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The U.S. tax-transfer system and low-income households: Savings, labor supply, and household formation [☆]

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ABSTRACT

Eligibility and benefits for anti-poverty income transfers in the U.S. are based on both the means and the household characteristics of applicants, such as their filing status, living arrangement, and marital status. In this paper we develop a dynamic structural model to study the effects of the U.S. tax-transfer system on the decisions of non-college-educated workers with children. In our model workers face uninsurable idiosyncratic risks and make decisions on savings, labor supply, living arrangement, and marital status. We find that the U.S. anti-poverty policy distorts the cohabitation/marriage decision of single mothers, providing incentives to cohabit. We also find quantitatively important effects on savings, and on the labor supply of husbands and wives. Namely, the model yields a U-shaped relationship between the earnings of one spouse and the labor supply of the other spouse, a result that we also find in the data. We show that these U-shaped relationships stem in part from the current design of anti-poverty income programs, and that the introduction of an EITC deduction on the earnings of secondary earners—as proposed in the 21st Century Worker Tax Cut Act—would increase the employment rate of the spouses of workers earning between $15K and $35K, especially of female spouses.

1. Introduction

The U.S. federal government spent about $264 billion on mandatory means-tested income security programs in 2019.[2] The bulk of the tax credits and income transfer programs to assist low-income households are not only earnings-, income- and assets-tested, but they also depend on the living arrangement and the filling and marital status of applicants. In this paper we assess the effects of the U.S. tax-transfer system on low-income households along the following response margins: consumption/savings; labor supply; living arrangement; and marital status. We measure effects that have not been sufficiently examined within the framework of structural models of household decision making, especially the effects on cohabitation versus marriage, and on the labor supply of husbands and wives.

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2 This total does not include amounts that reduce tax receipts. See Congressional Budget Office: https://www.cbo.gov/system/files/2019-06/55347-MeansTested.pdf.

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To this end, we develop a dynamic model for non-college-educated workers with children. Workers, females and males, receive uninsurable idiosyncratic shocks to their labor productivity. In addition, adult females are also subject to fertility shocks; they choose consumption, savings, labor supply, and whether or not to form a two-adult household provided they have an offer from a male. When a two-adult household is formed, either as cohabitants or as a married couple, they are assumed to share risks (intra-household risk sharing) and to solve a joint decision problem. Cohabiting couples get married as soon as they are better off than under cohabitation. The endogenous choices of both the living arrangement and marital status allow us to assess how tax-transfer reforms shape the composition of the population by household type: single mothers, cohabiting couples, and married couples.[3] We embed in the model the federal individual income taxes, payroll taxes, two federal tax credits—the Child Tax Credit (CTC) and the Earned Income Tax Credit (EITC)—and two income assistance programs—the Temporary Assistance for Needy Families (TANF) and the Supplemental Nutrition Assistance Program (SNAP).[4] We model these tax-transfer programs introducing all the kinks and non-convexities stemming from means testing, as well as the different treatment of applications based on living arrangement and filing status. We calibrate the model to match moments from a sample of 3,945 one- and two-adult households with children formed by non-college-educated workers. Our sample of households is drawn from the 2014 Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS). We first use the model to assess the impact of the incentives and disincentives introduced by the tax-transfer programs on the decisions of households across the stationary distribution of the model. Then, we evaluate a reform of the EITC along the lines proposed in the “21st Century Worker Tax Cut Act”, a legislative proposal introduced to the 113th Congress on March 26, 2014. The Act proposed the introduction of a new EITC deduction on the earnings of the secondary earner in a married couple.

We find important effects on labor supply. While some are in line with those found in previous studies, the new endogenous margins introduced in our model allow us to identify effects of the tax-transfer system that have been overlooked in previous structural models. As an example of the former, we find that the U.S. tax-transfer system provides strong incentives to work for lone mothers. In the stationary solution of our model, a low productive, working lone mother of two children gets a working subsidy of about 15 percent of her earnings. Overall, our model yields a lone mothers’ participation elasticity of 0.63, which is in line with values estimated in the empirical literature.[5] The new labor supply effects identified in our model result from joint decision making within two-adult households. For example, since taxes and transfers for married couples are based on family earnings, and transfer programs contain phase-in and phase-out regions, a hump-shaped relationship emerges between the earnings of a married parent and the employment tax rate of his/her spouse. Similarly, a worker’s marginal tax rate varies with his/her spouse’s earnings. As a result, the joint determination of the labor supply of husbands and wives creates U-shaped relationships between the earnings of a married parent and the employment rate and work hours of his/her spouse. Neglecting joint decision making within two-adult households would result in an underestimation of the effects of public assistance reforms.[6] In Section 2 of this paper we use a sample of non-college-educated married couples with children drawn from the ASEC, and present evidence of a statistically significant, U-shaped relationship between husbands’ earnings and their wives’ employment rate, like the one generated by our model.

Our model finds that the current tax-transfer system has marriage disincentives for most non-college educated households with children. By design, the only difference between cohabitation and marriage in our model is the tax-transfer system they face. This allows us to assess how taxes and transfers shape lone mothers’ decisions regarding cohabitation and marriage, as well as the decision of cohabiting couples regarding their marital status. For lone mothers, a two-adult household brings both insurance (risk sharing) and economies of scale, but also a change in taxes and transfers, so her choice of the living arrangement will depend on her own wealth and labor productivity, and on her suitor’s wealth and productivity. Overall, we find that the current tax-transfer system provides incentives to cohabit: Most lone mothers are more likely to accept a cohabiting offer than a marriage offer. Only those with very low labor productivity are more likely to accept marriage than cohabitation when the offer comes from the father of her children. Since the U.S. tax-transfer system exhibits a differential treatment of cohabiting couples where the male is the biological father of the children and of those where he is not, we model both types of cohabiting couples.[7] We find marriage acceptance rates that are up to 15 percentage points lower than cohabitation acceptance rates among lone mothers. TANF introduces important disincentives to marry for lone mothers. We find that removing TANF would increase marriage, at the cost of cohabitation, especially among lone mothers with low labor productivity. Low-income cohabiting couples also face disincentives to marry, especially those where both members of the couple work. For instance, since the EITC for married couples is based on family earnings, the within-couple distribution of potential earnings ability is a key determinant of the marriage bonus/penalty. Under

[3] For the rest of the paper, we will refer to single mothers as “lone mothers” to emphasize that there is no partner or a family member in the house helping them to bring up their children (beyond child support). This will make clearer the distinction between these latter mothers and non-married, cohabiting mothers.

[4] These are the largest means-tested income programs to assist low-income households with children. To be consistent with our focus on income programs, against non-income programs like for instance Medicaid, agents in our model are subject to income shocks but not to health shocks.

[5] There is a vast empirical literature that has estimated the behavioral responses to income transfers, especially on the labor supply of single mothers. See, e.g., Eissa and Hoynes (2006) for a survey of this literature.

[6] The role of joint household decision making in accounting for international differences in married couples’ labor supply has been studied by Bick and Fuchs-Schündeln (2018). Guner et al. (2012), using a model with joint decision making calibrated to the U.S. economy, find that separate tax filling would increase the labor supply of married females.

[7] For more details on the biological distinction in welfare rules see Moffitt et al. (2020).

the current tax-transfer system, we find that most low-income two-earner couples are better off as cohabitants, and that transitions from cohabitation to marriage are mostly chosen by couples where the female does not work. Removing the EITC from the tax-transfer system would yield a marked increase in marriage rates, especially among low-income working couples. This result is consistent with reduced-form empirical evidence on the marriage effects of the EITC. For instance, expansions in the EITC have been shown to yield a decline, although small, in new marriages (Rosenbaum, 2000; Eissa and Hoynes, 2003; Herbst, 2011).

Finally, we find sizable effects of the tax-transfer system on savings. The two tax credits—the EITC and the refundable part of the CTC—contain investment income limits; however, distortions to savings spring mainly from the TANF and SNAP asset limits. There is substantial variation in asset limits across U.S. states, ranging from $1K to no limits. In our model we use a $2K asset limit, which is the national weighted median value, and show that there is bunching at this threshold among lone mothers in the stationary solution of the model. This implies that asset limits contribute to crowding out household self-insurance through savings. (See Hubbard et al., 1995 for early work showing that asset-based social insurance discourages saving.)

In our assessment of the EITC deduction on the earnings of secondary earners proposed by the "21st Century Worker Tax Cut Act" for married couples, we find that it flattens the U-shaped relationship between one spouse's earnings and the other spouse's employment rate. A 50 percent deduction increases the average employment rate of both husbands and wives (1.3 and 6.9 percent, respectively), and the fraction of two-earner married households by 10 percent. However, it decreases their hours worked by 0.9 and 1.4 percent, respectively. The deduction also affects the choice of the living arrangement by increasing the marriage rate, thus reducing the population shares of lone mothers and cohabiting couples. The cost of this new deduction to the government is about $36 per household in the population of non-college-educated workers with children.

Our paper is related to a growing literature that uses structural models to study the effects of the tax-transfer system on household decisions. Instead of providing an exhaustive review of this literature, we simply highlight how our work complements previous lines of research. Greenwood et al. (2000) present a highly stylized model of labor supply, marriage, and fertility and find that welfare reduces marriage. In their framework, only single mothers receive welfare, and taxes are lump sum. The model abstracts from a consumption/savings decision and from cohabitation. Keane and Wolpin (2010) study how government income transfers interact with preference heterogeneity and labor and marriage opportunities in accounting for the observed differences in the behavior of black, Hispanic and white young women. They find important differences in the structural parameters across these three groups, including differences in their preferences for marriage. Welfare transfers are found to augment the differences in employment between whites and minorities created by the structural parameters. Their model abstracts from a consumption/savings decision and cohabitation, and assumes that upon marriage husbands remain unresponsive to household conditions. Chan (2013) develops a model for the labor supply and program participation of single mothers. He uses the model to estimate the contributions of policy and the economy to the observed increase in their labor supply from 1992 to 1999, a period of important welfare reforms and high economic growth. Policy is found to explain only 15 percent of the increase, while the economy explains 50 percent. The model does not include a consumption/savings decision and abstracts from opportunities to form two-adult households. Athreya et al. (2014) and Koşar (2019) introduce a consumption/savings decision in their models to study the effects of the EITC on the labor supply and human capital accumulation of single mothers. They do not, however, allow for cohabitation or marriage. Blundell et al. (2016) also consider endogenous savings in their study of the effects of the Income Support Program and the Working Families Tax Credit in the U.K. on female education and labor supply. In their framework, marriage is exogenous and husbands are modeled as shocks—they make no decisions and remain unresponsive to household conditions. There is no cohabitation. Guner et al. (2020) assess the effects of expansions in child care subsidies and child care tax credits (which are contingent on work) versus expansions in the Child Tax Credit (which is not contingent on work). They develop a rich, deterministic model of savings, female labor force participation, and male and female hours worked. In contrast to our model, the living arrangement (single or married) is fixed exogenously, and welfare transfers (TANF and SNAP) are approximated by linear functions of household income. Finally, Ortigueira and Siassi (2013) study the labor supply of husbands and wives under joint decision making in an environment with unemployment risk. However, they do not model the tax-transfer system, and abstract from the endogenous determination of both the living arrangement and marital status.

The remainder of the paper is organized as follows. Section 2 presents new empirical evidence related to family labor supply. Section 3 presents the model. Section 4 describes our sample of households, calibrates the model and assesses its fit with the data. Section 5 examines the effects of the tax-transfer system. The evaluation of the EITC reform is conducted in Section 6.

2. The labor supply of non-college-educated husbands and wives

In this section we present evidence of a statistically significant, U-shaped relationship between one spouse's earnings and the labor market participation of the other spouse among non-college-educated married couples with children. Our model, which is presented in the next section, reproduces these estimated U-shaped relationships. As will become clearer below, modeling family labor supply is key when assessing the effects of the tax-transfer system among low-income households. Our results suggest that these U-shaped relationships stem in part from the current design of the EITC: Because of the phase-in, plateau, and phase-out regions of this tax credit the labor market participation tax rate of secondary earners is

Table 1
Summary statistics: non-college-educated married couples with children.

	No. of observations	LFP	Hours worked†			Earnings† ($)		
			Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Husbands	14, 534	0.9411	2, 162	2, 080	558	45, 490	37, 389	45, 726
Wives	14, 534	0.6028	1, 687	2, 080	682	25, 980	22, 000	26, 359

Notes. Summary statistics for the labor supply and earnings of non-college-educated married couples with children (ASEC 2012-2016). Earnings are CPI-deflated and expressed in dollars of 2013. †Conditional on working.

hump-shaped in the spouse's level of earnings, reaching a maximum when earnings are at the upper end of the EITC plateau region. In Section 6 we show that a reform of this program that introduces a deduction on the earnings of secondary earners flattens their participation tax rates, thus bringing some of them into the labor market.

Our sample of married couples with children under 19 years of age is drawn from five years of CPS ASEC data spanning from 2012 to 2016. Married couples in our sample have one, two or three children, husband and wife are non-college-educated, and their sources of income are restricted to earnings, interest/dividend income, and government transfers (excluding social security, disability and survivors income). That is, we exclude married couples receiving income from any of the following sources: business, farm, army, veterans, unemployment, retirement, social security, disability, survivors income, child support and alimony.

Summary statistics for labor supply and earnings are presented in Table 1. Husbands' labor force participation is higher than that of wives. Average hours worked, conditional on working, are also higher among husbands: 2,162 hours for husbands against 1,687 for wives. They also earn more, on average.

Wives' employment rate and husbands' earnings—We start by examining the relationship between husbands' earnings and wives' employment. We estimate the following probit model for wives' employment

$$\text{Prob(wife's hours worked } > 0) = \Phi\Big(\beta_0 + \sum_{i=1}^{K-1} \beta_i s_i\Big),$$

where $\Phi(\cdot)$ is the cdf of the standard normal; s_i for $i = 1, \ldots K-1$ are the variables containing a restricted cubic spline of husband's earnings; and K is the number of knots. We find a statistically significant, U-shaped relationship between husbands' earnings and wives' employment. When we estimate the model by the number of children we obtain similar significant U-shaped relationships. Fig. 1 displays the fitted employment rates for wives. The shaded areas are the respective 95 percent confidence intervals. (Supplementary Appendix A contains a detailed presentation of the coefficient estimates and some robustness checks confirming that the U-shaped relationship is robust.) The predicted probability of employment for a wife whose husband has no earnings is 0.65, which is about 13 percentage points higher than that of a wife whose husband earns $25K. When the husband's earnings reach $40K, the wife's probability of employment is back at 0.65.

Husbands' employment rate and wives' earnings—We also find a statistically significant U-shaped relationship between wives' earnings and husbands' employment. We estimate a probit model for husband's employment using variables containing a restricted cubic spline of wife's earnings. However, the relationship is not significant among married couples with one child. Fig. 2 displays the fitted employment rates for husbands. (See Supplementary Appendix A for estimation details and robustness checks.)

Wives' hours worked (conditional on working) and husbands' earnings—We also explore the relationship between husbands' earnings and wives' hours worked. To this end, we estimate the following model

$$\text{Wife's hours worked } = \alpha_0 + \sum_{i=1}^{K-1} \alpha_i s_i,$$

where s_i, for $i = 1, \ldots, K-1$, are the variables containing a restricted cubic spline of husbands' earnings. Our results show that there is also a statistically significant U-shaped relationship between husbands' earnings and wives' hours worked. (See Supplementary Appendix A for details.)

3. A model of savings, labor supply and living arrangements

3.1. Demographics

Our model economy is populated by ex-ante identical females, ex-ante identical males, and by children. The population of interest for our analysis is made up of non-college-educated households with children. This population includes lone mothers, unmarried cohabiting couples, and married couples. Within the group of unmarried cohabiting couples we distinguish

Fig. 1. Wives' fitted probabilities of employment and 95 percent confidence intervals. The fitted probabilities are from the probit model of wives' employment on a restricted cubic spline of husbands' earnings.

Fig. 2. Husbands' fitted probabilities of employment and 95 percent confidence intervals. The fitted probabilities are from the probit model of husbands' employment on a restricted cubic spline of wives' earnings.

between both-parents-present couples and mother-only-present couples. Our focus on households formed by non-college-educated workers with children is motivated by their higher at-risk-of-poverty rate, relative to households where at least one adult is college educated.

Individuals of gender $g \in \{f, m\}$ enter the economy as singles with no children. Females (f) are subject to fertility shocks and can have up to three children.[8] We assume that children age stochastically, i.e. every period a fraction of households

[8] Our modeling of fertility as a process independent of taxes and transfers is supported by empirical evidence showing that fertility does not respond to changes in the EITC (Baughman and Dickert-Conlin, 2009).

see their children become adults, in which case the household leaves our population of interest. Within a household, all children age at the same time. That is, from one period to the next the number of children either stays constant, grows or becomes zero, but it never decreases gradually.

More specifically, the number of children in a household follows a Markov chain with five states: childless ($n = 0$), with one child ($n = 1$), with two children ($n = 2$), with three children ($n = 3$) and, finally, with grown-up children who have already left the nest ($n = \emptyset$). We denote this set of states by $N = \{0, 1, 2, 3, \emptyset\}$, where state $\emptyset$ is an absorbing state, as children eventually become adults and leave the household. The transition matrix between these five states is

$$M = \begin{pmatrix} m_{00} & m_{01} & m_{02} & m_{03} & m_{0\emptyset} \\ 0 & m_{11} & m_{12} & m_{13} & m_{1\emptyset} \\ 0 & 0 & m_{22} & m_{23} & m_{2\emptyset} \\ 0 & 0 & 0 & m_{33} & m_{3\emptyset} \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix} \tag{1}$$

where $m_{nn'}$ is the probability of moving from state n to state n'. As stated above, our population of interest is made up of households in states 1, 2 and 3. The measure of this population and the average number of years a household remains on it are pinned down by the fertility-aging parameters in matrix M.

3.2. Productivity and earnings

Adult individuals allocate their time endowment to leisure and work, and the productivity of their working time is subject to idiosyncratic shocks. We denote labor productivity by z, and assume that it evolves according to the process

$$\ln z' = \rho \ln z + \epsilon, \qquad \text{with } \epsilon \sim N(0, \sigma_\epsilon^2). \tag{2}$$

For households with two adults we denote the vector of individual labor productivities by $\boldsymbol{z} = [z_f \; z_m]$ and the vector of log productivities by $\ln \boldsymbol{z} = [\ln z_f \; \ln z_m]^{\mathrm{T}}$. The vector of productivity shocks is denoted by $\boldsymbol{\epsilon} = [\epsilon_f \; \epsilon_m]^{\mathrm{T}}$ and the shocks' variance-covariance matrix by $\sigma_{\boldsymbol{\epsilon}}^2$. Productivity shocks for workers within the same household are allowed to be partially correlated. We write the evolution of labor productivities within two-adult households as $\ln \boldsymbol{z}' = \rho \ln \boldsymbol{z} + \boldsymbol{\epsilon}$, since the persistence parameter ρ is assumed to be the same for females and males. Entering single females and males draw their initial productivity level from the ergodic distribution implied by the autoregressive process (2), namely the log-normal distribution $LN\big(0, \sigma_\epsilon/(1-\rho^2)\big)$.

Earnings of a worker of gender $g \in \{f, m\}$ are given by $e_g = h_g z_g \omega_g$, which is the product of hours worked, h_g, labor productivity, z_g, and her/his wage rate, ω_g, which is assumed to be exogenous. For households with two adults we denote by $\boldsymbol{e}$ the vector of earnings, i.e. $\boldsymbol{e} = [e_f \; e_m]$. Households can save in a risk-free asset subject to a non-borrowing constraint. Household asset holdings are denoted by a.

3.3. Living arrangements

A female with children can be in one of the following four living arrangements: single living alone with her children (ℓ_s); unmarried and cohabiting with the father of her children (ℓ_{cp}); unmarried and cohabiting with a male who is not the father of her children (ℓ_c); and married and living with her husband and their children (ℓ_m). We denote the living arrangement by $\ell \in L = \{\ell_s, \ell_{cp}, \ell_c, \ell_m\}$. Single males are not modeled explicitly. They are simply assumed to receive "love shocks" and make either cohabitation or marriage proposals to single females living alone or with her children, if any. Provided that a female has a proposal, she learns her suitor's state variables (wealth and labor productivity), and decides whether to accept or reject the proposal.[9] If she accepts, the couple forms a household, pools resources and solves a joint decision problem. In particular, cohabiting couples make decisions on the individual consumption levels, hours worked, joint savings and on whether or not to get married. Married couples decide on individual consumption, hours worked and joint savings. We assume full commitment to marriage and therefore do not assess the effects of the tax-transfer system on marriage dissolution.[10] Living arrangements have implications beyond taxes and transfers. In our model economy one- and two-adult households differ in terms of: (i) their ability to share risks within the household; (ii) household consumption commitments; and (iii) child care demand while working. As it should be apparent, intra-household risk sharing is not available to one-adult households. In two-adult households, however, individuals are assumed to share idiosyncratic risks efficiently, in the sense that individual allocations lie on the Pareto frontier.

[9] This mate selection process is consistent with empirical evidence showing that women are more likely than men to select their mates in terms of non-physical characteristics such as wealth and labor productivity. Men, on the contrary, are more likely to select their mates in terms of their physical appearance (Conroy-Beam and Buss, 2016).

[10] Evidence on the effects of welfare rules on divorce is mixed. Herbst (2011) does not find a relationship between government income transfers and divorce rates. Low et al. (2018) find that the welfare reform of the 1990s reduced divorce rates. Assuming limited commitment to marriage, their model shows that this reform reduced the ex-ante welfare of women.

By consumption commitments we refer to the quasi-non-discretionary, minimum expenses needed to run a household, such as shelter and utilities. We assume that these expenses vary with the number of adults and children in the household, but are otherwise fixed. Consumption commitments increase individuals' risk aversion and enhance the role played by intra-household risk sharing. By interacting with income risk, consumption commitments affect household decisions, thus playing a role similar to that played in other papers.[11] Specifically, in our model consumption commitments affect the household decision on (discretionary) consumption and, for lone mothers, also the decision on whether or not to form a two-adult household. Given a level of earnings risk, an increase in consumption commitments will increase savings. Likewise, given a level of earnings risk, an increase in consumption commitments for two-adult households, relative to those of lone mothers, will reduce the formation of two-adult households. By contrast, given consumption commitments, an increase in earnings risk will make lone mothers more prone to form two-adult households as the value of risk sharing provided by this type of household increases.

Finally, regarding child care costs, we assume that two-adult households can allocate their working times in a way that reduces child care costs incurred while working. By contrast, lone mothers must necessarily incur child care costs during their working time. That is, two-adult households not only have twice as many adult time resources as one-adult households, but they can also allocate individual working times so that they save on child care.

3.4. Taxes and means-tested transfers

Here, we provide only an oversimplified description of the taxes and transfers that are introduced in the model. A detailed exposition, along with the equations for each of the programs, is presented in Supplementary Appendix B. As explained above, we model the federal tax-transfer programs including all the thresholds in earnings, income, and assets that define eligibility and benefits, as well as the different criteria based on living arrangement, biological relationship to dependents, and filing status. As stated, we focus on federal taxes and income programs, and abstract from variation across states.

Income and Payroll Taxes. We model the three main filing statuses with the Internal Revenue Service (IRS): single (s), head of household ($\hbar$) and married filing jointly (x). The filing status affects both taxes paid (tax rates and deductions), as well as eligibility and benefits for tax credits. A tax filer's income is made up of earnings, e, and capital income, ra, where r is the return on investment and a is the filer's asset level. Income taxes before credits owed by a tax filer under filing status $j = s, \hbar, x$, with income $y = e + ra$ and n qualifying children, are denoted by $T^j(y, n)$. This function includes the income tax deduction, personal exemptions, and the seven tax brackets with the respective tax rates. Payroll taxes are denoted by $T_p(e) = \tau_p \min\{e, \bar{e}\}$, where $\tau_p = \tau_{p,\mathrm{SS}} + \tau_{p,\mathrm{ME}}$ is the employee's tax rate (the sum of social security and medicare tax rates), and $\bar{e}$ is the payroll tax cap.

The Earned Income Tax Credit (EITC). The EITC is a refundable credit. Eligibility is determined by: (i) a limit on investment income (ra); (ii) a limit on income (earned plus non-earned income), which depends on the number of children and the filing status. Provided eligibility, a tax filer with n qualifying children under filing status $j = s, \hbar, x$ receives a credit $I^j(a, e, n)$. This function includes the thresholds defining the phase-in, the plateau, and the phase-out regions of the EITC, along with the respective earnings subsidy rates. Both the earnings thresholds and the credit rates depend on the number of qualifying children and the filing status. (Fig. B1 in Supplementary Appendix B shows the EITC schedule for the 2013 tax returns.)

The Child Tax Credit (CTC). The (non-refundable) child tax credit for a tax filer under status j, income y and n qualifying children equals a subsidy per child times the number of children if income is below a certain threshold. At this threshold, the child tax credit starts being phased out. If the child tax credit, $CTC^j(y, n)$, is lower than the tax liability, $T^j(y, n)$, then this liability is reduced by the amount of the child tax credit. If the child tax credit is higher than the liability, then the liability is reduced to zero and the filer can apply for the (refundable) Additional Child Tax Credit (ACTC). The amount of this tax credit is denoted by $ACTC^j(y, e, n)$.

Temporary Assistance for Needy Families (TANF). Despite some variation across states, many features of the program are common to all states. Eligibility and benefits are determined by categorical and quantitative variables of the assistance unit on a monthly basis. When the children's two parents live together, marital and tax filing statuses become irrelevant for the purpose of TANF. The assistance unit in this case is formed by the two parents and their children. Hence, in our model there are two types of TANF assistance units: one-parent households (lone mothers and mother-only-present cohabiting couples) which we denote by (u); and two-parent households (both-parent-present cohabiting couples and married couples) which we denote by (ν). Financial eligibility requirements include: (i) a limit on asset holdings (stocks, bonds, bank deposits, property)[12]; (ii) a limit on gross family income (earned and non-earned income); (iii) a limit on net family income (computed

[11] See, for instance, Sommer (2016) and Santos and Weiss (2016).

[12] Eight states have eliminated TANF asset limits (Ohio, Louisiana, Colorado, Hawaii, Illinois, Virginia, Alabama and Maryland). Other states do not impose limits on certain assets, such as retirement and education accounts, and vehicles.

as net of an earned income disregard, and work, child care and fixed deductions). Provided eligibility, the income transfer, $B^{\jmath}(a,e,n)$, for $\jmath = u, \nu$, is determined by a standard of need and net family income, with a maximum payment set by a payment standard. (Fig. B2 in Supplementary Appendix B shows the 2013 TANF schedule.) TANF has work requirements and time limits, typically of 60 months, to receive TANF benefits. However, the extent of enforceability of these limits varies widely across states. Besides a number of exemptions from time limits, states are allowed to extend assistance beyond these limits to up to 20% of their caseload.

Supplemental Nutrition Assistance Program (SNAP). SNAP is a federal program that provides monthly food assistance.[13] For SNAP, an assistance unit is an individual or a group of individuals who live together and purchase and prepare meals together. In our model there are two types of SNAP assistance units: lone mothers (ℓ_s); and two-adult households with children (ℓ_{2a}). Eligibility is determined by: (i) a limit on resources; (ii) a limit, which depends on household size, on gross income (earned and non-earned income, including child support and income received from TANF); and (iii) a limit on net income (gross income minus an earned income disregard, a child care deduction when needed for work, a standard deduction and an excess shelter deduction). Provided eligibility, SNAP benefits, $F^{\jmath}(a,e,n)$, for $\jmath = \ell_s, \ell_{2a}$, are calculated by subtracting the family's expected contribution towards food, which is calculated as a fraction of its net income, from a maximum allotment for the family. (Fig. B3 in Supplementary Appendix B shows the 2013 SNAP schedule.)

3.5. Bellman equations

Before laying out the problems solved by the households in our model, we introduce some notation. For the sake of brevity, we merge the non-refundable part of the child tax credit with income and payroll taxes and denote it by $\mathcal{T}^j(a,e,n)$, i.e.

$$\mathcal{T}^j(a,e,n) = T^j(y,n) + T_p(e) - \min\{CTC^j(y,n), T^j(y,n)\}. \tag{3}$$

Likewise, we merge the refundable part of the child tax credit with the Earned Income Tax Credit, which is also refundable, and denote it by $\mathcal{I}^j(a,e,n)$, i.e.

$$\mathcal{I}^j(a,e,n) = I^j(a,e,n) + ACTC^j(y,e,n). \tag{4}$$

We denote a filer's net balance with the Internal Revenue Service (tax liabilities after credits) by $IRS(a,e,n)$. It should be noted that taxes and tax credits in the U.S. are based on annual income and earnings, while TANF and SNAP are monthly-based programs. We resolve this mixed timing by setting the length of a period in the model equal to one year and by annualizing transfers from TANF and SNAP. Finally, as will become apparent from the Bellman equations below, we abstract from stigma from participation in income programs and from any other friction that could prevent participation.[14]

Lone mothers of n children

A lone mother of $n > 0$ children makes decisions on consumption/savings, labor supply and, provided she has a cohabitation or a marriage proposal, on whether she accepts the proposal or remains alone. The probabilities of receiving proposals from single males are denoted as follows: $\pi_n^{\ell_{cp}}$ is the probability that a lone mother of n children receives a cohabitation proposal from the father of the children; $\pi_n^{\ell_c}$ is the probability that she receives a cohabitation proposal from a single man who is not the father of the children; and $\pi_n^{\ell_m}$ is the probability that she receives a marriage proposal. The probability that she has no proposal is hence $\pi_n^{\ell_s} = 1 - \pi_n^{\ell_{cp}} - \pi_n^{\ell_c} - \pi_n^{\ell_m}$. These probabilities will be set to match the joint distribution of living arrangements and number of children across our sample of households from the CPS.

We denote the value function of a female in living arrangement $\ell \in L$ by v_f^{ℓ}. Then, the value of a lone mother of $n > 0$ children with labor productivity z and asset holdings a is given by

$$v_f^{\ell_s}(z,a,n) = \max_{c,l,a'} \left\{ U_f(c,l) + \beta\, \mathbb{E}\left[\pi_n^{\ell_s} v_f^{\ell_s}(z',a',n') + \sum_{\ell \in L\setminus \ell_s} \pi_n^{\ell} \max\{v_f^{\ell}(\boldsymbol{z}', a' + a_m', n'), v_f^{\ell_s}(z',a',n')\} \right] \right\}$$

$$\text{s.t.} \tag{5}$$

$$c + \hat{c}^{\ell_s}(n) + \Gamma(h,n) + a' = e_f + (1+r)a + \vartheta n - IRS(a,e_f,n) + B^u(a,e_f,n) + F^{\ell_s}(a,e_f,n)$$

$$\ln z' = \rho \ln z + \epsilon, \text{ with } \epsilon \sim N(0,\sigma_\epsilon^2), \quad a_m' \sim \bar{F}_{a_m}, \quad z_m' \sim LN\big(0, \sigma_\epsilon/(1-\rho^2)\big),$$

$$c \geq F^{\ell_s}(a,e_f,n), \quad 0 \leq l \leq 1 \quad \text{and} \quad a' \in A,$$

[13] Even though SNAP is an in-kind transfer program, the food coupons are considered near-cash transfers and thus studied by the literature along with income transfer programs.

[14] Available estimates of take-up rates are obtained from the entire U.S population of eligible households, including those formed by one or more educated adults, and by single mothers and couples living with their parents or other family members. While we are not aware of estimates for take-up rates for the subpopulation of households considered in our study, it can be argued that they are higher than those estimated for the entire population. For this reason, we focus on the effects of the statutory rules governing income programs and abstract from stigma or any other friction.

where

$$IRS(a, e_f, n) = \mathcal{T}^{\hbar}(a, e_f, n) - \mathcal{I}^{\hbar}(a, e_f, n), \tag{6}$$

and where $h = 1 - l$ are hours worked, $e_f = h\,z\,\omega_f$ are household earnings, ϑ is child support per child, a' are next-period asset holdings if she remains as a lone mother, and $a' + a'_m$ are next-period household asset holdings if she accepts a proposal from a single male with assets a'_m. The wealth distribution across single males is assumed to be exogenous and denoted by $\bar{F}_{a_m}$. As stated above, the productivity level of the single male making the proposal is drawn from the ergodic distribution implied by the productivity process (2). The function $\hat{c}^{\ell_s}(n)$ represents the consumption commitments of a lone mother with n children. The function $\Gamma(h, n)$ represents work-related expenses (commuting costs, etc.) plus child care costs paid while working. Asset holdings lie in the set $A = [0, \bar{a}]$, where $\bar{a}$ is a non-binding upper bound. The expectation is taken on her own labor productivity next period, z', on the labor productivity and the level of assets of potential suitors, z'_m and a'_m, respectively, and on the number of children, n'. The value functions when the children have left the household, $v_f^{\ell}(z, a, \emptyset)$ for $\ell \in L$, in the maximization problem above, correspond to the values of remaining childless forever.

The problem of a single female without children ($n = 0$) is similar to the one above, with the exception that the probability that she receives a proposal to cohabit is the sum of $\pi_0^{\ell_{cp}}$ and $\pi_0^{\ell_c}$.[15]

Cohabiting couples with n children

We model cohabitation as an unmarried female and an unmarried male living in the same dwelling, pooling wealth and income, sharing the fixed costs of running the household and making joint decisions on savings, individual consumption and labor supplies. Risk sharing within the household is assumed to be efficient, in the sense that the couple maximizes a weighted sum of the two adults' utilities. These weights are referred to as Pareto weights, and will be denoted by η_g for $g \in \{f, m\}$, with $\eta_f + \eta_m = 1$. Cohabiting couples file separate tax returns and get married as soon as marriage yields more value to the couple than cohabitation. Since taxes, tax credits and TANF vary across cohabiting couples depending on whether or not the cohabiting male is the father of the children, we present these two cases in turn.

Both-parents-present cohabiting couples

Both-parents-present cohabiting couples face the additional, non-trivial decision of who of the two adults files as head of household ($\hbar$) and who as single (s). The simultaneous labor supply and filing status decisions are made so that the optimal level of household earnings creates a lower tax liability after credits.[16] In the instance where only one adult works, then, trivially, she/he claims the children as dependents and files as head of household. Importantly, the parent that does not claim the children as qualifying children cannot take the EITC using the rules for those with no qualifying child. This is one of the key differences with respect to cohabiting households where the male is not the father of the children.

The problem of a both-parents-present cohabiting couple with labor productivities $\boldsymbol{z} = [z_f\ z_m]$, assets a and n children involves decisions on savings, individual consumption, labor supplies, tax filing statuses, and on whether to get married or remain as cohabitants. Formally, a cohabiting couple in living arrangement ℓ_{cp}, with Pareto weights on individual utilities η_g, solves

$$\begin{aligned}
&V^{\ell_{cp}}(\boldsymbol{z}, a, n) = \max_{c_f, c_m, l_f, l_m, a'} \left\{ \sum_{g=f,m} \eta_g U_g(c_g, l_g) + \beta\, \mathbb{E}\left[\max\{V^{\ell_{cp}}(\boldsymbol{z}', a', n'), V^{\ell_m}(\boldsymbol{z}', a', n')\} \right] \right\} \\
&\text{s.t.} \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad (7) \\
&c_f + c_m + \hat{c}^{\ell_{cp}}(n) + \Gamma(h_f, h_m, n) + a' = e + (1+r)a - IRS(a, \boldsymbol{e}, n) + B^{\nu}(a, e, n) + F^{\ell_{2a}}(a, e, n) \\
&\ln \boldsymbol{z}' = \rho \ln \boldsymbol{z} + \boldsymbol{\epsilon}, \quad \text{with } \boldsymbol{\epsilon} \sim N(0, \sigma_{\boldsymbol{\epsilon}}^2) \\
&c_f,\ c_m \geq 0,\ \ c_f + c_m \geq F^{\ell_{2a}}(a, e, n),\ \ 0 \leq l_f,\ l_m \leq 1 \ \text{ and } \ a' \in A,
\end{aligned}$$

where

$$IRS(a, \boldsymbol{e}, n) = \begin{cases} \mathcal{T}^{\hbar}(a/2, e_f, n) + \mathcal{T}^{s}(a/2, e_m, 0) - \mathcal{I}^{\hbar}(a/2, e_f, n) & \text{if female files as } \hbar \\ \mathcal{T}^{s}(a/2, e_f, 0) + \mathcal{T}^{\hbar}(a/2, e_m, n) - \mathcal{I}^{\hbar}(a/2, e_m, n) & \text{if male files as } \hbar, \end{cases}$$

and where $h_g = 1 - l_g$ are hours worked, and $e = e_f + e_m = h_f\, z_f\, \omega_f + h_m\, z_m\, \omega_m$ are household earnings. The function $V^{\ell_{cp}}$ denotes the value of the both-parents-present cohabiting couple, and the function V^{ℓ_m} denotes the value of a married

[15] Even though households without children are not in our population of interest, we include single childless females in the model so that single males can propose to them and start a cohabiting or married household before they have their first child. Without single childless females, all cohabiting and married couples in the model would have at least one child born to a lone mother, and we do not want to restrict our sample of U.S. households to this group when we compare outcomes from our model with the data.

[16] We do not impose the statutory requirement that the individual filing as head of household must contribute at least 50 percent to household expenses. Contribution to household expenses is self-declared and difficult to verify. Indeed, using CPS data (which we present below) we observe a substantial fraction of both-parents-present cohabiting couples where the head of household is not the worker with the highest earnings.

couple. The expectation is formed over the two labor productivities and over the number of children. As mentioned above, the adult filing taxes as single cannot apply for the EITC. Also note that TANF eligibility and benefits depend on total household wealth, a.

Mother-only-present cohabiting couples

Under the current U.S. tax-transfer system, the problem of a cohabiting couple when the male is not the father of the children differs from that of both-parents-present cohabiting couples along important dimensions. First, the male cannot claim the children as dependents, as they fail to satisfy the relationship test. Consequently, he cannot file as head of household, but he can apply for the EITC as single without dependents. Note that this is in contrast to the case of both-parents-present cohabiting couples, where the father of the children is not allowed to apply for the EITC as single without dependents. Second, most states do not include the male in the TANF assistance group, and his resources and income are not counted towards eligibility and benefits. This is in contrast to cohabiting couples where the male is the father of the children. For SNAP, the male is in the assistance group regardless of his biological relationship with the children, as long as the cohabiting couple shares and prepares food together.

The value of a mother-only-present cohabiting couple is

$$V^{\ell_c}(\boldsymbol{z}, a, n) = \max_{c_f, c_m, l_f, l_m, a'} \left\{ \sum_{g=f,m} \eta_g U_g(c_g, l_g) + \beta\, \mathbb{E}\left[\max\{V^{\ell_c}(\boldsymbol{z}', a', n'), V^{\ell_m}(\boldsymbol{z}', a', n')\} \right] \right\}$$

$$\begin{aligned} &\text{s.t.} \\ &c_f + c_m + \hat{c}^{\ell_c}(n) + \Gamma(h_f, h_m, n) + a' = e + (1+r)a + \vartheta n - IRS(a, \boldsymbol{e}, n) + B^u(a/2, e_f, n) + F^{\ell 2a}(a, e, n) \\ &\ln \boldsymbol{z}' = \rho \ln \boldsymbol{z} + \boldsymbol{\epsilon}, \quad \text{with } \boldsymbol{\epsilon} \sim N(0, \sigma^2_{\boldsymbol{\epsilon}}) \\ &c_f,\ c_m \geq 0,\ \ c_f + c_m \geq F^{\ell 2a}(a, e, n),\ \ 0 \leq l_f,\ l_m \leq 1 \ \text{ and } \ a' \in A, \end{aligned} \tag{8}$$

where

$$IRS(a, \boldsymbol{e}, n) = \mathcal{T}^{\hbar}(a/2, e_f, n) + \mathcal{T}^s(a/2, e_m, 0) - \mathcal{I}^{\hbar}(a/2, e_f, n) - \mathcal{I}^s(a/2, e_m, 0),$$

and where $h_g = 1 - l_g$ are hours worked, and $e = e_f + e_m = h_f\, z_f\, \omega_f + h_m\, z_m\, \omega_m$ are household earnings. Note that TANF eligibility and benefits depend on the female's wealth and earnings (assistance unit $\jmath = u$), while SNAP is based on household-level variables ($\jmath = \nu$).

Married couples with n children

The problem solved by married couples is similar to the one solved by cohabitants, save for the tax-transfer system they face, and for the fact that once married they cannot change marital status. Married couples file with a *married filing jointly* status ($j = x$).[17] Hence, a married couple with labor productivities $\boldsymbol{z}$, assets a and n children solves

$$V^{\ell_m}(\boldsymbol{z}, a, n) = \max_{c_f, c_m, l_f, l_m, a'} \left\{ \sum_{g=f,m} \eta_g U_g(c_g, l_g) + \beta\, \mathbb{E}\, V^{\ell_m}(\boldsymbol{z}', a', n') \right\} \tag{9}$$

$$\begin{aligned} &\text{s.t.} \\ &c_f + c_m + \hat{c}^{\ell_m}(n) + \Gamma(h_f, h_m, n) + a' = e + (1+r)a - IRS(a, e, n) + B^{\nu}(a, e, n) + F^{\ell 2a}(a, e, n) \\ &\ln \boldsymbol{z}' = \rho \ln \boldsymbol{z} + \boldsymbol{\epsilon}, \quad \text{with } \boldsymbol{\epsilon} \sim N(0, \sigma^2_{\boldsymbol{\epsilon}}) \\ &c_f,\ c_m \geq 0,\ \ c_f + c_m \geq F^{\ell 2a}(a, e, n),\ \ 0 \leq l_f,\ l_m \leq 1 \ \text{ and } \ a' \in A, \end{aligned}$$

where

$$IRS(a, e, n) = \mathcal{T}^x(a, e, n) - \mathcal{I}^x(a, e, n), \tag{10}$$

and where $h_g = 1 - l_g$ are hours worked and $e = e_f + e_m = h_f\, z_f\, \omega_f + h_m\, z_m\, \omega_m$ are household earnings. Note that the married couples' taxes, tax credits and assistance transfers are based on household income, earnings, and wealth.

Before solving the model and moving to the analysis of the effects of the tax-transfer system, we find it useful to illustrate how the combined tax and transfer programs impact on disposable incomes. Fig. 3 displays the net transfer functions for the different types of households described above. There are sizable differences in net transfers across living arrangements, both for one- and two-earner households. The rest of the paper sheds light on how these differences affect the decisions of non-college-educated parents.

[17] Since low-income married couples with children are always better off filing jointly, we do not model the optimal choice between joint and separate filing. Notice, for instance, that married couples filing separately cannot apply for the EITC.

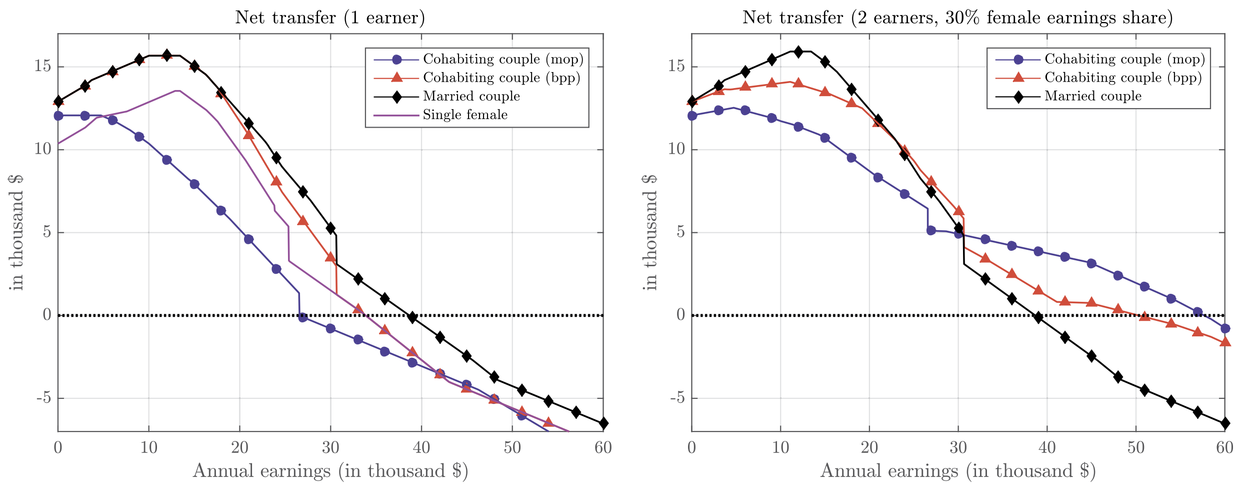

Fig. 3. Net transfers (total transfers received minus taxes paid). *Notes:* In the construction of these functions we have assumed that households have two children, that they are asset-eligible for TANF and SNAP (we assume $a = 0$), and that both-parent-present cohabiting couples choose the filing status to maximize net transfers.

3.6. The stationary distribution

In this section we derive the invariant probability measures of one- and two-adult households. We begin with some notation. Let us denote by $\mathcal{B}^s$ the Borel σ-algebra on the space of labor productivity and asset holdings of lone mothers, $Z^f \times A$, where Z^f is the space of labor productivity and A is the space of asset holdings. The projections of $B \in \mathcal{B}^s$ on Z^f and A are denoted, respectively, by B_{z_f} and B_a. Let $\mathcal{B}^c$ denote the Borel σ-algebra on the space of labor productivities and asset holdings of couples, $Z^f \times Z^m \times A$.

Using the policy functions for consumption, savings, hours worked, lone mothers' acceptance/rejection of cohabitation and marriage proposals, cohabiting couples' marriage decisions, and for filing statuses in both-parents-present cohabiting couples, we derive the transition functions for lone mothers and couples (see Supplementary Appendix C). Specifically, we denote by $P^s(z_f, a_f, n; B, n', \ell')$ the probability that a lone mother with labor productivity z_f, assets a_f, and n children will have productivity and assets lying in set $B \in \{\mathcal{B}^s \cup \mathcal{B}^c\}$, will have n' children and will move to living arrangement $\ell' \in L$ next period. For couples, we denote by $P^c(z_f, z_m, a, n, \ell; B, n', \ell')$ the probability that a couple with productivities z^f and z^m, assets a, n children and in living arrangement ℓ will transit to productivities and assets lying in set $B \in \mathcal{B}^c$, will have n' children and will move to living arrangement ℓ' next period.

We can now write the mass of lone mothers at each $B \in \mathcal{B}^s$ with n children as

$$\psi^s(B, n') = \sum_{n \in N} \int_{Z^f \times A} P^s(z_f, a, n; B, n', \ell_s)\psi^s(dz_f, da, n), \tag{11}$$

for all $B \in \mathcal{B}^s$ and $n' \in N \setminus \{0, \emptyset\}$. For $n' = 0$

$$\psi^s(B, 0) = \int_{Z^f \times A} P^s(z_f, a, 0; B, 0, \ell_s)\psi^s(dz_f, da, 0) + \mathbb{1}_{\{0 \in B_a\}}\psi_0^s \int_{B_{z_f}} \tilde{f}_{z_f}(dz_f), \quad \text{for all } B \in \mathcal{B}^s, \tag{12}$$

where ψ_0^s is the measure of entering single females (who enter with zero assets), and $\tilde{f}_{z_f}(\cdot)$ is the density function of the log-normal distribution from where the newborn draw their initial productivity shock. To ensure a stationary measure of households at non-absorbing states, the measure of entering single females must be equal to the measure of households that transit to the absorbing state $\emptyset$ each period. That is,

$$\psi_0^{\ell_s} = \frac{1}{\tilde{m}_{1,*} \cdot \mathbf{1}}, \tag{13}$$

where $\tilde{m}_{1,*}$ is the first row of matrix $(\mathbf{I}_4 - \tilde{M})^{-1}$; $\mathbf{I}_4$ is the (4×4) identity matrix, $\tilde{M}$ is the (4×4) upper-left block of M, and $\mathbf{1}$ is the (4×1)-vector of ones.

The mass of couples at each $B \in \mathcal{B}^c$, with n children and in living arrangement $\ell \in \{\ell_{cp}, \ell_c, \ell_m\}$ is given by

$$\psi^c(B, n', \ell') = \sum_{n \in N} \sum_{\ell \in L \setminus \ell_s} \int_{Z^f \times Z^m \times A} P^c(z_f, z_m, a, n, \ell; B, n', \ell')\psi^c(dz_f, dz_m, da, n, \ell) +$$

$$\sum_{n\in N} \int_{Z^f\times A} P^s(z_f, a, n; B, n', \ell')\psi^s(dz_f, da, n) \tag{14}$$

for all $B \in \mathcal{B}^c$, $n' \in N \setminus \{\emptyset\}$ and $\ell' \in L \setminus \ell_s$.

3.7. Parameterization

Preferences. We assume that females and males have identical preferences over consumption and leisure, which are represented by the per-period utility function

$$U(c,l) = \frac{c^{1-\sigma}-1}{1-\sigma} + \varphi\,\frac{l^{1-\zeta}-1}{1-\zeta}, \tag{15}$$

where σ is the coefficient of relative risk aversion, $\varphi > 0$ is a utility weight on leisure, and $\zeta > 0$ affects the Frisch elasticity of labor supply.

Consumption Commitments. We specify the fixed, non-discretionary expenses for households of type $\ell \in L$ with n children as

$$\hat{c}^{\ell}(n) \;=\; \hat{c}^{\ell}_0 + \hat{c}^{\ell}_1 \cdot n, \tag{16}$$

where $\hat{c}^{\ell}_0$ and $\hat{c}^{\ell}_1$ are parameters.

Work-related and child care costs. Households incur direct budgetary costs when adult members choose to supply positive hours to market work. We distinguish two such costs: (i) Work-related costs such as transportation, meals outside of the home, buying clothing, etc., and (ii) Child care paid while working. We parameterize these costs as a function of hours worked and the number of children

$$\begin{aligned} \Gamma(h^f,n) \;&= \gamma_1 \mathbb{1}_{\{h^f>0\}} + \gamma_2 \mathbb{1}_{\{h^f>0\}} n^{\alpha} && \text{for} \quad \ell = \ell_s, \\ \Gamma(h^f,h^m,n) \;&= \gamma_1\big[\mathbb{1}_{\{h^f>0\}} + \mathbb{1}_{\{h^m>0\}}\big] + \gamma_2 \mathbb{1}_{\{h^f+h^m>1\}} n^{\alpha} && \text{for} \quad \ell = \ell_{cp}, \ell_c, \ell_m, \end{aligned} \tag{17}$$

where γ_1 denotes work-related costs and includes all expenditures, except child care, that cannot be eluded when an adult in the household chooses to work. γ_2 is a child care cost parameter. It should be noted that couples, by solving a joint time allocation problem, can reduce child care costs: I.e., the two working adults can split their working hours so that there is always at least one adult available to take care of the children (note the indicator function $\mathbb{1}_{\{h^f+h^m>1\}}$). $0 < \alpha \leq 1$ is a parameter that introduces economies of scale in child care (all else equal, child care costs per child decrease with the number of children: e.g., multiple children at the same school, sibling discounts at day care center, etc.).

Cohabitation and marriage proposal probabilities. We parameterize proposal probabilities according to the parsimonious specification $\pi^{\ell}_n = \iota_n \tilde{\pi}^{\ell}$, for $\ell = \ell_{cp}, \ell_c, \ell_m$, where $\tilde{\pi}^{\ell}$ are the base probabilities of receiving the proposals and ι_n are coefficients scaling those base probabilities depending on the lone mother's number of children. More specifically, lone mothers with two or three children receive cohabitation and marriage proposals at potentially different rates than childless single females and lone mothers of one. This differential could result, for instance, from males' preferences. When calibrating the parameters of the model we set $\iota_0 = \iota_1 = 1$ and we calibrate ι_2 and ι_3 internally.

4. Data, calibration, and model fit

We now describe the sample of households that we use to calibrate the parameters of the model. Some of the parameters have a direct empirical counterpart and, hence, values to these parameters are set outside of the model. Values to the remaining fourteen parameters are set so that the stationary solution of our model matches fourteen moments calculated from our sample.

4.1. Data

Personal and household data on employment, annual hours worked, earnings, and taxes and transfers are taken from the 2014 Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS), which also contains information on education, number of children, living arrangement, filing and marital status. The ASEC is administered to households in March and surveys information for the previous calendar year.

Our sample of households is drawn from the ASEC, from where we remove all households with characteristics that do not match those of the households in our model economy. More specifically, from the 2014 ASEC we drop: households with more than one family (i.e. if a subfamily is present); households with a member who is not a child, partner, partner's child

Table 2
Our sample of households.

	Lone mothers	Cohabiting couples		Married couples
		Both parents present (bpp)	Mother only present (mop)	
Individuals (%)	14.81	7.08	2.22	75.89
Households (%)	19.65	7.12	2.35	70.87
Distribution (# children)				
1	45.60	55.01	66.20	36.51
2	36.55	29.10	19.88	42.74
3	17.83	15.88	13.90	20.74
Distribution (# earners)				
0	19.72	3.43	10.34	2.47
1	80.28	37.47	25.07	40.98
2	–	59.10	64.59	56.55

Source: Sample of households from the 2014 Annual Social and Economic Supplement (ASEC). The CPS ASEC supplement household weights are used for the calculation of distributions.

or spouse of the reference person (i.e. we remove households where a grandparent, uncle, or another non-related individual is present); households formed by cohabiting couples where at least one of the cohabitants has been previously married or is separated; households where the female is not the mother of all the children in the household; households where the male is the father of some of the children but not all; households headed by a male with children and without a wife or cohabitant; households where there is a child with neither parent present; households with at least one adult in the armed forces; households with no children or more than three children; households with at least one member holding a college degree; households with no income; households receiving disability, retirement, survivor or veterans income; and households where there is a member with negative earnings. After completing this pruning of the raw data, we end up with a sample of $14,540$ individuals in $3,945$ households.

Table 2 presents the sample composition by living arrangement: lone mothers, both-parents-present cohabiting couples, mother-only-present cohabiting couples and married couples with children. Almost 20 percent of the households in our sample are made up by lone mothers, 7.1 percent are both-parents-present cohabiting couples, 2.3 percent are mother-only-present cohabiting couples, and 70.9 percent are married couples. For each living arrangement, the distribution of households over the number of children is shown in rows 3 to 5. Nearly half of lone mothers have only one child. Among married couples, about 63 percent have two or three children. The distribution of households over the number of earners is shown in rows 6 to 8. Almost 20 percent of lone mothers do not work. About 40 percent of both-parents-present cohabiting couples and married couples have only one adult with earnings, and almost 60 percent have two earners. Among mother-only-present cohabiting couples, 10 percent do not work, 25 percent have only one earner and the remaining 65 percent have two earners.

Average labor supply and average earnings for groups of individuals in this sample will be used as targets to calibrate some parameter values in our model. It must be stressed, however, that all the moments used as targets are from lone mothers and married couples. We purposely leave aside moments from cohabiting couples so that we can then use the model to assess the effects of the differential tax-transfer treatment of cohabiting and married couples. As noted above, the only difference between cohabitation and marriage in our model is the tax-transfer system they face. Hence, the model so calibrated can inform us on the existence and extent of a marriage penalty/bonus in the tax-transfer system.

4.2. Parameters calibrated outside the model

Taxes, tax credits and assistance programs. Tax rates, income brackets, deductions and personal exemptions are taken from the IRS website for the 2013 tax returns. Parameter values determining eligibility and benefits for the EITC and the CTC in 2013 are also taken from the IRS website. Tables B1 to B5 in Supplementary Appendix B present all these parameter values. Since there is some variation across U. S. states in the parameter values determining eligibility and benefits for TANF, we implement most of the Delaware's 2013 TANF schedule, a state with parameters close to national weighted median values.[18] For the TANF asset limit, we set it to $\$2,000$, which is the limit applied in eighteen states and also the national weighted median value. Parameter values of the 2013 SNAP are taken from the U.S. Department of Agriculture, Food and Nutrition Service website.[19] Tables B6 and B7 in Supplementary Appendix B present TANF and SNAP parameter values, respectively.

Demographics. We make some simplifying assumptions on the fertility and children-aging process (see Supplementary Appendix D) that leaves us with seven parameters to calibrate: $m_{0\emptyset}$, m_{01}, m_{02}, $m_{1\emptyset}$, m_{12}, m_{13} and m_{23}. We set these probabilities so that matrix M and its associated stationary distribution match the following seven moment conditions: (1)

[18] https://dhss.delaware.gov/dhss/dss/tanf.html.
[19] https://www.fns.usda.gov/snap/supplemental-nutrition-assistance-program.

The average age at first birth among non-college-educated females is 23 years. Since in our model single females enter the economy childless at age 18, we must set values to m_{00} and $m_{0\emptyset}$ so that the expected number of years until a child is born, conditional on having a child, is equal to 5[20]; (2) the share of households with 1 child in our ASEC sample of households is 40.31 percent; (3) the share of households with 2 children is 40.01 percent; (4) the probability of having twins, conditional on having a conception, is 3.26 percent (National Vital Statistics Reports, 2010). We assume that this conditional probability is the same for childless females and for those who are already mothers of one child, and hence obtain two moment conditions to match; (5) for households with children, the expected duration until the children leave the house, and hence the household leaves our population of interest, is 20 years; (6) the fraction of women without a college degree who remain childless throughout their childbearing years is 17 percent.[21] Given the demographic structure of the model, these seven moment conditions uniquely identify the seven free parameters (see Supplementary Appendix D for details).

The elasticity of intertemporal substitution, productivities and the risk-free rate of return. Standard values for the elasticity of intertemporal substitution, $1/\sigma$, range between 1 and 1/3, so we choose an intermediate value and set $\sigma = 1.5$. The process governing the evolution of idiosyncratic labor productivity is assumed to be the same for females and males (Heathcote et al., 2010). The two parameters characterizing this process are set as in Flodén and Lindé (2001), who estimate $\rho = 0.914$ and $\sigma_\epsilon = 0.206$. We set the cross-spouse/partner correlation of productivity shocks to 0.15 (Hyslop, 2001). The annual risk-free rate of return on savings is set to 3 percent.

Consumption commitments. A number of assistance programs not explicitly considered in our analysis, such as reduced rent, public housing projects, the housing choice vouchers program and energy assistance benefits contribute to reducing households' consumption commitments. These are programs that disproportionately benefit lone mothers. For example, in our sample the fraction of lone mothers benefiting from reduced rent, public housing or energy assistance is more than six times higher than among households formed by couples with children. Also, the total tenant payment in public housing units is calculated as a fraction of household income, which implies a higher subsidy to one-earner households. We take all this as indication that consumption commitments are lower for lone mothers. Using average household earnings among lone mothers in our sample and the formula used to calculate the total tenant payment in public housing units, we set annual consumption commitments for lone mothers with two children at \$2,000. We break down this total by setting $\hat{c}_0^{\ell_s} = 1,000$ and $\hat{c}_1^{\ell_s} = 500$. While we calibrate total consumption commitments for couples internally, we set $\hat{c}_1^{\ell_{cp}} = \hat{c}_1^{\ell_c} = \hat{c}_1^{\ell_m} = 1,500$. This number is obtained by multiplying the minimum extra income needed to remain above the 2013 official poverty line per additional child (\$4,300 according to the U.S. Census Bureau) by the share of income spent on rent and utilities.

Child care and child support. We set the value of α, which governs child care savings per child as the number of children in the household increases, using data on child care expenses from the Survey of Income and Program Participation (SIPP). Among households with children under 15 years of age, we find that families with 2 (3+) children spend on average 46% (64%) more on child care than families with 1 child. We set $\alpha = 0.5$ to be consistent with these estimates. Finally, we set child support per child, ϑ, using information from lone mothers in our sample who receive child support. We find that lone mothers of one child receive on average \$3,019 per year, and lone mothers of two children receive \$5,480. Based on these numbers, we set $\vartheta = \$3,000$.[22]

Distribution of asset holdings across single males. As mentioned above, we treat $\bar{F}_{a_m}$ as an exogenous object and will keep it fixed throughout our numerical experiments. We estimate this distribution from the 2013 wave of the Survey of Consumer Finances (SCF), using a sample of non-college-educated, never married males below 45 years of age. From this sample we exclude individuals with negative net wealth or above \$500,000 (the wealthiest 3 percent). The empirical wealth distribution within the remaining sample is summarized in Table 3. As can be seen, there is substantial dispersion with regard to the assets that a potential cohabitant/spouse may contribute to the common pool of assets: more than 20 percent of single males hold less than \$1,000, while males from the upper decile own more than \$170,000. The median male making a cohabiting or marriage proposal owns roughly \$9,700.

4.3. Parameters calibrated endogenously

The remaining fourteen parameters are calibrated internally: β, φ, ζ, η_f, ω_f, ω_m, $\hat{c}_0^{\ell_m}$, γ_1, γ_2, $\tilde{\pi}_{\ell_{cp}}$, $\tilde{\pi}_{\ell_c}$, $\tilde{\pi}_{\ell_m}$, ι_2 and ι_3. We set values to these parameters so that the stationary solution of our model economy matches fourteen moments

20 The expected number of periods for a female before she becomes a mother, conditional on becoming a mother, is $1/(1 - m_{00} - m_{0\emptyset})$.

21 Source: PEW, 2010. This number is calculated as the fraction of women aged 40-44 without children. The share of childless women without a high school degree is 15%, while it is 17% for high school graduates and 18% for women with some college. We choose an intermediate value of 17%. All numbers are based on CPS data from 2006-08.

22 The standard deviation of this variable in our sample is \$2,700, which reflects heterogeneity across lone mothers, misreporting and measurement error. It is not uncommon that custodian parents have informal agreements with noncustodial parents concerning child support payments which may lead to misreporting. Also, liquidity-constrained noncustodial parents that missed payments may pay out more than one year of child support in a single installment. Since child support risk for lone mothers is not well understood we set ϑ to its mean value for all lone mothers.

Table 3
Single males' asset distribution (in thousand dollars).

Decile	1	2	3	4	5	6	7	8	9	10
Net worth	0.2	0.8	2.9	6.5	9.7	13.5	22.7	41.0	77.8	174.6

Source: 2013 Survey of Consumer Finances (SCF).

Table 4
Parameters calibrated endogenously.

Description	Parameter	Value	Moment	Data	Model
Discount factor	β	0.957	Median wealth marr.	22,804	22,815
Regulates Frisch elasticity	ζ	3	Single f. Frisch elast.	0.63	0.63
Utility weight	φ	0.192	Hours single females	0.223	0.223
Pareto weight	η_f	0.554	Ratio hours	0.798	0.797
Female wage rate	ω_f	52.5	Avg. earnings females	15,737	15,713
Male wage rate	ω_m	79.8	Gender wage gap	0.180	0.180
Consumption commitment	$\hat{c}_0^{\ell_m}$	\$8,000	Hours married indiv.	0.273	0.272
Work & child care costs	γ_1	\$1,728	LFP married indiv.	0.771	0.771
Work & child care costs	γ_2	\$4,908	LFP single females	0.803	0.803
Prob. no proposal	$\tilde{\pi}^{\ell_s}$	0.741	Population share ℓ_s	0.197	0.197
Prob. bpp-cohabitation prop.	$\tilde{\pi}^{\ell_{cp}}$	0.033	Population share ℓ_{cp}	0.071	0.071
Prob. mop-cohabitation prop.	$\tilde{\pi}^{\ell_c}$	0.012	Population share ℓ_c	0.023	0.023
Prob. marriage prop.	$\tilde{\pi}^{\ell_m}$	0.214	Population share ℓ_m	0.709	0.709
Scaling factor prop. prob.	ι_2	0.25	Share ℓ_m with $n = 1$	0.365	0.362
Scaling factor prop. prob.	ι_3	0.05	Share ℓ_m with $n = 2$	0.427	0.416

from the data. While we cannot uniquely identify each parameter by a particular target, we report below in parenthesis the parameter that influences each moment the most. In particular, the moments used as targets to calibrate the fourteen parameters are:

1-3. The shares of each household type in our 2014 ASEC sample are as follows: lone mothers, 19.7 percent; two-parent cohabiting couples, 7.1 percent; mother-only-present cohabiting couples, 2.3 percent; married couples, 70.9 percent ($\tilde{\pi}_{\ell_{cp}}, \tilde{\pi}_{\ell_c}, \tilde{\pi}_{\ell_m}$).

4-5. The shares of married couples in our sample with 1 child, 2 children and 3 children are 36.5 percent, 42.7 percent and 20.7 percent respectively (ι_2, ι_3).

6. The employment rate of lone mothers is 80.3 percent (γ_2).

7. Average hours worked by lone mothers represent 22.3 percent of their time endowment (φ).

8. The employment rate among married individuals (females and males) is 77.1 percent (γ_1).

9. Average hours worked by married individuals (females and males) represent 27.3 percent of their time endowment ($\hat{c}_0^{\ell_m}$).

10. Average hours worked by working married females are 20.2 percent lower than those worked by working married males (η_f).

11. Micro estimates of the intensive-margin Frisch elasticity of labor supply for single females without children are roughly the same as for males, which range between 0.2 and 0.7 (Blundell and MaCurdy, 1999). We target an intensive-margin Frisch elasticity, evaluated at average hours worked, of 0.63 for single females without children and taxable income (i.e. income minus deduction and personal exemption) between \$8, 925 and \$36, 250. We choose workers in this group to help us identify parameter ζ because they are not entitled to tax credits and transfers, and we can hence obtain their intensive-margin Frisch elasticity as $\frac{1}{\zeta}\frac{1-h}{h}$, where h is the worker's number of hours. (Recall that lone mothers and couples have non-differentiable budget constraints, thus hindering the calculation of their Frisch elasticities.) (ζ).

12. Median net worth among married households, conditional on non-negative net worth, is \$22,804 (2013 SCF) (β).

13. Average earnings across lone mothers and married females are \$15,737 (ω_f).

14. The gender wage gap, defined as the mean log wage difference between full-time male and female workers, is 18 percent (ω_m).

The parameter values that match these moments are presented in Table 4.

4.4. Model fit

We assess the fit of the model using a set of moments which have not been used as targets. We compare moments generated by our model with those that we obtain from either our ASEC samples of lone mothers and married couples or the empirical literature.

Table 5
Data *vs.* model: labor supply and household earnings.

	Lone mothers		Married couples	
	data	model	data	model
PANEL A. LABOR SUPPLY				
Employment rates				
Females	80.28	80.27	61.07	59.00
Males	–	–	93.02	95.24
Distribution (# earners)				
1	80.28	80.27	40.98	45.75
2	–	–	56.55	54.24
Average hours worked†				
Females	1,523	1,522	1,684	1,671
Males	–	–	2,111	2,096
PANEL B. HOUSEHOLD EARNINGS‡				
Average	20,490	20,433	58,807	51,070
Std. Dev.	21,062	11,746	58,010	26,979
Median	17,000	17,153	50,000	47,023
p25	8,000	13,424	29,200	27,806
p75	28,000	23,700	75,000	67,141

Source: Data: Calculations from our 2014 ASEC sample of households; model: Simulations from the stationary solution. †Conditional on positive hours; ‡conditional on positive earnings.

Labor supply. While our targets above pin down the employment rate and average hours worked by lone mothers, they do not uniquely pin down those of married females and married males separately. Hence, we start by comparing average labor supply of married workers in the model with those in the data. Our model does well in accounting for both employment and average hours worked of married individuals. Namely, the employment rate of married females in the model is 59.00 percent, against 61.07 percent in the data. Average annual hours worked by working married females are 1,671 in the model and 1,684 in the data. For married males, the model yields an employment rate of 95.24 percent, against 93.02 percent in the data. Average hours worked by working married males equal 2,096 in the model and 2,111 in the data. (See panel A of Table 5.)

Household earnings. Panel B of Table 5 shows moments of household earnings in the model and in the data for each type of household. Average household earnings in the model are very close to those in the data for lone mothers, and about 13 percent below the data for married couples. The dispersion is lower in the model than in the data. This is in part explained by a thinner right tail in the model's distribution of household earnings. Our model generates less households with six-figure earnings than in the data. For instance, the model does not generate married couples with earnings above $150,000. Since our interest is on anti-poverty policy, this inability of the model to generate high-earning households has no sizable implications for our results.

Median household earnings in the model are very close to those in the data, both for lone mothers and married couples. The 25th earnings percentile for lone mothers is somewhat higher in the model than in the data. This is because some lone mothers in our sample have annual earnings as low as $100, and our model does not generate households with such low annual earnings, as it would not be optimal for them after having paid the fixed costs of participation.[23] The 75th earnings percentiles in the model are, on the contrary, lower than in the data. As explained, our model does not match well the measure of households at the top of the empirical earnings distribution. However, it matches well the empirical measures of households at the earnings levels that are relevant for our analysis. Our model also matches well the empirical shares of lone mothers and married households by income. For instance, among the households with earnings below $30K, 46 percent are lone mothers (versus 41 percent in the data). That is, lone mothers are over-represented in the subpopulation of low-income households (recall that lone mother represent 19 percent of our total population of households). Among households with earnings below $50K, 30.64 percent are lone mother households, compared to 30.89 in the data.

EITC recipients and costs. We now compare the distributions of EITC recipients and costs from the model with their counterparts from our sample. Since the CPS imputes the EITC on the basis of the worker's filing status, number of dependents and earnings (i.e. EITC values in the CPS are not actual take-ups), this exercise serves well our purpose. Panel A of Table 6 presents the shares of households entitled to the EITC, in the model and in our sample. Among lone mothers, 74.45 percent receive the EITC in the model, against 71.8 percent in our sample. For married couples, 44.60 percent receive the EITC in

[23] It should be noted that we have not censored the data setting a minimum cutoff in hours for the calculation of summary statistics. Since some lone mothers in our sample report working less than 200 hours per year, the p25 for earnings from the data would go up if these mothers were defined as non-working, a practice that is not uncommon in the literature. In the model, lone mothers do not choose such a low value for hours worked because of the fixed costs of working.

Table 6
Data *vs.* model: EITC.

	Lone mothers		Married couples	
	data	model	data	model
A. EITC recipients (%)	71.78	74.45	43.67	44.60
B. Distr. of EITC recipients				
One child	11.92	16.43	17.62	16.09
Two children	9.85	7.92	27.74	26.14
Three children	5.54	2.57	14.56	15.98
C. Distr. of EITC costs				
One child	8.81	12.27	13.02	7.76
Two children	10.54	10.65	30.58	27.08
Three children	5.99	3.86	20.69	22.41

Notes: EITC recipients and EITC costs in the data and in the model.

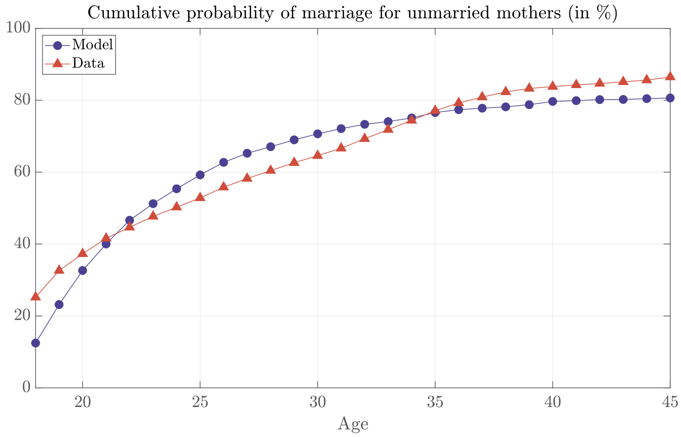

Fig. 4. Cumulative probability of marriage over life cycle. *Notes:* Fraction of mothers who are married at each age from 18 to 45. See footnote 24 for further explanation.

the model, against 43.67 percent in our sample. Panel B compares the model and empirical distributions of EITC recipients by household type and number of children. The model matches fairly well the empirical distribution, especially for married couples. For lone mothers, the model predicts a somewhat lower representation of lone mothers with three children among EITC recipients—2.57 against 5.54 in the data. The distribution of EITC costs by household type and number of children is shown in Panel C of Table 6. EITC costs are the sum of the non-refundable reductions in tax liabilities and the amounts refunded to eligible tax filers.

Marriage rates over the life cycle. By construction, our benchmark economy matches the empirical share of married households, but imposes no restrictions on the shape of the profile of marriage rates over the life cycle. Here we compare the cumulative probability of marriage for unmarried mothers in the model with its counterpart from our ASEC sample.[24] These cumulative probabilities are displayed in Fig. 4. Both in the data and the model, the profiles are steeper for young mothers, and flatten out as they age. This is mostly explained by the fact that lone mothers, conditional on having a marriage proposal, become pickier over time. In our model, young females enter the economy with no assets and are, hence, more likely to accept marriage proposals. As they start to accumulate some wealth, they reject more proposals.[25] Also, younger lone mothers tend to have fewer children than older ones, which implies that they give up less assistance income if they lose eligibility upon marriage.

Lone mothers' employment elasticity. There is a vast empirical literature examining the labor supply responses to the EITC expansions of the 1980's and 1990's (TRA86, OBRA90 and OBRA93). A well-established consensus in this literature is that these expansions increased employment among single mothers, with an estimated elasticity with respect to net income in the range of 0.6 – 1.2 (see Eissa and Hoynes, 2006 for a review of this literature). As another test of the model fit, we

[24] We run a Monte Carlo simulation of 10, 000 entering single females and compute, for each subsequent year, the ratio of married mothers to all mothers. The empirical counterpart is calculated from our sample of mothers as the ratio of married mothers of age x to all mothers of the same age.
[25] The model-generated life-cycle profiles for wealth and employment are presented in Supplementary Appendix E.

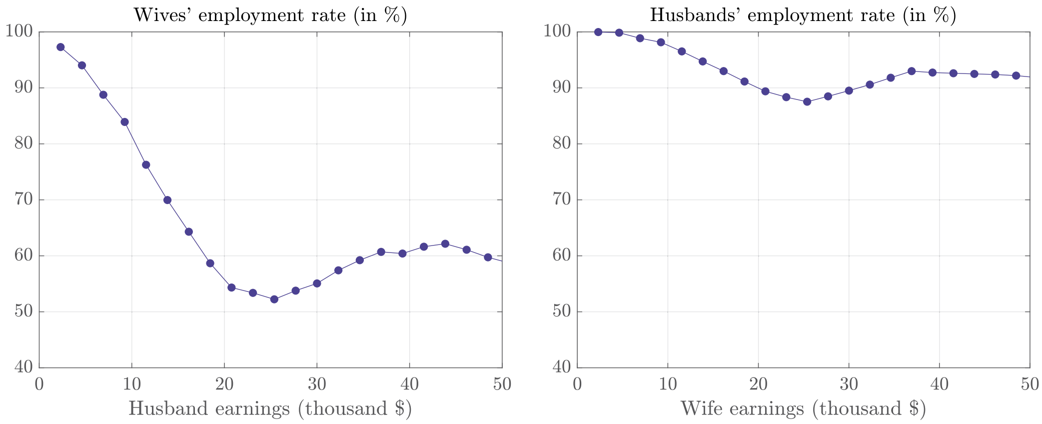

Fig. 5. Left panel: wives' employment and husbands' earnings. Right panel: husbands' employment and wives' earnings.

compute the lone mothers' employment elasticity with respect to net earnings implied by an expansion of the EITC. More precisely, we compute this elasticity as

$$\varepsilon^P_{\ell_s} = \frac{\partial \ln \mathcal{P}_{\ell_s}}{\partial \ln E[1-\tau^P_{\ell_s}]}, \tag{18}$$

where $\mathcal{P}_{\ell_s}$ is the employment rate of lone mothers and $E[1-\tau^P_{\ell_s}]$ is the mean net-of-participation tax rate. The participation tax rate of a working lone mother is defined as

$$\tau^P_{\ell_s} = \frac{TT(a, e_f, n) - TT(a, 0, n)}{e_f}. \tag{19}$$

The function TT in the numerator of (19) is the tax-transfer function of lone mothers, which includes taxes, tax credits and assistance transfers, i.e. $TT = IRS - B^u - F^u$. The numerator is the difference in the net transfer between employment and non-employment. We compute both short- and long-run employment elasticities. The short-run elasticity holds fixed the wealth and living arrangement distributions at the benchmark solution. The long-run elasticity is computed using the stationary distribution implied by the assumed expansion of the EITC. We find short- and long-run employment elasticities for lone mothers equal to 0.60 and 0.63, respectively.[26]

Wives and husbands' employment probabilities and their spouses' earnings. Fig. 5 displays the relationship between one spouse's level of earnings and the other spouse's probability of employment generated by our model. Both relationships are U-shaped, as found in the data and shown in Section 2. Also, as in the data, wives' employment rates display more variation than the husbands', and both reach their minimum values when their spouses' earnings are about $25K. Except for married couples where the husband earns less than $13K, our model generates wives' employment rates that are remarkably close to those found in the data: they first decline to reach a minimum of about 52 percent at husbands' earnings around $25K, and then increase to a bit over 60 percent. The model predicts wives' employment rates that are higher than those predicted from the data when husbands earn less than $13K. Since both in the model and in the data the measure of these households is very small, this will not affect our main conclusions in this paper.

5. The effects of the U.S. tax-transfer system across the stationary distribution

5.1. Lone mothers

Labor supply. Before examining the (dis)incentives introduced by the tax-transfer system to supply labor across the stationary distribution, we first show the participation tax rates of lone mothers with no assets as a function of the number of children and the level of earnings (left panel of Fig. 6). The participation tax rates in this plot are defined as in equation (19) above, $\tau^P_{\ell_s}(0, e_f, n)$, which are calculated using only the tax-transfer scheme as a function of earnings. It is apparent

[26] It should be noted, however, that a comparison of the model's elasticities with those estimated in the empirical literature is not straightforward. First, most papers in the empirical literature estimating these elasticities use the tax-filing unit as the relevant unit of analysis, and, hence, include unmarried mothers who live with a partner or with other family members. In our model a lone mother lives alone with her children and is, therefore, unable to share risks as well as household consumption commitments. Second, while the empirical elasticities are estimated from employment rates prior to the 1980's and 1990's EITC expansions, our elasticities are computed from employment rates after these reforms, and it may well be that the elasticities have not remained constant.

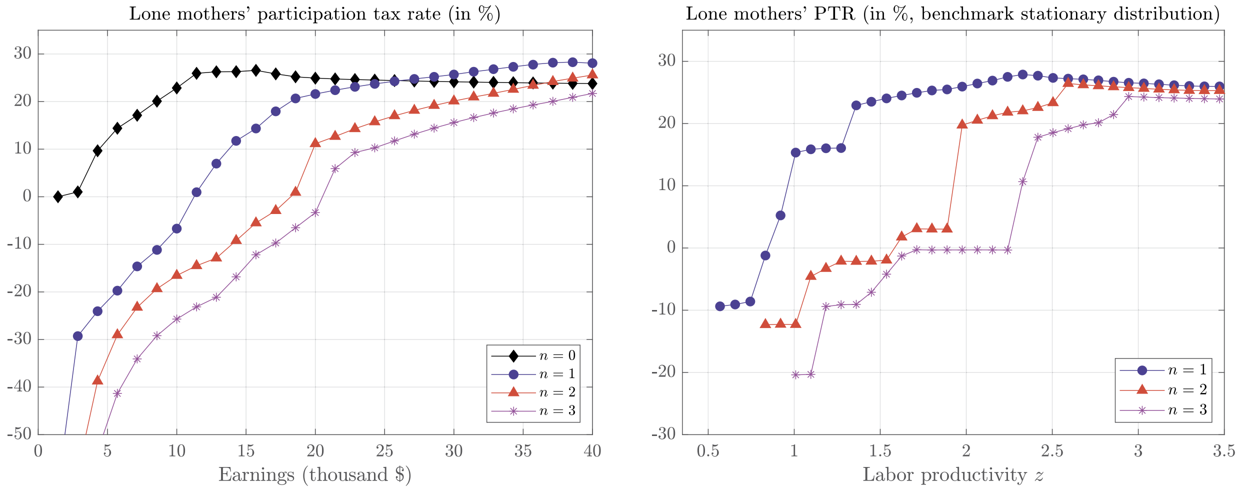

Fig. 6. Lone mothers' participation tax rates. *Notes:* Lone mothers' participation tax rates obtained from the tax-transfer system as a function of earnings (left panel), and lone mothers' participation tax rates from the model as a function of labor productivity (right panel).

from this figure that the tax-transfer system, especially the EITC, provides substantial incentives for employment. Compared to single females without children, lone mothers face negative participation tax rates up to earnings of about $21K in the case of mothers of three children. The second kink of the EITC schedule and the loss of eligibility to TANF and SNAP for mothers of one, two and three children are visible in these tax rates from the jumps occurring at earnings levels of $17K, $19K and $21K, respectively.

We now present the participation tax rates of working lone mothers with no assets as a function of the number of children and labor productivity, $\tau^P_{\ell_s}(0, e_f(z, 0, n), n)$, where $e_f(z, 0, n)$ are earnings from the solution of our model (right panel of Fig. 6). In this plot, our focus on lone mothers with no assets simplifies the exposition without affecting the implications qualitatively. Fig. 6 reveals the incentives for employment, as well as the disincentives for hours worked present in the U.S. tax-transfer system. As was to be expected, working lone mothers with low productivity get the highest incentives to work. In particular, lone mothers of three get a participation subsidy of up to 20 percent of their earnings. Participation tax rates increase with productivity, converging to about 25 percent. The disincentives for hours worked can readily be seen from the flat parts in the schedules in this figure. The existence of productivity intervals yielding the same participation tax rate means that an increase in productivity does not always increase earnings. That is, working lone mothers with labor productivity in this interval reduce hours worked to avoid losing income from taxes and transfers. As is clear from the figure, the incidence of these disincentives is highest among lone mothers of three children, as they get more generous transfers, and have, therefore, relatively more to lose. (For instance, lone mothers of three with labor productivities between 1.7 and 2.3 choose the same level of earnings.)

In light of the sizable employment subsidies shown above, we compute the cost to the government of lone mothers' employment. That is, we compute the government's net extra cost of employment across lone mothers as the difference between the net cost of employment and the net cost of non-employment. We abstract from payroll taxes as they create entitlements to future government expenses that are not included in our model. Table 7 presents these net extra costs of employment to the government, expressed in dollars both per working lone mother and per hour worked. As expected, the employment of lone mothers of two and three children is the most costly to the government. In fact, the government pays 1,587 extra dollars per employed lone mother of two, and 2,884 extra dollars per employed lone mother of three.[27] The cost of employment of lone mothers of one child is -$1,240, meaning that the government collects a revenue from their employment.

Savings. The $2K asset limit for TANF and SNAP eligibility distorts the savings decision of lone mothers. The extent of the distortion depends importantly on their labor productivity. For instance, lone mothers of one child with median labor productivity ($z = 1$) will choose savings so that they meet the asset test even when their wealth level is as high as $14K (i.e., they are willing to dissave up to $12K in order to gain TANF and SNAP eligibility). Beyond this level of wealth, these lone mothers find it optimal to hold wealth above $2K and give up TANF and SNAP. On the other hand, high-productive lone mothers choose savings above the TANF and SNAP asset limit from much lower wealth levels. As an illustration, Fig. 7 displays next-period assets as a function of current assets for lone mothers of one child with low, medium and high labor productivity. It is apparent from this figure that introducing an asset limit as a threshold cliff is bound to have sizable effects

[27] Since our model abstracts from on-the-job human capital accumulation, these figures do not include the potential gains for the government from human capital accumulation. There could also be benefits for their children from having a working mother (see Mullins, 2019).

Table 7
Government's net extra cost of lone mothers' employment.

	Working lone mothers			
	All	$n = 1$	$n = 2$	$n = 3$
Net cost of employment ($) (per working lone mother)	-24	-1,240	1,587	2,884
Net cost of employment ($) (per lone mothers' hours worked)	-0.02	-0.78	1.09	2.15

Notes: Numbers in this table represent the net extra cost to the government of lone mothers' employment (excluding payroll taxes).

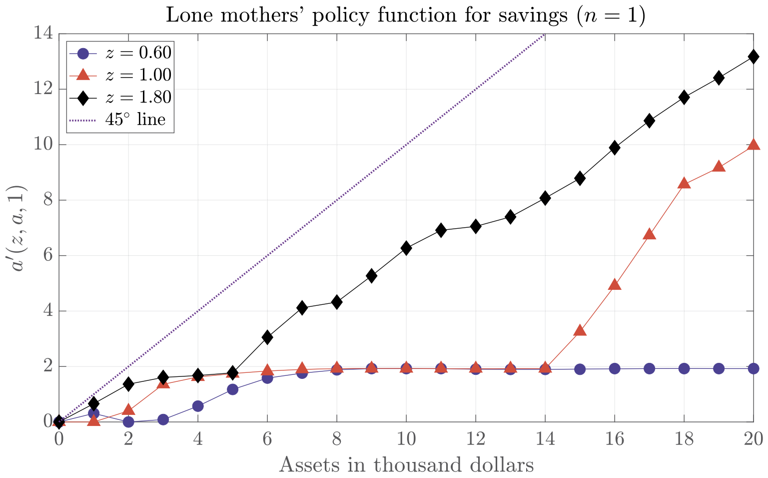

Fig. 7. Policy functions for savings. *Notes:* Savings policy functions for lone mothers of one child evaluated at three labor productivity levels. Values below the forty-five degree line correspond to negative net savings.

on savings. Phasing out TANF and SNAP benefits on the basis of assets, as is done on income, would help reduce distortions on savings. (The newly created Universal Credit that will replace all extant tax credits and income support programs in the U.K. does indeed introduce a phase out on assets between £6,000 and £16,000.)

5.2. *Cohabitation* vs. *marriage*

We now assess the marriage penalty/bonus, relative to cohabitation, created by the tax-transfer system, and the behavioral responses to such a penalty/bonus. We start by comparing labor supplies across these two types of couples with children. As noted above, in our model any difference in their labor supply decisions is a behavioral response to their tax-transfer schemes. We find that the employment rate of cohabiting males is only 3 percentage points higher than that of married males. However, the employment rate of cohabiting females is 28 percentage points higher than among married females. As for average hours worked (conditional on working), cohabiting males work 90 hours less per year than married males. Working females cohabiting with the father of their children work about 30 hours more per year than married females. Working females cohabiting with a male who is not the father of their children work almost 85 hours less than married females. This indicates that, everything else equal, the differential tax-transfer treatment of cohabiting and married couples has sizable labor supply effects, especially for females at the extensive margin. Employment among married mothers is significantly hindered by their tax-transfer scheme. The implied cost in terms of annual household earnings goes from almost $3K (if compared to mother-only-present cohabiting couples) to $6K (if compared to both-parents-present cohabiting couples).

Participation tax rates of cohabiting and married mothers. To understand the disincentives introduced by the tax-transfer scheme to female employment across living arrangements, we compare the participation tax rates of cohabiting and married mothers as a function of the earnings of their partners/husbands. The participation tax rate of a working mother earning e_f and whose partner/husband earns e_m is given by

$$\frac{TT(a, e_f + e_m, n) - TT(a, e_m, n)}{e_f},$$

where TT is the respective tax-transfer function of cohabiting or married couples. Note that in the calculation of these participation tax rates we use the cohabiting couples' optimal choices of the filing statuses. The participation tax rates for

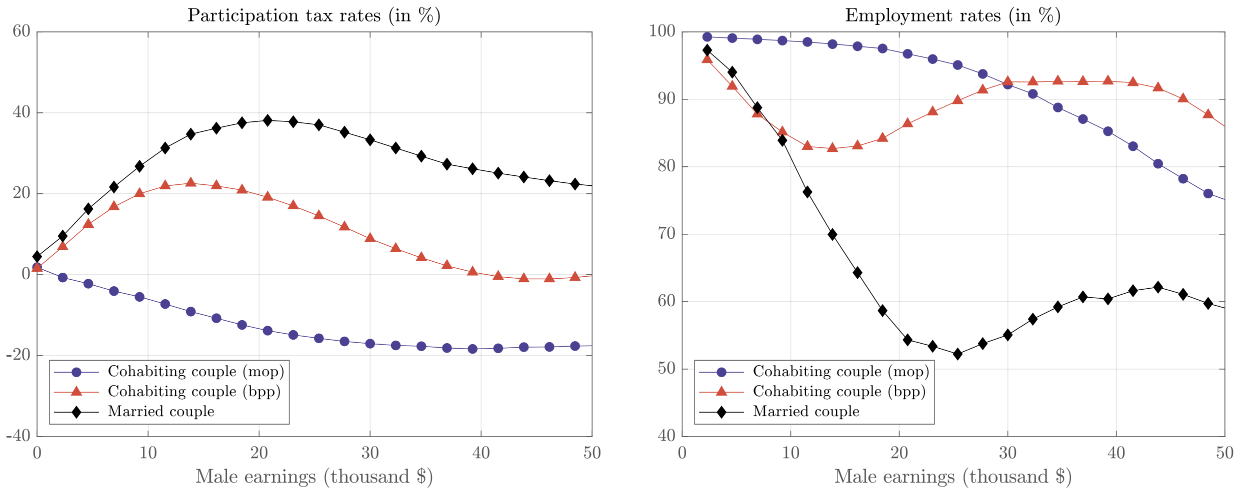

Fig. 8. Female participation tax rates and employment rates.

non-working mothers are imputed assuming a level of earnings equal to $\bar{h}^{pt} z_f \omega_f$, where $\bar{h}^{pt}$ is the number of hours of a part-time job.

Fig. 8 (left panel) shows that married mothers' participation tax rates are hump shaped on their husbands' earnings. They also face higher participation tax rates than cohabiting mothers. The maximum difference between their tax rates is reached at male earnings between $20K and $40K, which is the earnings interval that has most of the male workers in our sample. Interestingly, both-parents-present cohabiting mothers can obtain negative participation tax rates by filing as head of household when their partners' earnings are at or above the third kink of the EITC schedule. That is, when male earnings are too high for him to gain EITC income, the female can take over as head of household so that the couple can continue to receive EITC income. This is in contrast to married couples, for whom the EITC and income transfers are based on household earnings.

Employment rates of cohabiting and married mothers. The employment response to the profile of participation tax rates across cohabiting and married mothers is shown in Fig. 8 (right panel). We plot employment rates as functions of the earnings of their partners/husbands. Married females have the lowest employment rates, which, as already discussed, vary in a U-shaped fashion with the earnings or their husbands. The maximum gap in employment rates between cohabiting and married mothers occurs at male earnings around $25K. This illustrates the disincentives introduced by the tax-transfer system to married mothers' employment.

Effective tax rates of cohabiting and married couples. We compute the difference between effective tax rates before and after tax credits, for cohabiting and married couples.[28] Using the stationary distribution under the benchmark policy, we find that up to household earnings of about $35K, married couples gain more from tax credits than cohabiting couples. However, at household earnings above this level, cohabiting couples make a wider use of tax credits (see left panel of Fig. 9). Further, while cohabiting couples with combined earnings above $80K still remain entitled to tax credits, married couples lose entitlement at combined earnings over $50K. This is explained by the ability of cohabiting working females to file as head of household, and earn EITC income, regardless their partners' earnings. As explained above, both-parents-present cohabiting couples may find it optimal that the secondary earner takes over as head of household as soon as the primary worker's earnings falls into the phase-out region of the EITC.

We show that these implications of the model are readily seen in the data. The right panel of Fig. 9 displays the empirical counterpart of the left panel, i.e., the difference between effective tax rates before and after credits for households in our ASEC sample. The same patterns found in the model are observed in the data: Married couples gain more than cohabiting couples from tax credits at low levels of combined earnings, but the latter remain entitled to tax credits further beyond the level of earnings at which married couples lose entitlement. This finding will be qualified below when we look at the marital status decision of cohabiting couples. It will become clear that the relative gain of married couples from tax credits at low levels of household earnings stems from households where only the male works.

[28] More precisely, we compute the effective tax rates before and after refundable tax credits, and take the difference between the two. This difference measures the extent to which the EITC and the Additional Child Tax Credit (the refundable part of the Child Tax Credit) reduce effective tax rates of cohabiting and married couples.

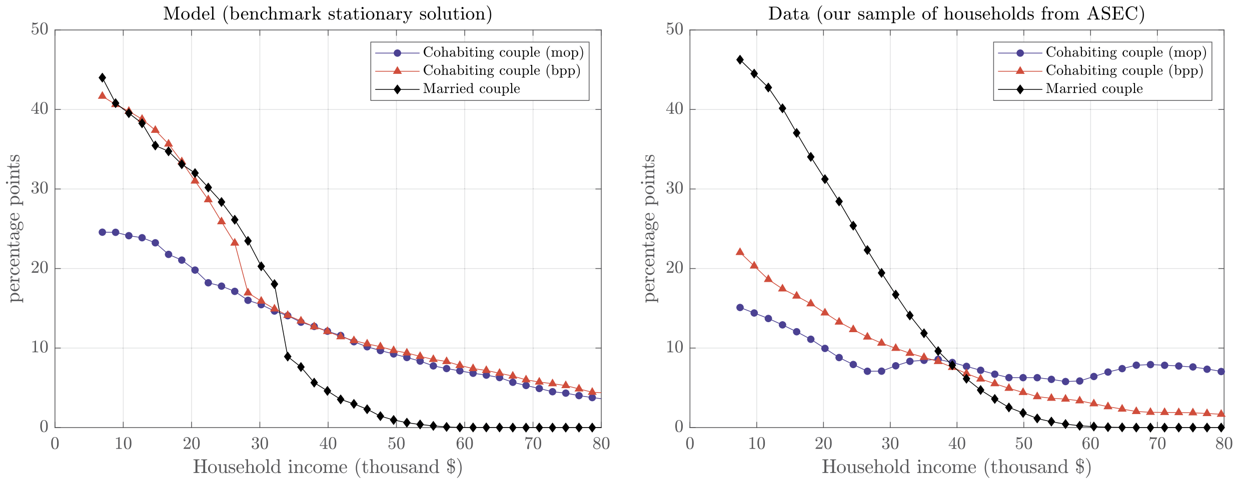

Fig. 9. Difference between effective tax rates before and after tax credits. *Notes:* Difference between effective tax rates before and after tax credits in the model (left panel) and in our data (right panel).

The marital status decision of cohabiting couples. Recall that in our model cohabiting couples get married as soon as they are better off as a married couple than as a cohabiting couple. Further, in our model cohabitation and marriage provide the same opportunities to share risks within the household, and also entail the same consumption commitments and child care costs while working. Thus, the marital status decision of cohabiting couples is based only on taxes and transfers. To shed light on how this decision varies across households, the left panel of Fig. 10 displays the policy function for marital status for different combinations of the couple's labor productivities, (z_m, z_f). The within-household distribution of labor productivities (and hence of potential earnings) is key in the choice of marital status, as taxes and transfers under cohabitation and marriage depend differently on the within-household distribution of earnings. It must be noted that looking only at household combined income—as we did in Fig. 9 to compare effective tax rates before and after tax credits—leaves aside important effects stemming from within-household heterogeneity. Under the current tax-transfer system, Fig. 10 shows that cohabiting couples where the female has very low labor productivity get married if male productivity is at least 0.85 (i.e. 15 percent below the median). That is, if the female will not be working and the male will work marriage is preferred. However, for higher levels of female productivity the marriage set shrinks. Females with higher earnings ability will join the labor market, and the couple will be more likely to choose cohabitation (the male productivity threshold for marriage increases).[29] A pattern consistent with this finding is present in our data. In our sample of two-adult households with children we find that the likelihood of cohabitation increases with female earnings. For instance, the likelihood of cohabitation among couples with one child is five percentage points higher if the female earns between $10K and $15K than if the female does not work.

To see how the EITC shapes the cohabitation/marriage regions in Fig. 10, in the right panel of this Figure we display the cohabiting couples' decision after removing the EITC from the tax-transfer system. There is a marked increase in the marriage region, with more marriages among low- and middle-income working couples. More specifically, using the stationary distribution from our model we find that abolishing the EITC would yield an eightfold increase in the marriage rate among both-parents-present cohabiting couples with two children, and a sixfold increase for couples where the male is not the father of the children. In sum, the current tax-transfer system introduces large financial disincentives to marry for low-income couples with children, especially if both the female and the male work. We will return to the EITC for married couples in the next section.

Lone mothers' cohabitation and marriage acceptance rates. We now show average acceptance rates as a function of the lone mother's labor productivity, Fig. 11. More productive lone mothers are pickier and accept fewer proposals, either to marry or to cohabit. Proposals to cohabit from a male who is not the father of the children have the highest acceptance rates at all levels of the lone mother's productivity. For proposals coming from the father of her children, a low-productive lone mother ($z \leq 0.75$) is as likely to accept a marriage offer as to accept a cohabitation offer. However, average and high-productive lone mothers are more likely to accept cohabitation than marriage proposals from the father of her children. Fig. 11 also sheds light on the extent of sorting in marriage and cohabitation (e.g., lone mothers with high wealth/earnings potential refuse offers from males with low wealth/earnings potential). The model generates significant sorting, despite our restriction to individuals without a college degree. (Supplementary Appendix E presents a more detailed analysis on the extent of assortative mating implied by the model.)

[29] Recall that marital status and work decisions are not independent from one another. Couples make both decisions jointly.

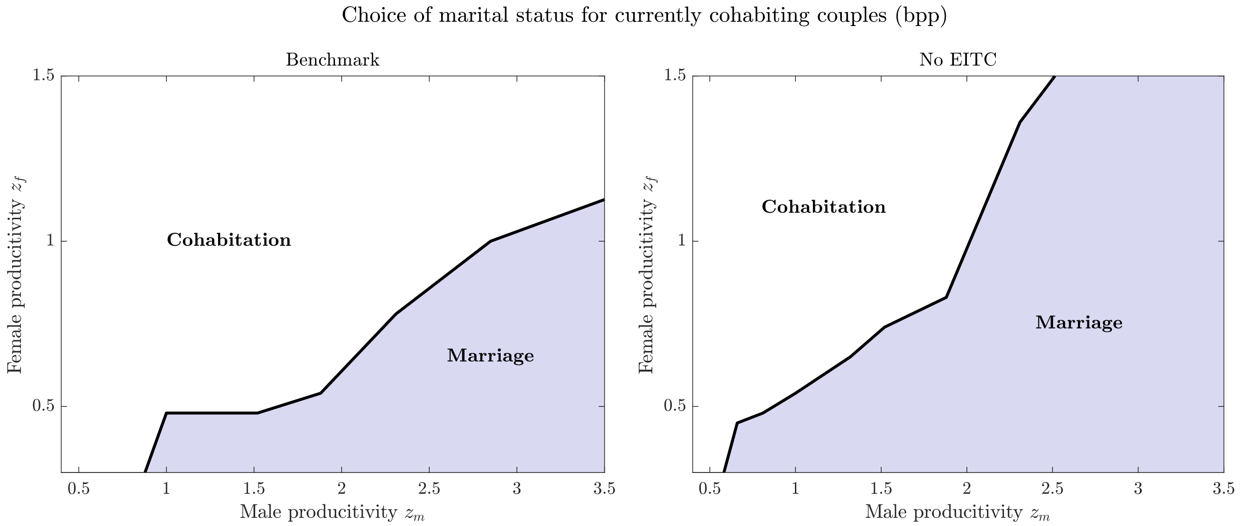

Fig. 10. The marital status decision of cohabiting couples. *Notes:* Marital status decision of cohabiting couples under the benchmark tax-transfer system (left panel), and the decision after removing the EITC (right panel). In both panels we assume that couples have two children, and that they are asset eligible for TANF and SNAP.

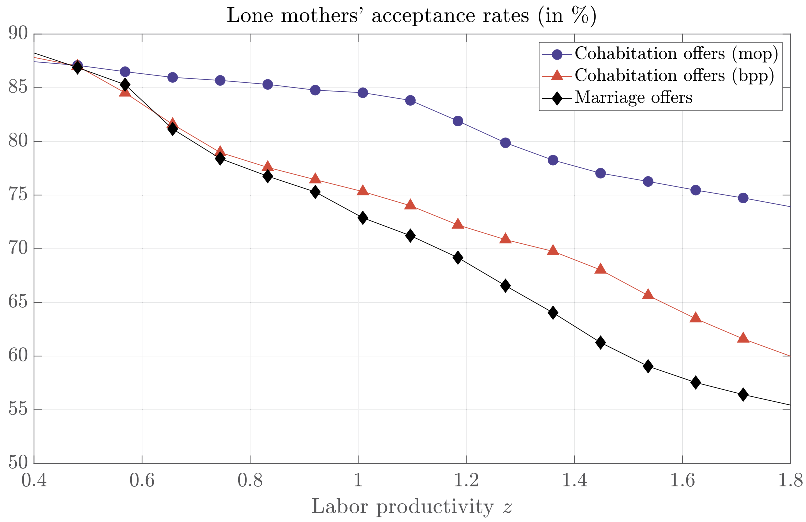

Fig. 11. Lone mothers' acceptance rates. *Notes:* Lone mothers' average acceptance rates of cohabiting and marriage proposals. For each level of labor productivity we plot average acceptance rates across the stationary distribution over assets and number of children.

Finally, in Fig. 12 we plot the lone mothers' preferred living arrangement for different combinations of their labor productivity, z_f, and the labor productivity of potential mates, z_m. The left panel of the figure displays the regions of preferred living arrangement under the benchmark policy: (1) remain single, (2) cohabitation, and (3) marriage; the right panel displays the three regions after removing TANF from the tax-transfer system. It is apparent from this Figure that TANF introduces a big disincentive for lone mothers to marry, especially among those with low labor productivity. Most of these mothers would choose marriage over cohabitation absent TANF. (Recall that under the current policy a low-productive lone mother does not lose income from TANF if she cohabits with a male who is not the father of her children.)

6. Responses to a reform of the EITC

This section evaluates the responses to a reform of the EITC as proposed in the "21st Century Worker Tax Cut Act". This was a bill introduced on March 26, 2014 to the 113th Congress by Patricia Murray (D), which was referred to the Finance Committee, but did not advance further. The bill proposed the creation of a new EITC deduction on the earnings of the secondary earner for married couples with children. The main motivation for this deduction is to improve the incentives of married mothers to enter work. The deduction would be applied before computing EITC eligibility, implying that the income

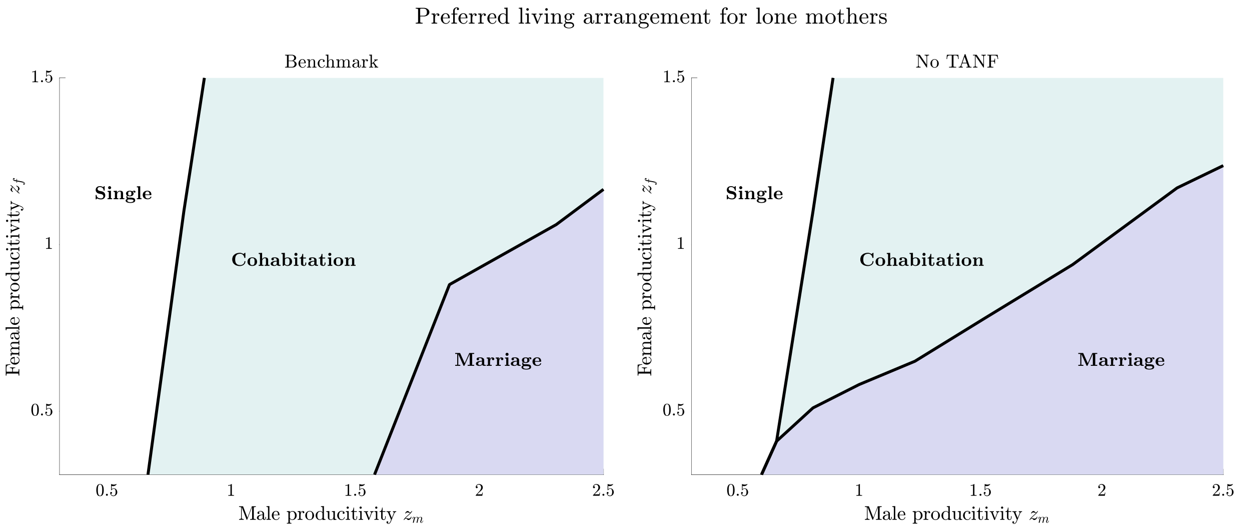

Fig. 12. Lone mothers' preferred living arrangement. *Notes:* Lone mothers' preferred living arrangement under the benchmark tax-transfer system (left panel), and after removing TANF (right panel). In both panels we assume that the lone mother has one child, and that the household would pass the SNAP and TANF asset eligibility test.

requirement for a married couple with n children would be $e_f + e_m + ra - 0.5\min\{e_f, e_m\} \leq y_l^{jn}$, under a deduction of 50 percent. Household earnings to determine the amount of the credit for eligible married couples would be $e = e_f + e_m - 0.5\min\{e_f, e_m\}$.

We first assess the long-run effects of this reform. We compute the stationary solution of the model under this new EITC schedule—holding taxes and other transfers unchanged—and report the percentage change of the variables of interest with respect to the benchmark stationary solution. The long-run effects include changes in the distribution of wealth, living arrangements, and marital status. We do not impose revenue neutrality so that we can ascertain the cost of the reform. The results are shown in Table 8. Although the effects are largest for married couples, the deduction also affects lone mothers' decisions. The employment rate of married females increases by 6.9 percent, and for married males it increases by 1.3 percent. The fraction of two-earner married households increases by 9.7 percent. Average hours worked, by contrast, decline slightly: Married females reduce hours by 1.4 percent, and married males by 0.9 percent. To understand these labor supply effects, it should be noted that the new deduction introduces a positive income effect on the labor supply of married couples with earnings in the phase-in region and at the beginning of the flat region, and a negative income effect for those in the phase-out region. It also introduces a negative substitution effect for married females in the phase-in region, but a positive substitution effect for females at the beginning of the flat region and in the phase-out region. As expected, the fraction of EITC recipients and EITC costs per household increase, but, interestingly, this reform reduces the sum of TANF and SNAP costs. Overall, this reform reduces married couples' net contribution to the federal budget (per married couple) by 3.90 percent.

Although the EITC schedule for lone mothers remains unchanged under this reform, the new deduction for two-earner married couples increases the value of marriage and, as a result, lone mothers' marriage acceptance rates. The higher marriage acceptance rate reduces the populations of lone mothers and cohabiting couples, and increases the population of married couples. Moreover, the increased prospects of marriage lead lone mothers to save less, as they need less precautionary savings. The composition of the population of lone mothers also changes. The new deduction lessens the marriage penalty, especially for high-productivity lone mothers if they marry. Hence, this is the group of lone mothers with the highest increase in the transition rate to marriage. Overall, lone mothers' average wealth declines by 1.02 percent with this reform.

To compute the cost of this reform to the government, we divide the sum of the net contributions to the federal budget (taxes minus transfers) across all households in our population of interest by the total number of households in this population. The net contribution per household under this reform is $1, 040, against $1, 076 in the benchmark economy. This implies a reduction in government revenues of $36 per non-college-educated household with children. It should be noted that this estimated cost is lower than the one that would be estimated from a model without endogenous household formation. The EITC deduction reduces the fraction of lone mother households, who are net recipients of federal funds, and increases the fraction of married couples, who are net contributors.

The short-run effects of the EITC reform are shown in Table 9. These effects are computed by holding the wealth distribution, living arrangements, and marital status fixed at the benchmark stationary solution. To highlight the consequences of modeling the husbands' behavioral responses, we report short-run effects under two distinct scenarios. First, we assume that husbands are unresponsive to the new deduction, holding their labor supply unchanged at the level in the benchmark

Table 8
Long-run effects of an EITC deduction on secondary earners.

	Bench.	Reform (% change)		Bench.	Reform (% change)
Demographics			**Married couples**		
Lone mothers (%)	19.64	−0.73	Employment rate (%)		
Married couples (%)	70.88	+1.42	Females	59.00	+6.92
Cohabiting couples (%)	9.49	−9.11	Males	95.24	+1.26
New marriage rate†	11.29	+4.50	Two-earner HHs (%)	54.24	+9.73
			Avg. hours worked‡		
Lone mothers			Females	1, 671	−1.43
Marriage acceptance rate	68.94	+0.96	Males	2, 096	−0.90
Employment rate (%)	80.27	+0.15	Avg. HH earnings‡	51, 070	+0.32
Avg. hours worked‡	1, 522	+0.00	Avg. HH disp. income	50, 207	+0.36
Avg. HH earnings‡	20, 433	−0.17	Avg. HH wealth	64, 496	−4.78
Avg. HH disp. income	26.255	−0.02	EITC recipients (%)	44.60	+23.42
Avg. HH wealth	6, 241	−1.02	EITC costs*	1, 625	+15.61
EITC recipients (%)	74.45	+0.19	SNAP + TANF costs*	1, 290	−15.40
EITC costs*	2, 744	−0.22	Net contribution*	2, 812	−3.90
SNAP + TANF costs*	2, 737	−0.09			
Net transfer*	4, 838	−0.12			

Notes: †The new marriage rate is the number of new marriages in a given period divided by the number of unmarried mothers in that period. ‡Conditioning on positive hours. *Net transfer from (resp. net contribution to) federal budget per household in the relevant subpopulation.

Table 9
Short-run and long-run effects for married couples.

	Benchmark	% change		
		Short run (Fixed l^m)	Short run	Long run
Employment rate (%)				
Females	59.03	+4.83	+6.85	+6.92
Males	95.24	+0.00	+1.25	+1.26
Two-earner households (%)	54.27	+5.26	+9.65	+9.73
Avg. hours worked‡				
Females	1, 671	−1.20	−1.63	−1.43
Males	2, 096	+0.00	−1.08	−0.90
Avg. household earnings‡	51, 073	+0.31	+0.20	+0.32
Avg. household disposable income	50, 209	+0.52	+0.37	+0.36
Avg. household wealth	64, 661	+0.00	+0.00	−4.78
EITC recipients (%)	44.58	+18.28	+21.71	+23.42
EITC costs*	1, 624	+12.38	+14.11	+15.61
SNAP + TANF costs*	1, 287	−8.44	−15.91	−15.40
Net contrib. to federal budget*	2, 817	−3.57	−2.82	−3.90

Notes: ‡Conditioning on positive hours. *Per married household.

solution. In this case, only the wives' labor supply responds to the reform. The second scenario assumes that both husband and wife respond to the reform and solve a joint decision problem.

The short-run effects under unresponsive husbands are shown in the column labeled by (fixed l^m). In this case, the introduction of the EITC deduction increases the married mothers' employment rate by 4.83 percent, as opposed to 6.85 percent when the couple solves a joint decision problem. The increase in the fraction of two-earner households is also underestimated when l^m is held fixed (5.26 versus 9.65 percent increase). Overall, this translates into an underestimation of the increase in EITC recipients and costs. Likewise, the decline in the total costs of SNAP and TANF among married couples with children would be underestimated (8.44 versus 15.91 percent decrease) by failing to account for the husbands' response to the deduction.

Participation tax rates and employment rates. Fig. 13 displays the average participation tax rates (left panel) and employment rates (right panel) of husbands and wives, both in the benchmark solution and after the reform. It is apparent from this figure that the 50 percent EITC deduction reduces the participation tax rate of workers whose spouses earn between $9K and $40K, which is the interval that corresponds to the plateau and phase-out regions of the EITC schedules for many of these households. The reduction in the participation tax rates fosters employment in these regions, both for husbands and wives, and removes the U-shaped relationship between one spouse's earnings and the other spouse's employment decision that we found both in the data and in the benchmark solution of the model. In short, an EITC deduction for secondary earners would contribute to lessening the disincentives to work created by the current tax-transfer system among married parents.

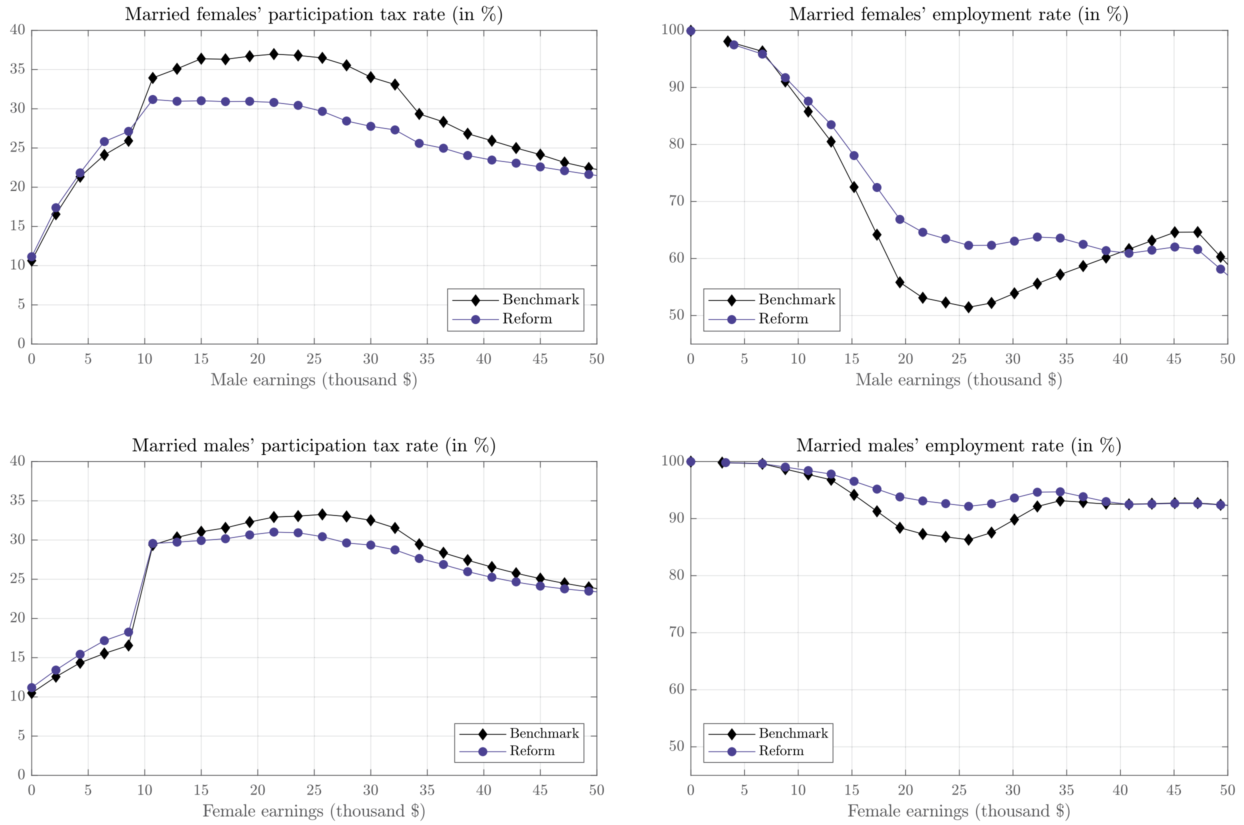

Fig. 13. Married individuals' participation tax rates and employment rates. *Notes:* Married females' participation tax rates and employment rates are shown in the top panels. Married males' participation tax rates and employment rates are shown in the bottom panels.

We have computed the welfare effects of this EITC reform, both for married individuals and newborn females (see Supplementary Appendix C for computational details). We find that the welfare of married individuals, measured in consumption equivalent units, increases by about 0.2 percent. The welfare effect on the newborn is positive but small (less than 0.1 percent).

7. Conclusion

Understanding the effects of taxes and transfers on low-income households' decisions is key for both positive and normative analyses. In this paper, we contribute to a growing literature that uses structural dynamic models to measure the (dis)incentives to save, work, cohabit, and marry present in the U.S. tax-transfer system. Measuring the behavioral responses along these margins will help design more efficient tax-transfer systems. We present a model of consumption/savings, labor supply, and cohabitation/marriage decisions that allows us to examine these responses, and to evaluate the consequences of a recent proposal to reform the U.S. tax-transfer system. Our model generates a stationary distribution of households and, hence, we can measure the (dis)incentives for households across this distribution, as well as assess the effects of policy reforms on a given population.

We introduce within-household risk sharing and joint decision making in two-adult households. This is important because income transfers to assist low-income households with children are means tested and phased out. Among two-adult households, these two features of the transfer system generate responses that existing models fail to capture. Contrary to previous models, which assume that the decisions of one of the workers in the household are exogenous and non-responsive to household conditions, we endogenize the decisions of each adult member. This turns out to be critical for the understanding and measurement of the responses to tax credits and income transfers, since family decision making opens a whole new set of choices, especially for households around the phase-out regions of the programs.

Our model can be used as a laboratory for ex-ante evaluation of the distributional consequences of policy reforms. While our model builds on the workhorse framework of precautionary savings and income inequality, it departs from it by introducing one- and two-adult households, an endogenous decision of the living arrangement and joint decision making within the household. We model the U.S. income tax scheme and the income transfer programs in great detail, embedding the eligibility and benefits criteria for households according to their number of qualifying children, filing status and living arrangement. This allows us to examine the behavioral responses to the tax-transfer system at a more disaggregated level, shed light on the marriage penalty/bonus, and identify new effects of policy reforms. For instance, our evaluation of the "21st Century Worker Tax Cut Act" reveals that introducing a new deduction to the EITC of two-earner married couples has consequences beyond two-earner workers, and beyond married households. Namely, while the deduction increases the employment rate of secondary earners, as intended, it also increases the employment rate and reduces the average hours worked by primary earners.

There are a number of other exercises that could be easily addressed within our framework. Some of these exercises, that we leave for future research, include: (i) The introduction of an endogenous labor demand. In our model, the wage rate is assumed to be exogenous and, hence, unaffected by any change in labor supply that may be brought about by transfer programs. This assumption does not allow us to address issues related to the incidence of taxes and transfers (see Rothstein, 2010). While endogenizing labor demand in our framework is rather straightforward, here we chose to focus on the supply side for the sake of clarify and space limitation. The inclusion of an endogenous labor demand will allow us to study minimum wage policies to understand how they interact with supply side, anti-poverty policies. (ii) A normative analysis of the tax-transfer system. Most studies on the optimal design of the tax-transfer system abstract from several of the margins included in our model, especially from the endogenous choice of the living arrangement and marital status. These are important response margins that should be included in normative analyses of the tax-transfer system.

Appendix. Supplementary material

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.red.2021.02.010.

References

Athreya, K., Kosar, G., Reilly, D., Simpson, N., 2014. Young Unskilled Women and the Earned Income Tax Credit: Insurance without Disincentives. Working Paper. The Federal Reserve Bank of Richmond.
Baughman, R., Dickert-Conlin, S., 2009. The EITC and fertility. Journal of Population Economics 22 (3), 537–563.
Bick, A., Fuchs-Schündeln, N., 2018. Taxation and labor supply of married women across countries: a macroeconomic analysis. The Review of Economic Studies 85 (1), 1543–1576.
Blundell, R., MaCurdy, T., 1999. Labor supply: a review of alternative approaches. In: Ashenfelter, Orley, Card, David (Eds.), Handbook of Labor Economics, vol. 3A. North-Holland, Amsterdam.
Blundell, R., Costa-Dias, M., Meghir, C., Shaw, J., 2016. Female labor supply, human capital, and welfare reform. Econometrica 84 (5), 1705–1753.
Chan, M.K., 2013. A dynamic model of welfare reform. Econometrica 81 (3), 941–1001.
Conroy-Beam, D., Buss, D.M., 2016. Do mate preferences influence actual mating decisions? Evidence from computer simulations and three studies of mated couples. Journal of Personality and Social Psychology 111 (1), 53–66.
Eissa, N., Hoynes, H.W., 2003. Good news for low-income families? Tax-transfer schemes and marriage. Manuscript.
Eissa, N., Hoynes, H.W., 2006. Behavioral responses to taxes: lessons from the EITC and labor supply. In: Poterba, James M. (Ed.), Tax Policy and the Economy, vol. 20. MIT Press, Cambridge, MA, pp. 74–110.
Flodén, M., Lindé, J., 2001. Idiosyncratic risk in the U.S. and Sweden: is there a role for government insurance? Review of Economic Dynamics 4 (2), 406–437.
Greenwood, J., Guner, N., Knowles, J.A., 2000. Women on Welfare: A Macroeconomic Analysis. AEA Papers and Proceedings, pp. 383–388.
Guner, N., Kaygusuz, R., Ventura, G., 2012. Taxation and household labor supply. The Review of Economic Studies 79 (3), 1113–1149.
Guner, N., Kaygusuz, R., Ventura, G., 2020. Child-related transfers, households labor supply and welfare. The Review of Economic Studies 87 (5), 2290–2321.
Heathcote, J., Storesletten, K., Violante, G.L., 2010. The macroeconomic implications of rising wage inequality in the United States. Journal of Political Economy 118 (4), 681–722.
Herbst, C.M., 2011. The impact of the earned income tax credit on marriage and divorce: evidence from flow data. Population Research and Policy Review 30, 101–128.
Hubbard, R.G., Skinner, J., Zeldes, S.P., 1995. Precautionary saving and social insurance. Journal of Political Economy 103 (2), 360–399.
Hyslop, D., 2001. Rising U.S. earnings inequality and family labor supply: the covariance structure of intrafamily earnings. The American Economic Review 91 (4), 755–777.
Keane, M.P., Wolpin, K.I., 2010. The role of labor and marriage markets, preference heterogeneity, and the welfare system in the life cycle decisions of black, Hispanic, and white women. International Economic Review 51 (3), 851–892.
Koşar, G., 2019. Dynamic responses to the earned income tax credit. Manuscript.
Low, H., Meghir, C., Pistaferri, L., Voena, A., 2018. Marriage, Labor Supply and the Dynamics of the Social Safety Net. NBER, Working Paper 24356.
Moffitt, R.A., Phelan, B.J., Winkler, A.E., 2020. Welfare rules, incentives, and family structure. The Journal of Human Resources 55, 1–42.
Mullins, J., 2019. Designing cash transfers in the presence of children's human capital formation. Manuscript.
National Vital Statistics Reports, 2010. Centers for Disease Control and Prevention. Vol. 59(1).
Ortigueira, S., Siassi, N., 2013. How important is intra-household risk-sharing for savings and labor supply? Journal of Monetary Economics 60 (6), 650–666.
PEW Research Center, 2010. Childlessness up Among all Women; Down Among Women with Advanced Degrees. June 2010.
Santos, C., Weiss, D., 2016. Why not settle down already? A quantitative analysis of the delay in marriage. International Economic Review 57 (2), 425–452.
Sommer, K., 2016. Fertility choice in a life cycle model with idiosyncratic uninsurable earnings risk. Journal of Monetary Economics 83, 27–38.
Rosenbaum, D., 2000. Taxes, the Earned Income Tax Credit, and Marriage. Working Paper. University of North Carolina at Greensboro.
Rothstein, J., 2010. Is the EITC as good as NIT? Conditional cash transfers and tax incidence. American Economic Journal: Economic Policy 2 (1), 177–208.