribution of individuals by marital status is independent of age, we use the 30-39 age group for our calibration purposes. This age group captures the marital status of recent cohorts during their prime-working years, while being at the same time representative of older age groups.

Preferences and Technology There are three utility functions parameters to be determined: the intertemporal elasticity of labor supply (γ), the parameter governing the disutility of market work for males and females, B_m and B_f, and the disutility shock of market work for married females, θ. We set the Frisch elasticity parameter γ to 0.2. This value is on the low side of recent available estimates, but via other choices in our economy, the macro elasticity is broadly consistent with estimates. We set γ to 0.2. Given γ, we select the parameter B_f and B_m to reproduce average market hours per worker observed in the data, about 42.7% and 37.0% of available time for males and females in 2008.[6] Finally, the disutility shocks are specified as $\theta_L = 1 - \triangle$ and $\theta_H = 1 + \triangle$. The parameter $\triangle$ is set so as to reproduce the observed variance of log-hours of married females at age 40. As it is the standard in the literature, we select the discount factor β, so that the steady-state capital to output ratio matches the value in the data (2.93).

Utility costs associated to joint work allow us to capture the residual heterogeneity among couples, beyond heterogeneity in endowments and childbearing status, that is needed to account for the observed heterogeneity in participation choices. We assume that the utility cost parameter of joint participation is distributed according to a (flexible) gamma distribution, with parameters k_z and θ_z. Thus, conditional on the husband's type z,

$$q \sim \zeta(q|z) \equiv q^{k_z - 1} \frac{\exp(-q/\theta_z)}{\Gamma(k_z)\theta_z^{k_z}},$$

where $\Gamma(.)$ is the Gamma function, which we approximate on a discrete grid. This procedure allows us to exploit the information contained in the differences in the labor force participa-

[6] The numbers are for people between ages 25 and 54 and are based on data from the CPS. We find mean yearly hours worked by all males and females by multiplying usual hours worked in a week and number of weeks worked. We assume that each person has an available time of 5,000 hours per year.

tion of married females as their own wage rate changes with skill. In this way, we indirectly control the 'slope' of the distribution of utility costs, which is potentially key in assessing the effects of changing incentives for labor force participation.

Using the Census data, we calculate that the employment-population ratio of married females between ages 25 and 54, for each of the educational categories defined earlier.[7] Table A4 shows the resulting distribution of the labor force participation of married females by the productivities of husbands and wives for married households. The aggregate labor force participation for this group is 71.8%, and it increases from 68.2% for the unskilled group to 77.4% for the skilled. Our strategy is then to select the two parameters governing the gamma distribution, for every husband type, so as to reproduce each of the rows in Table A4 as closely as possible. This process requires estimating four parameters (i.e. a pair (θ, k) for each husband educational category). Given the estimated values for k_z and θ_z, we determine the loading factors $\vartheta_x(t_{min})$ so that the model is consistent with the participation rate of mothers by the age of their youngest child present at home, shown in Figure A2 (lef panel). To compute the participation rate of married females by skill by the age of their youngest child at home, we use data from the 2008 ACS.

Finally, we set the capital share to $\alpha = 0.343$ and the depreciation rate of capital to $\delta^k = 0.055$.[8] To select the parameter governing the elasticity of substitution, ρ, we use standard estimates of this elasticity that suggest a value of 1.5 – see Katz and Murphy (1992) and Heckman, Lochner and Taber (1998). This dictates $\rho = 1/3$. To calibrate the share parameter ξ, we force the model to reproduce the aggregate *skill premium* in the data, defined as per-worker earnings of workers in the skilled category to per-worker earnings of workers in the unskilled category. For this statistic, we target a value of 1.8.[9]

Tables A12 and A13 shows full set of parameters.

4 Children

In the model each single female and each married couple belong to one of three groups: *without* children, *early* child bearer and *late* child bearer. We use information on the age of last birth of mothers by skill to determine who is each category. The unskilled early child

[7] We consider all individuals who are *not* in armed forces.

[8] We calibrate the capital share and the depreciation rate using a notion of capital that includes fixed private capital, land, inventories and consumer durables. For the period 1960-2000, the resulting capital to output ratio averages 2.93 at the annual level. We estimate the capital share and the capital to output ratio following the standard methodology; see Cooley and Prescott (1995). The data for capital and land are from Bureau of Economic Analysis (Fixed Asset Account Tables) and Bureau of Labor Statistics (Multifactor Productivity Program Data).

[9] The empirical target for the skill premium is from our calculations using data from the 2005 American Community Survey (ACS). We restrict the sample to the civilian adult population of both sexes, between ages 25 and 54 who work full time, and exclude those who are unpaid workers or make less than half of the minimum wage. Full time workers are defined as those who work at least 35 hours per week and 40 weeks per year. We estimate a value tightly centered around 1.8, when we include self-employed individuals or not.

bearers have all children at age 1 (age 25). Skilled early-child bearers have children at age 1 (25) and at age 3 (27). Late child bearers have their children at ages 8 and 10, corresponding to ages 32 and 34. This particular structure captures the fact that births occur within a short time interval, mainly between ages 25 and 29 for unskilled households and between ages 30 and 34 for skilled households in the 2008 CPS June supplement.[10]

For singles, we use data from the 2008 CPS June supplement and calculate the fraction of 40 to 44 years old single (never married or divorced) females with zero live births. This provides us with a measure of lifetime childlessness. Then we calculate the fraction of all single women above age 25 with a total number of two live births who were below age 30 at their last birth. This fraction gives us those who are early child bearers, and the remaining fraction are assigned as late child bearers. The resulting distribution is shown in Table A5.

We follow a similar procedure for married couples, combining data from the CPS June Supplement and the U.S. Census. For childlessness, we use the larger sample from the U.S. Census.[11] The Census does not provide data on total number of live births but the total number of children in the household is available. Therefore, as a measure of childlessness we use the fraction of married couples between ages 35-39 who have no children at home.[12] Then, using the CPS June supplement we look at all couples above age 25 in which the female had a total of two live births and was below age 30 at her last birth. This gives us the fraction of couples who are early child bearers, with the remaining married couples labeled as the late ones. Table A6 shows the resulting distributions. Table A7 displays the number of children for single mothers by skill, and the corresponding ones for married couples.

Childcare Costs We use the U.S. Bureau of Census data from the Survey of Income and Program Participation (SIPP) to calibrate childcare costs. We estimate a relation that represents the relation between the average age of children at home and per-child childcare, conditional on mother's skills and marital status. We estimate:

$$\widehat{d}(x, t; mar) = a_x^{mar} + b_x^{mar} \ln(t),$$

where $mar \in \{M, S\}$ stands for marital status, and t is the average age of children at home. The childcare spending per children in the data, $\widehat{d}(x, t; mar)$, reflects effective spending, so captures differences among household in access to informal care or quality of childcare chosen. Figure A2 (right panel) shows the estimated values. Our estimates imply that

[10] The CPS June Supplement provides data on the total number of live births and the age at last birth for females, which are not available in the U.S. Census.

[11] The CPS June Supplement is not particularly useful for the calculation of childlessness in married couples. The sample size is too small for some married household types for the calculation of the fraction of married females, aged 40-44, with no live births.

[12] Since we use children at home as a proxy for childlessness, we use age 35-39 rather than 40-44. Using ages 40-44 generates more childlessness among less educated people. This is counterfactual, and simply results from the fact that less educated people are more likely to have kids younger, and hence these kids are less likely to be at home when their parents are between ages 40-44.

childcare costs are non-trivially larger for skilled mothers, while they decline fast as children age. The annual rate of decline is about 11-12% when the child age is five for skilled mothers. For unskilled mothers, the corresponding rate of decline is about 10-11%

Given the price of unskilled labor services, we recover the efficiency units required for each age in each case. That is, childcare costs of a married couple where the wife is of skill x are given by $w^u d^M(x,t) = \widehat{d}(x,t;M)$ for each t, while for a single woman are given by $w^u d^S(x,t) = \widehat{d}(x,t;S)$. The resulting values for efficiency units are scaled so that the total childcare expenditure for children between ages 0 to 5 is in line with the data. The total yearly cost for employed mothers, who have children between 0 and 5 and who make childcare payments, was about \$6,414.5 in 2005, which is about 10% of average household income. In the benchmark economy, this choice of parameter values results in 1.2% of the total labor input being used to produce childcare services. This is broadly in line with the share of employment in the childcare sector in the U.S., which was about 1.1% in 2012.[13]

5 Taxes

Income Taxes To construct income tax functions for married and single individuals, we follow Guner et al (2014) and estimate *effective tax rates* as a function of reported income, marital status and the number of children. The underlying data is tax-return, micro-data from Internal Revenue Service for the year 2000 (Statistics of Income Public Use Tax File). For married households, the estimated tax functions correspond to the legal category *married filing jointly.* For singles without children, tax functions correspond to the legal category of *single* households; for singles with children, tax functions correspond to the legal category *head of household.*[14] To estimate the tax functions for a household with a certain number of children, married or not, the sample is further restricted by the number of dependent children for tax purposes.

Since the EITC, CTC and CDCTC are explicitly modelled in the benchmark economy, we consider tax liabilities in the absence of these credits. To this end, let I stand for multiples of mean household income in the data. That is, a value of I equal to 2 implies an actual level of income that is twice the magnitude of mean household income in the data, and we denote by $\widetilde{t}(I)$ the corresponding tax liabilities after any tax credits. Tax credits reduce the tax liability first to zero and if there is any refundable credit left, the household receives a transfer. Let $credit(I)$ be the total credits without any refunds, which we can identify in the

[13] Total employment in childcare services (NAICS 6244) was about 1.6 million in 2012. This number is the sum of total paid employment and the number of establishments without paid employees. See http://thedataweb.rm.census.gov/TheDataWeb_HotReport2/econsnapshot/2012/snapshot.hrml?NAICS=6244.

[14] We use the 'head of household' category for singles with children, since in practice it is clearly advantageous for most unmarried individuals with dependent children to file under this category. For instance, the standard deduction is larger than for the 'single' category, and a larger portion of income is subject to lower marginal tax rates.

IRS micro tax data. Taxes in the absence of credits is then given by $t(I) = \widetilde{t}(I) + credit(I)$. The incomes tax functions, i.e. $T^S(I,k)$ and $T^M(I,k)$,take the following form

$$\tau(I) = 1 - \lambda I^{-\tau},$$

where I is measured in multiples of mean household income, $\tau(I)$ is the average tax rate, parameter τ determines the progressivity of taxes and λ determines the taxes at the mean household income ($I = 1$). Parameters τ and λ depend on marital status and the number of children. The total tax liabilities amount to $\tau(I) \times I \times$ *mean household income*.

Estimates for λ and τ are contained in Table A8 for different tax functions we use in our quantitative analysis. Given the number of children that different types of households have in Table A7, we estimate tax functions for households with zero, two and three children. We then round the number of children from Table A7 to the nearest integer and assign the appropriate tax function to each household. Figure A3 (left panel) displays estimated average and marginal tax rates for different multiples of household income for married and single households with two children. Our estimates imply that a married household with two children at around mean income faces an average tax rate of about 9.2% and marginal tax rate of 14.6%. As a comparison, a single household with two children around mean income faces average and marginal tax rates of 7.73% and 10.96%, respectively. At twice the mean income level, the average and marginal rates for a married household amount to 12.89% and 18.09%, respectively, while a single household at the mean income level has an average tax rate of 9.95% and a marginal tax rate of 13.11%.

Social Security and Capital Taxation We calculate $\tau_p = 0.086$, as the average value of the social security contributions as a fraction of aggregate labor income for 1990-2000 period.[15] Using the 2008 ACS, we calculate total Social Security benefits for all single and married households.[16] Tables A9 and A10 show Social Security benefits, normalized by the level corresponding to single males of the lowest type, $p_m^S(z_1)$. We treat $p_m^S(z_1)$ as a free parameter, and determine all other benefit levels according to Tables A11 and A12. Then, given τ_p, choose $p_m^S(z_1)$ to balance the budget for the social security system. Hence, while the relative values social security benefits come from the data, the absolute level of one, $p_m^S(z_1)$, is adjusted to balance the budget of the system. The implied value of $p_m^S(x_1)$ for the benchmark economy is about 18.1% of the average household income in the economy.

We use τ_k to proxy the U.S. corporate income tax. We estimate this tax rate as the one that reproduces the observed level of tax collections out of corporate income taxes after the

[15]The contributions considered are those from the Old Age, Survivors and DI programs. The Data comes from the Social Security Bulletin, Annual Statistical Supplement, 2005, Tables 4.A.3.

[16]Social Security income is all pre-tax income from Social Security pensions, survivors benefits, or permanent disability insurance. Since Social Security payments are reduced for those with earnings, we restrict our sample to those above age 70. For married couples we sum the social security payments of husbands and wives.

major reforms of 1986. Such tax collections averaged about 1.92% of GDP for 1987-2000 period. Using the technology parameters we calibrate in conjunction with our notion of output (business GDP), we obtain $\tau_k = 0.097$.

6 Welfare State

Transfers, $TR^S_f(I,k,D), TR^S_m(I)$, and $TR^M(I,k,D)$, consist of three components. The first component is the Earned Income Tax Credit (EITC). The second part is child-related transfers, which consists of Child Tax Credit (CTC), the Child and Dependent Care Tax Credit (CDCTC), and childcare subsidies. The final component is the means-tested transfers.

Earned Income Tax Credits (EITC) The Earned Income Tax Credit is a fully refundable tax credit that subsidizes low income working families. The EITC amounts to a fixed fraction of a family's earnings until earnings reach a certain threshold. Then, it stays at a maximum level, and when the earnings reach a second threshold, the credit starts to decline, so that beyond a certain earnings level the household does not receive any credit. The amount of maximum credits, income thresholds, as well as the rate at which the credits declines depend on the tax filing status of the household (married vs. single) as well as on the number of children. To qualify for the EITC, the capital income of a household must also be below a certain threshold, which was \$2,650 in 2004. In 2004, for a married couple with 0 (2 or 3) children, the EITC started at \$2 (\$10) and increased by 7.6 (39.9) cents for each extra \$ in earnings up to a maximum credit of \$3,900 (\$4,300). Then the credit stays at this level until the household earnings are \$7,375 (\$15,025). After this level of earnings, the credit starts declining at a rate of 7.6 (21) cents for each extra \$ in earnings until it becomes zero for earrings above \$12,490 (\$35,458). The formulas for a single household with 0 (2 or 3) children are very similar. We calculate the level of $EITC$ as a function of earnings with the following formula,

$$\begin{aligned} EITC &= \max\{CAP\text{-}\max\{slope_1 \times (bend_1 - earnings), 0\} \\ &\quad - \max\{slope_2 \times (earnings - bend_2), 0\}, 0\}, \end{aligned}$$

where CAP, the maximum credit level, $bend_1$ and $bend_2$, the threshold levels, and $slope_1$ and $slope_2$, the rate at which credit increase and decline are given by (as a fraction of mean household income in 2014):

	CAP	$slope_1$	$bend_1$	$slope_2$	$bend_2$
Married					
No ch.	0.006	0.076	0.085	0.076	0.122
2 or 3 ch.	0.071	0.399	0.178	0.21	0.248
Single					
No ch.	0.006	0.076	0.085	0.076	0.105
2 or 3 ch.	0.071	0.399	0.178	0.21	0.232

Figure A4 (left panel) shows the EITC as a function of household income and the tax filing status.

Child Tax Credits We also model the Child Tax Credits (CTC), or simply *child credits*, as closely as possible to how they are present in the U.S. tax code. Child credits operate as a means-tested transfer to households with children. If a household's income is below a certain limit, $\widehat{I}_{CTC}$, then the potential credit is $d_{CTC} = \$1,000$ per child in 2004. If the household income is above the income limit, then the credit amount declines by 5% for each additional dollar of income. In the current tax code, $\widehat{I}_{CTC}$ is \$110,000 for a married couple and \$75,000 for singles. As a result, a married couple with two children whose total household income is below \$110,000 has a potential child credit of \$2,000, a household with two children whose total household income is \$120,000 can only get \$1,500. The child credit becomes zero for married couples (singles) whose total household income is above \$150,000 (\$115,000). As the CTC is not fully refundable, the actual CTC that a household gets depends on the total tax liabilities of the household and other child-related credits that the household might qualify.

For a household with income level I (again indicated as a multiple of mean household income in the economy) and k children, the *potential CTC* is given by

$$CTC_{potential}(I) = \max\{[k \times 0.0165 - \max(I - \widehat{I}_{CTC}, 0) \times 0.05], 0\}, \tag{11}$$

with

$$\widehat{I}_{CTC} = \begin{cases} 1.819, & \text{if married filing jointly} \\ 1.240, & \text{if single} \end{cases},$$

where again the maximum amount of credit per child, 0.0165, and income limits, 1.819 and 1.240, are in multiples of mean household income in the U.S. in 2004. Both the CTC and the CDCTC are *non-refundable*, as a result, how much of the potential credit a household actually gets depends on its total tax liabilities and total tax credits (CTC plus CDCTC). Let $Credit_{potential}(I) = CTC_{potential}(I) + CDCTC_{potential}(I)$ and $Taxes(I)$ be the total potential tax credits and the tax liabilities of the household. Then,

$$CDCTC_{actual}(I) = \begin{cases} CDCTC_{potential}(I), \text{ if } Taxes(I) > Credit_{potential}(I) \\ \max\{Taxes(I) - CDCTC_{potential}(I), 0\}, \text{ if } Taxes(I) < Credit_{potential}(I) \\ \qquad \text{and } CDCTC_{potential}(I) > Taxes(I) \\ \\ CDCTC_{potential}(I), \text{ if } Taxes(I) < Credits_{potential}(I) \\ \qquad \text{but } CDCTC_{potential}(I) < Taxes(I) \end{cases},$$

and

$$CTC_{actual}(I) = \begin{cases} CTC_{potential}(I), \text{ if } Taxes(I) > Credits_{potential}(I) \\ 0, \text{ if } Taxes(I) < Credits_{potential}(I) \\ \qquad \text{and } CDCTC_{potential}(I) > Taxes(I) \\ \\ Taxes(I) - CDCTC_{potential}(I), \text{ if } Taxes(I) < Credits_{potential}(I) \\ \qquad \text{but } CDCTC_{potential}(I) < Taxes(I) \end{cases}$$

Hence, if the tax liabilities of a household are larger than the total potential credit implied by the CTC and the CDCTC, the household receives the full credit and its tax liabilities are reduced by $CTC_{potential} + CDCTC_{potential}$. If the total potential credits are larger than tax liabilities, then the household only receives a credit up to its tax liabilities. As a result, the households with low tax liabilities do not benefit from the CTC or CDCTC. This is partially compensated by the Additional Child Tax Credit (ACTC), which gives a household additional tax credits if its potential child tax credit is higher than the actual child tax credits it receives. In order to qualify for the ACTC, however, a household must have earnings above $10,750. Thus, a household with very low earnings does not qualify for the ACTC. Given CTC_{actual} and CTC_{credit}, the ACTC is calculated as

$$ACTC(I) = \begin{cases} \min\{\max[(earnings - 0.178), 0] * 0.15, CTC_{potential}(I) - CTC_{actual}(I)\} \\ \qquad \text{if } CTC_{actual}(I) \leq CTC_{credit}\ (I) \\ 0, \text{ otherwise} \end{cases}.$$

Childcare Credits All households with positive income can qualify for the Child and Dependent Care Tax Credit (CDCTC), or, as we refer in the paper, for *childcare credits*. We model these credits as closely as possible to the tax code. Potential childcare credits are calculated in two steps, using the total childcare expenditures of the household, a cap, and rates that depend on household income. First, for each household, a childcare expenditure that can be claimed against credits is calculated. This expenditure is simply the minimum of the earnings of each parent in the household, a cap and actual childcare expenditures. The cap is set $3,000 and $6,000 for households with one child and with more than one child in 2004. Second, each household can claim a certain fraction of this qualified expenditure as a tax credit. This fraction starts at 35%, and declines by household income by 1% for each $2,000 above $15,000 until it reaches 20%, and then remains constant at this level.

We model the childcare credits (CDCTC), child credits (CTC) as well as the Earned Income Tax Credit (EITC) as they appear in 2004 tax code. Since we represent all variables as a fraction of mean household income, in the absence of any change in the tax code, the reference year is not critical. While there were temporary changes in the tax code during the Great Depression, the only major permanent change has been the 2017 Tax Cuts and Jobs Act.

For a married couple with k children, the qualified expenditure is calculated as follows

$$\text{Expense } = min\{d_{CDCTC} \times \min\{k, 2\}, earnings_1, earnings_2, d\},$$

where $earnings_1$ and $earnings_2$ are the earnings of the household head and his/her spouse and d is the child care expenditure (net of any childcare subsidy that a household might qualify). Note that a married couple household can have qualified expenses only if both the husband and the wife have non-zero earnings. The child care expenditures for the calculation of the childcare credits are capped at d_{CDCTC} per child per year, with a maximum of $2 \times d_{DCCTC}$.

For a single female household, the equivalent formula is given by

$$\text{Expense } = min\{d_{CDCTC} \times \min\{k, 2\}, earnings, d\}.$$

In 2004, d_{CDCTC} was \$3,000, i.e. maximum qualified expenditure for households with more than 1 child was capped at \$6,000. In multiples of mean household income in the U.S. (\$60,464 in that year), d_{CDCTC} was equal to 0.0496, i.e. about 5% of mean household income in the US. A household, however, only receives a fraction $\theta_{CDCTC}(I)$ of qualified expenses. The rate, θ_{CDCTC}, is a declining function of household income. It is set at 35% for households whose income is below \$15,000 ($\widehat{I}_{CDCTC}$), and after this point the rate declines by 1% for each extra \$2,000 that the household earns down to a minimum of 20%. Hence, the potential $CDCTC$ that a household can receive is then given by

$$CDCTC_{potential}(I) = \text{Expense} \times \theta_{CDCTC}(I), \tag{12}$$

with

$$\theta_{CDCTC}(I) = \begin{cases} 0.35, \text{ if } I \leq \widehat{I}_{CDCTC} \\ 0.35 - \min\{[\text{integer}(\frac{I-\widehat{I}_{CDCTC}}{0.033}) + 1] \times 0.01, 0.15\}, \text{ otherwise} \end{cases},$$

where $\widehat{I}_{CDCTC}$ is equal to 0.248 is in multiples of mean household income in the U.S. in 2004. Figure A4 (right panel) illustrates the sum of $CDCTC_{potential}(I)$ and $CTC_{potential}(I)$.[17]

[17] The simulations for $CDCTC_{potential}(I)$ in Figure A4 are done under the assumption th at at each income level, the husband and the wife earns 60% and 40% of the household income, respectively, and the households spend 10% of their income on childcare.

Childcare Subsidies We assume that the childcare subsidies in the model economy reflect the childcare subsidies provided by the Children Child Care and Development Fund (CCDF) in the US. In 2010, about 1.7 million children (ages 0-13) were served by CCDF. This is about 5.5% of all children (ages 0-13) in the US. In 2010, the average household income of households that received childcare subsidy was about $19,000. About 74% of families who receive childcare subsidies from CCDF made co-payments , and co-payments were about 6% of family income. If we take $19,000 as average income of subsidy receivers, this amounts to a co-payment of 1,140 dollars per year. In 2010, the average monthly payment for childcare providers (including the co-payment by the families) was about $400 per month or $4,800 a year. Hence about 24% of total payments $(1,140/4,800)$ came from households, while the remaining 76% are subsidies. In our calibration we simply set $\theta = 0.75$ and set $\widehat{I}$ such that the poorest 5.5% of families with children receive a subsidy from the government. This procedure sets $\widehat{I}$ at about 15.8% of mean household income in the benchmark economy. In the main policy experiments that we consider, we make the childcare subsides universal by setting $\widehat{I}$ to an arbitrarily large number.

Means-Tested Transfers We use the 2004 wave of the Survey of Income and Program Participation (SIPP) to approximate a welfare schedule as a function of labor earnings for different household types. The sample of household heads aged 25-54 spans 876,277 observations across 24,392 households. Per household there are between 1 and 48 monthly observations with an average of nearly 36 monthly observations per household. The SIPP is a panel surveying households every three months retrospectively for each of the past three months. We compute the average amount of monthly welfare payments and monthly labor earnings, both corrected for inflation, for each household. The welfare payments include the following main means-tested programs: Supplemental Social Security Income (SSI), Temporary Assistance for Needy Families (TANF formerly AFDC), Supplemental Nutrition Assistance Program (SNAP formerly food stamps), Supplemental Nutrition Program for Women, Infants, and Children (WIC), and Housing Assistance.[18] We then estimate an "effective transfer function" (conditional on marital status and the number of children). We assume that these functions take the following form

$$W(I) = \begin{cases} \omega_0 \text{ if } I = 0 \\ \max\{0, \omega_1 - \omega_2 I\} \text{ if } I > 0 \end{cases},$$

where ω_0 is the transfers for a household with zero income and ω_2 is the benefits reduction rate. In order to determine ω_0, we simply calculate the average amount of welfare payments for households with zero non-transfer income. Then we estimate an OLS regression of welfare

[18] The SIPP only provides the information of whether a household receives Housing Assistance, but does not contain information on actual payments. We use the methodology of Scholz, Moffitt and Cowan (2009) to impute Housing Assistance reception. For all other transfer programs, the SIPP provides information on the actual amount received.

payments on household non-transfer income to determine α_0 and α_1. In Table A11 shows the estimated values of ω_0, α_1 and α_2 by marital status and the number of children. Figures A3 (left panel) shows the welfare payments as a function of household income for married and single female households, respectively.

References

[1] Center on Budget and Policy Priorities. 2017. *Policy Basics: Special Supplemental Nutrition Program for Women, Infants, and Children.* Priorities, Washington, DC.

[2] Center on Budget and Policy Priorities. 2020. *A Quick Guide to SNAP Eligibility and Benefits.* Center on Budget and Policy Priorities, Washington, DC.

[3] Congressional Budget Office (CBO). 2013. *Growth in Means-Tested Programs and Tax Credits for Low-Income Households.* Congressional Budget Office, Washington DC.

[4] Cooley, Thomas F. and Edward C. Prescott. 1995., "Economic Growth and Business Cycles" in *Frontiers of Business Cycle Research*, pages 1-18, Thomas F,. Cooley (ed.), Princeton University Press, Princeton: New Jersey.

[5] Guner, Nezih, Kaygusuz, Remzi and Gustavo Ventura. 2014. "Income Taxation of U.S. Households: Facts and Parametric Estimates," *Review of Economic Dynamics* 17(4): 559-581.

[6] Heckman, James J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* vol. 47(1): 153-161.

[7] Heckman, James, Lance Lochner and Christopher Taber. 1998. "Explaining Rising Wage Inequality: Explorations With A Dynamic General Equilibrium Model Of Labor Earnings With Heterogeneous Agents," *Review of Economic Dynamics* 1(1): 1-58.

[8] Mazzara, A. 2017. *Federal Rental Assistance Provides Affordable Homes for Vulnerable People in All Types of Communities.* Center on Budget and Policy Priorities, Washington, DC.

[9] Scholz, John Karl, Robert Moffitt, and Benjamin Cowan. 2009. "Trends in Income Support," in *Changing Poverty, Changing Policies*, pages 203-241, M. Cancian and S. Danziger (editors), Russell Sage Foundation, New York: New York.

[10] Social Security Administration. 2020. *Annual Report of the Supplemental Security Income Program.* Social Security Administration, Baltimore, MD.

Table A1: Initial Productivity Levels, by Type and Gender

	$\varpi_m(1,z)$	$\varpi_f(1,x)$	$\varpi_f(1,x)/\varpi_m(1,z)$
Skilled	0.95	0.83	0.88
Unskilled	0.73	0.58	0.80

Note: Entries are the productivity levels of males and females, ages 25, using 1980-2006 data from the CPS March Supplement. These levels are constructed as weekly wages for each type –see text for details.

Table A2: Distribution of Married Working Households by Type

	Females	
Males	Unskilled	Skilled
Unskilled	51.37	12.81
Skilled	8.93	26.90

Note: Entries show the fraction of marriages out of the total married pool, by wife and husband educational categories. The data used is from the 2008 ACS, ages 30-39. Entries add up to 100 –see text for details.

Table A3: Fraction of Agents by Type, Gender and Marital Status

	Males			Females		
	All	Married	Singles	All	Married	Singles
Unskilled	65.38	48.19	17.19	62.23	44.03	18.21
Skilled	34.62	26.51	8.11	37.77	29.10	8.66

Note: Entries show the fraction of individuals in each educational category, by marital status, constructed under the assumption of a stationary population structure –see text for details.

Table A4: Labor Force Participation of Married Females, 25-54

	Females	
Males	Unskilled	Skilled
Unskilled	69.1	85.2
Skilled	64.8	73.3

Note: Each entry shows the labor force participation of married females ages 25 to 54, calculated from the 2008 ACS. The outer row shows the weighted average for a fixed male or female type.

Table A5: Childbearing Status, Single Females

	Childless	Early	Late
Unskilled	29.27	57.42	13.31
Skilled	54.63	28.17	17.20

Note: Entries show the distribution of childbearing among single females, using data from the CPS-June supplement. See text for details.

Table A6: Childbearing Status, Married Couples

Childless			Early		
	Females			Females	
Male	Unskilled	Skilled	male	Unskilled	Skilled
Unskilled	9.22	13.17	Unskilled	63.46	40.58
Skilled	9.89	11.51	Skilled	45.88	26.95

Note: Entries show the distribution of childbearing among married couples. For childlessness, data used is from the U.S. Census. For early childbearing, the data used is from the CPS-June supplement. Values for late childbearing can be obtained residually for each cell. See text for details.

Table A7: Fertility Differences

Singles		Married		
			Females	
		Male	Unskilled	Skilled
Unskilled	2.21	Unskilled	2.34	2.05
Skilled	1.82	Skilled	2.33	1.98

Note: Entries show, conditional on having children, the total number of children different types of households have by age 40-44. The authors' calculations from the 2008 CPS-June supplement. See text for details.

Table A8: Tax Functions

Estimates	Married		Single	
	(no child)	(2 child.)	(no child)	(2 child.)
λ	0.9024	0.9078	0.8815	0.9227
τ	0.0569	0.0596	0.0356	0.0351

Note: Entries show the parameter estimates for the postulated tax function. These result from regressing effective average tax rates against household income, using 2000 micro data from the U.S. Internal Revenue Service. For singles with two children, the data used pertains to the 'Head of Household' category – see text for details.

Table A9: Social Security Benefits, Singles

	Male	Female
Unskilled	1	0.888
Skilled	1.166	0.995

Note: Entries show Social Security benefits, normalized by the mean Social Security income of the lowest type male, using data from the 2008 ACS. See text for details.

Table A10: Social Security Benefits, Married Couples

	Females	
Males	Unskilled	Skilled
Unskilled	1.764	1.911
Skilled	1.981	2.093

Note: Entries show the Social Security income, normalized by the Social Security income of the single lowest type male, using data from the 2008 ACS. See text for details.

Table A11: Welfare System

Estimates	Married		Single Female		Single Male
	(no child)	(2 child.)	(no child)	(2 child.)	(no child)
ω_0	0.063	0.090	0.090	0.116	0.075
ω_1	0.023	0.043	0.044	0.101	0.032
ω_2	-0.017	-0.033	-0.042	-0.091	-0.028

Note: Entries correspond to the parameters summarizing our description of a host of transfer and social insurance programs ('welfare system'). Data comes from the 2004 wave of the SIPP. See text for details.

Table A12: Parameter Values - Idiosyncratic Shocks

Statistic	Permanent Shocks	Persistent Shocks
Variance Single Skilled Males	0.281	0.0042
Variance Single Unskilled Males	0.244	0.0066
Variance Single Skilled Females	0.226	0.0020
Variance Single Unskilled Females	0.226	0.0015
Variance Married Skilled Males	0.230	0.0036
Variance Married Unskilled Males	0.230	0.0061
Variance Married Skilled Females	0.220	0.0008
Variance Married Unskilled Females	0.228	0.0021
Covariance (male, female)	0.047	0.0010

Note: Entries are the variances of permanent and persistent innovations, by marital status, gender and skill. For married individuals, we covariances reported are independent of skill as assumed. See text for details.

Table A13: Parameter Values

Parameter	Value	Comments
Population Growth (n)	0.01	U.S. Data
Discount Factor (β)	0.982	Calibrated - matches K/Y
Labor Supply Elasticity (γ)	0.2	Literature estimates.
Disutility from work, (B_f, B_m)	82.15, 28.67	Calibrated
Preference Shock $\theta = 1 \pm \triangle$	1 ± 0.88	See text – Matches variance log hoursat age 40
Skill depreciation, females (δ_x)	0.025, 0.056	Calibrated
Growth of skills (α_x^e)	-	See text - CPS data
Distribution of utility costs $\zeta(.\|z)$ (Gamma Distribution)	-	See text - matches LFP by education conditional on husband's type
Loading Factor $\vartheta_x(t_{\min})$	-	See text – matches LFP by age of youngset child
Capital Share (α)	0.343	Calibrated
Skilled Labor Share (ν)	0.513	Calibrated
Substitution Elasticity (ρ)	1/3	Literature estimates
Depreciation Rate (δ_k)	0.055	Calibrated
Childcare costs for single females, $d^S(x,t)$	-	See text - matches expenditure by age, and skills.
Childcare costs for married females $d^M(x,t)$	-	See text - matches expenditure by age, and skills.
Tax functions $T^M(I,k)$ and $T^S(I,k)$	-	See Appendix - IRS Data
Transfer functions $TR^M(I,k)$,	-	See text and Appendix
$TR_f^S(I,k)$ and $TR_m^S(I,k)$	-	
Payroll Tax Rate (τ_p)	0.086	See Appendix
Social Security Incomes,	-	See Appendix - U.S. Census
$p_m^S(z)$, $p_f^S(x)$ and $p^M(x,z)$	-	
Capital Income Tax Rate (τ_k)	0.097	See Appendix - matches corporate tax collections

Note: Entries show parameter values together with a brief explanation on how they are selected. Values for the population growth rate, the discount factor and depreciation rates are at the annual level. See text and Appendix for details.

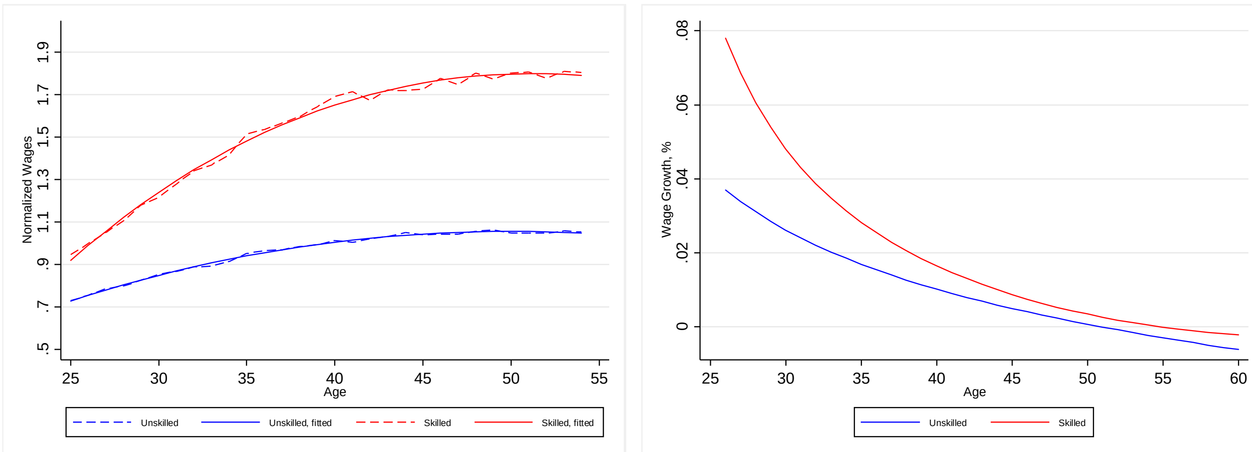

Figure A1 - Age-Labor Productivity Profiles, Males (left);
Female Human Capital Growth (right)

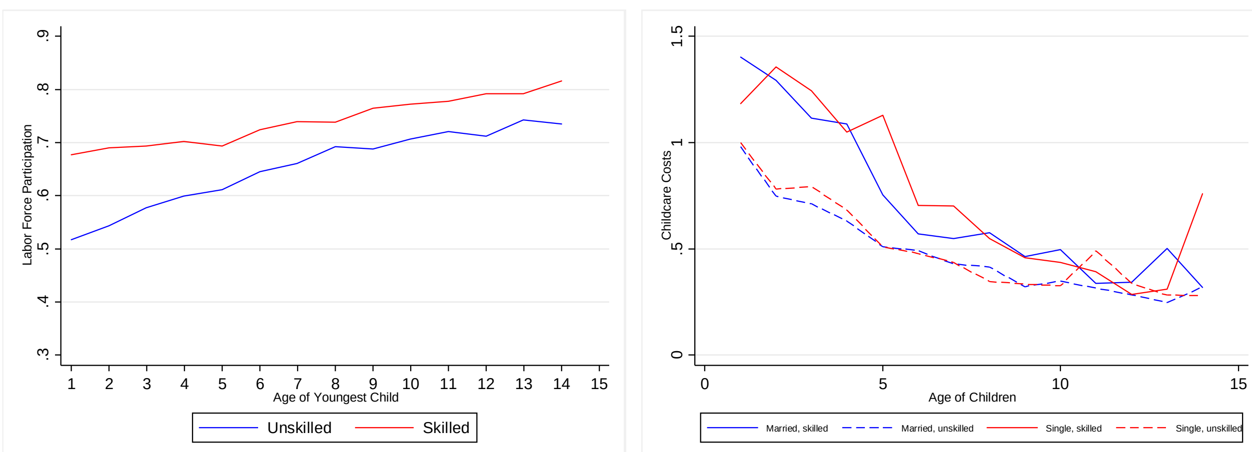

Figure A2 - LFP of Mar. Females, by age of the youngest child (left);
Childcare Costs per Child (right)

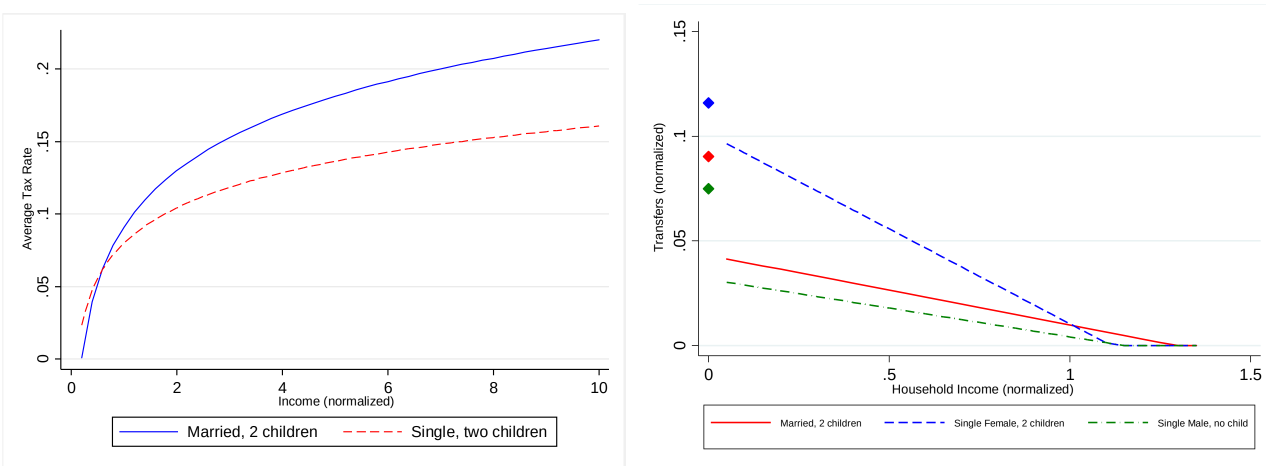

Figure A3 - Average Taxes (left); Welfare Payments (right)

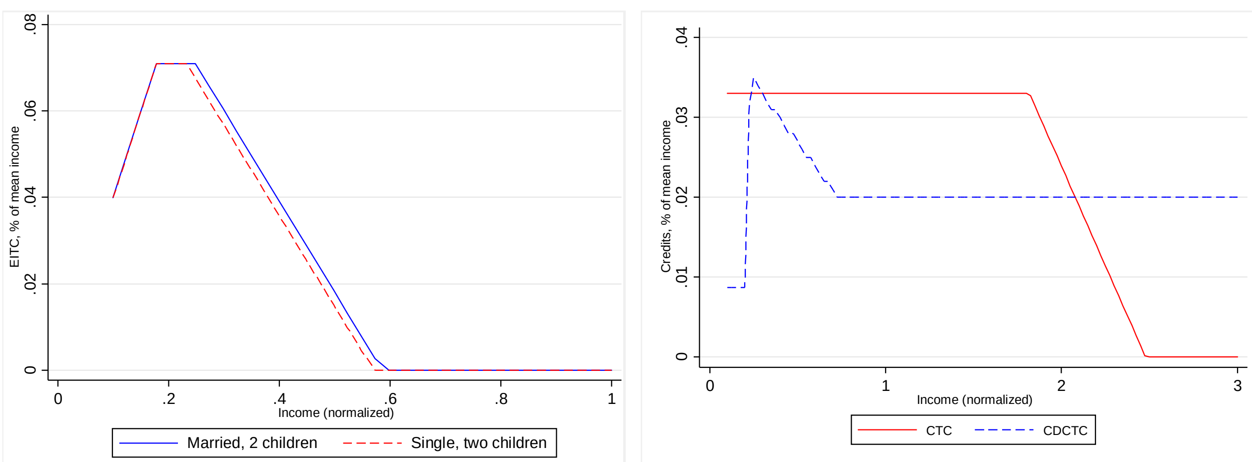

Figure A4 - The Earned Income Tax Credit (left); Potential CTC and CDCTC (right)