Child-Related Transfers, Household Labor Supply and Welfare

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Abstract

What are the macroeconomic effects of transfers to households with children? How do alternative policies fare in welfare terms? We answer these questions in an equilibrium life-cycle model with household labor supply decisions, skill losses of females associated to non participation, and heterogeneity in terms of fertility, childcare expenditures and access to informal care. Calibrating our model to the U.S. economy, we first provide a roadmap for policy evaluation by contrasting transfers that are conditional on market work (childcare subsidies and childcare credits) with those that are not (child credits), when both types can be means tested or universal. We then evaluate expansions of current arrangements for the U.S., and find that expansions of conditional transfers have substantial positive effects on female labor supply, that are largest at the bottom of the skill distribution. Expanding childcare credits leads to long-run increases in the participation of married females of 10.6%, while an equivalent expansion of child credits leads to the opposite (-2.4%). Expanding existing programs generates substantial welfare gains for newborn households, which are largest for less-skilled households. Expanding childcare credits leads to the largest welfare gains for newborns and achieves majority support.

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1 Introduction

This paper is about the macroeconomic and welfare implications of transfers to households with children, or *child-related transfers* for short. Should child-related transfers be universal or means-tested? Should they be conditional on work or independent of mothers' labor supply? If such transfers are conditional on work, should they be in the form of a subsidy (and depend on how much a household spends on childcare) or lump-sum? In light of lessons we learn from answers to these questions, we then focus on expansions of the existing programs in the United States. We ask: what are the effects on household labor supply? What are the consequences on the human capital of females? What are the resulting welfare effects for different households? Are potential expansions of current programs supported by a majority of households?

Across developed countries, the nature and magnitude of child-related transfers differ non trivially. Sweden for instance, devotes nearly 0.9% of aggregate output to this form of public assistance. Several authors, e.g. Rogerson (2007), have attributed the high levels of female labor supply in Scandinavia to the scope and magnitude of child-related transfers there. In contrast, childcare subsidies in the United States are much smaller and child-related transfers that are independent of market work are higher.[1] Child-related transfers are part of an active policy debate in the United States and other countries. In the United States, former President Obama discussed these policies in major speeches and events. Candidates from both major parties advanced proposals in this regard in the 2016 Presidential race, and the tax reform package of 2017 (the Tax Cuts and Jobs Act) included a major expansion of the child tax credits. Yet, the consequences for the U.S. economy of large expansions of current transfers to households with children are largely unexplored. We fill this void in this paper, by considering jointly several programs and the resulting tradeoffs for aggregate and welfare effects.

We build an equilibrium life-cycle model with heterogeneous single and married indi-

[1] The main childcare subsidy program in the United States is minuscule in relation to other developed countries. Overall, the United States spends less than 0.1% of output in childcare subsidies, and subsidies per child in formal childcare amount to less than US$ 900 in 2011. (Source: OECD Family Database, http://www.oecd.org/social/family/database.htm. Table PF3.1). Indirect childcare subsidies via the Child and Dependent Care Tax Credit (CDCTC) program are also small, with implicit expenditures of only about 0.02% of GDP. On the other hand, the size of the Child Tax Credit (CTC) program that provides tax credits to households with children – independently of childcare expenses – is relatively larger and about 0.3% of GDP. Source: Maag (2013). We describe these programs in detail in section 2.

viduals suitable for policy analysis. The model economy has three key features. First, as in Guner, Kaygusuz and Ventura (2012-a, 2012-b), we allow for labor-supply decisions of spouses at the extensive and intensive margins. Second, in line with data, we jointly account for the presence of children across married and single households, the timing of their arrival and the associated childcare costs. In particular, we account for the observed heterogeneity in the number of children, childcare costs and the availability of informal childcare. Finally, we model the dynamic costs and benefits of participation decisions by allowing the labor market skills of females to depreciate due to childbearing disruptions. Hence, the expansions of transfer schemes that we consider capture potential changes in female skills and the gender wage gap.

We parameterize our model in line with the U.S. data, taking into account the three main programs of transfers to households with children: the childcare subsidies, childcare credits, and child credits. As we describe in detail later, these programs are critically different in nature. Childcare subsidies and childcare credits require positive labor earnings for both parents and positive childcare expenditures. While childcare subsidies target households at the bottom of the income distribution, all households qualify for childcare credits but the amount of credit declines with household income. In contrast, the child credit is independent of parents' market work, targets poor and middle-income households, with credits that decline with household income.

What are the effects of these programs on female labor supply and welfare? Several forces are at play. First, in some married households, females choose to stay home and avoid incurring childcare expenses, even when the option of working and accumulating skills is available and would make them better off. Some of these households would like to borrow to cover their childcare expenses so that the female member of the household works, but they can't by assumption. As a result, childcare subsidies and childcare credits can allow females to enter the labor force and enhance their skills, and potentially lead to welfare gains. Second, whenever the transfers are means-tested and involve a redistribution of resources from richer to poorer households, they can generate welfare gains for poorer households and losses for richer ones. Furthermore, the effects of these two forces are expected to be larger for lifetime-poor households, as childcare costs are larger for them in relative terms. For the same reasons, these households are expected to react more in terms of labor supply and participation decisions. Third, higher taxes are required when the programs are expanded.

Since childbearing is concentrated in a short span of the life cycle of households, and higher taxes are expected over the entire life cycle, some households will dislike the expansion of these programs even when they are net beneficiaries in the periods when childcare expenses are incurred.

Understanding Child-related Transfers We first proceed to use our model to understand the role of child-related transfers on household labor supply, output and welfare. We do so by answering three questions connected to the nature of the existing transfer programs: Should transfers be universal or means-tested (i.e. only households below an income limit qualify)? Should transfers be conditional on work or simply conditional on having children? If transfers are conditional on work, should they be in the form of a subsidy (i.e. they cover a fraction of childcare expenses) or a lump-sum transfer (i.e. independent of how much households actually spend on childcare)? Figure 1 provides a taxonomy of programs along these dimensions, and places the three U.S. programs within this taxonomy. Child credits are means-tested and unconditional; childcare subsidies are means tested but also conditional on work and provide a subsidy to cover a fraction of childcare expenses; childcare credits are universal, conditional on work, and provide a subsidy. Answers to these questions are critical to understand how child-related transfers work, not just in the United States but more generally. To answer these questions, we take all the resources devoted to child-related transfers in the benchmark economy (i.e. total resources used by three programs in Figure 1), and reallocate them to a single program – one of six options presented in Figure 1 – and study the aggregate effects on labor supply and output as well as the welfare gains for newborns.

For the first question, we find that *means testing,* which allows for more generous transfers to low-income households, leads to larger welfare gains (or smaller losses) than universal programs (independent of whether these programs are conditional on work or take the form of subsidy or a lump-sum transfer). Regarding the second question, our findings show that *unconditional* transfers deliver larger welfare gains (independent of whether they are universal or means tested), as they provide transfers to low-income households in which females typically do not work. These gains become larger if such transfers are means tested. On the third question, if transfers are conditional on work, then *lump-sum* transfers fare better than subsides in terms of welfare (independent of whether they are universal or means tested).

This follows as less-skilled (poorer) households typically spend little on childcare in absolute amounts, and hence, in contrast to subsidies, lump-sum conditional transfers have the largest potential impact. If policy makers are interested in boosting married female labor supply, then the answers differ greatly. Unconditional transfers, both universal and means tested, depress labor supply, while conditional universal transfers generate the largest positive effect on female labor supply.

Expanding Child-related Transfers To evaluate expansions of existing transfer programs in the United States, we first proceed to make childcare subsidies at the benchmark subsidy rate (75%) universal. This expansion requires an additional 1.2% income tax on all households. We then evaluate expansions of child credits and childcare credits that involve the same government expenditure and require the same additional tax rate on households. In addition, we also explore consequences of the expansion of child credits associated with the tax reform bill of 2017.

We find that expansions of child-related transfers lead to substantial changes in female labor supply, which are largest at the bottom of the skill distribution. We find that universal subsidies and the expansion of childcare credits lead to large and positive effects on female labor supply. With a universal subsidy, the participation rate of married females increases by 10.2% and aggregate hours by about 1.8% across steady states. Even larger effects emerge under an expansion of childcare credits. The overall participation rate increases by 10.6%, with larger effects on less-educated females. Our findings also show that the endogeneity of female skills is key in assessing the quantitative effects of child-related transfers. We find that the effects of expanding childcare subsidies or childcare credits on participation rates and hours are sharply reduced when female skills are assumed to be exogenous.

In contrast, an equivalent expansion of child credits leads to reductions in labor supply across the board. Across steady states, the participation rate of married females drops by 2.4%, hours by 1.4% and aggregate by 1.7%. Since this program is a transfer to households with children without any work requirement, it produces an income effect on labor supply decisions that reduces participation and hours of work. These negative effects on labor supply and output are even larger under the expansion of child credits embedded in the 2017 tax reform.

We find that the welfare gains for newborn households associated to expansions of the existing programs are substantial. These gains are largest for less-skilled households in all cases analyzed. Taking into account transitions between steady states, welfare gains (consumption compensation) amount to 2.5%, 1.3% and 0.8%, under the expansions of childcare and child credit programs, and the universalization of childcare subsidies, respectively. We also find that welfare effects differ significantly across households, with poorer households generically benefiting more due to the redistributive nature of the programs in place.

Overall, the expansion of childcare credits emerges as the policy that delivers the most significant welfare gains for newborn households, and makes a majority of newborns better off. At the same time, it delivers the largest increases in married female labor force participation and aggregate output. This program expansion provides conditional childcare subsidies for all households, which are critical to deliver large labor supply responses. It also provides additional transfers to poor households if 100% of their childcare expenses are covered.

Related Literature This paper is related to several strands of literature. First, it is related to the empirical literature, going back to Heckman (1974), that studies the effects on female labor supply of childcare costs in general, e.g. Hotz and Miller (1988), and childcare subsidies in particular. Blau and Hagy (1998), Tekin (2007) and Baker, Gruber and Milligan (2008) are examples of papers in this group; all find positive and large effects of childcare subsidies on female employment. It is also related to the growing literature that studies macroeconomic models with heterogeneity in two-earner households. Examples of these papers are Chade and Ventura (2002), Greenwood, Guner and Knowles (2003), Olivetti (2006), Kaygusuz (2010, 2015), Hong and Rios-Rull (2007), Heathcote, Violante, Storesletten (2010), Erosa, Fuster and Restuccia (2010), Guner, Kaygusuz and Ventura (2012-a, 2012-b), Bick and Fuchs-Schündeln (2018), among others.

Finally, our paper contributes to a recent macroeconomics literature on childcare costs and child-related transfers. Work in this area shows that childcare costs and child-related transfers are important determinants of married female labor supply; e.g. Attanasio, Low and Sanchez-Marcos (2008) and Hannusch (2018). Expansions of childcare subsidies can lead to large increases in married female labor supply; e.g Bick (2016). Likewise, subsidizing childcare can be optimal from a welfare point of view; e.g. Domeij and Klein (2013) and Ho and Pavoni (2018). We expand this literature in two ways. First, we focus on a wider set of policy tools. In addition to childcare subsidies, we consider transfers that are both conditional and unconditional on work, and study the consequences of means testing. This allows us to provide general policy lessons. Second, we study the expansion of existing programs in the U.S. in an environment with rich heterogeneity and where policies affect female skills over the life cycle. We show that a policy expansion that combines features of childcare subsidies and direct transfers generates the largest aggregate welfare gains and makes a majority of newborns better off.

The paper is organized as follows. Section 2 outlines the main transfer programs to households with children in the United States. Section 3 presents the model environment we study. In section 4, we discuss the parameterization of our model and choice of parameter values. We use the calibrated model in section 5 to provide an understanding of the effects of child-related transfers, by studying hypothetical program changes along the taxonomy provided in Figure 1. In section 6, we present our findings on the expansion of the existing programs in the U.S. on aggregates and welfare. Finally, section 7 concludes.

2 Child-Related Transfers in the U.S.

We describe below key programs in the United States that provide assistance to households with children: childcare subsidies, childcare tax credits and child tax credits.

Childcare Subsidies The main program that provides childcare subsidies for low-income families in the US is the Child Care Development Fund (CCDF). The program was created as part of the welfare reform (the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996) and consolidated an array of programs into one.[2] In order to qualify for a subsidy, parents must be employed, in training, or in school. The program targets low-income households. States can use the CCDF funds to assist families with incomes up to 85% of the state median income (SMI), but can set lower limits. As of 2011, state income eligibility limits varied from 37% to 83% of SMI (Lynch 2001). In 1999, the population-weighted average of the income threshold was $25,637 (calculations based on Blau 2000, Table 3, and population estimates from the Census Bureau), which is about

[2] For an excellent overview of the history of childcare subsidy programs and details of the current program, see Blau (2003). The CCDF is administered by the Federal level by the Child Care Bureau (CCB), Office of Family Assistance in the Administration for Children and Families (ACF). States receive grants from the program, and they are responsible for ensuring that these are administered in compliance with Federal guidelines. States have, however, significant discretion.

60-61% of U.S. median household income in 1999. However, only a small fraction of qualified families get a subsidy. In 1999 and 2000, the CCDF served only 12-15% of eligible children (Blau and Tekin 2007). Households might lack information and the application procedures tend to be complicated. States also use direct rationing (Adams and Rohacek 2002, and Adams and Heller 2015). In 2010, about 1.7 million children (ages 0-13) were served by the CCDF, which is about 5.5% of all children (ages 0-13) in the US.[3] In 2012, the average income of those receiving a subsidy was about $20,000 (about 28% of the mean household income).[4]

Families receiving childcare subsidy from the CCDF must make a co-payment. These co-payments increase with parental income. Both the level of co-payments and the benefit reduction rate differ greatly across states. On average co-payments were about 6% of total family income.[5] Given an average income of $20,000 for recipients, this amounts to a co-payment of about $1,200 dollars per year. In 2010, the CCDF paid a monthly amount of about $400 per family, or $4,800 per year, to care providers (including the co-payment).[6] Hence about 25% of childcare costs ($1,200 out of $4,800) were paid by the families, while the remaining 75% constituted the subsidy.

We refer to this program as *childcare subsidy*. As we indicate in Figure 1, this program is a means-tested, conditional, subsidy program.

Childcare Credits The Child and Dependent Care Tax Credit (CDCTC) is a non-refundable tax credit that allows parents to deduct a fraction of their childcare expenses from their tax liabilities. While the childcare subsidies mainly serve poor households, the CDCTC provides a credit on their out-of-pocket childcare expenses for children below age 12 to all households. To be able to qualify for the tax credit, both parents must work. The maximum qualified childcare expenditure is $3,000 per child, with an overall maximum of $6,000. Parents receive a fraction of qualifying expenses as a tax credit. This fraction starts at 35%, remains at this level up to a household income of $15,000, and then declines with

[3]Source: http://www.acf.hhs.gov/programs/occ/resource/fy-2010-data-tables-final, Table 1.

[4]About 57% of families had incomes that were less than $19,900, about 28% had incomes between $19,900 and $29,850, and 15% had incomes that were greater than $27,465 (source: http://www.acf.hhs.gov/sites/default/files/occ/data_fact_sheet_preliminary_ffy_2012.doc). About two thirds of the families who receive a subsidy are single-mother families (Herbst 2008).

[5]Source: http://www.acf.hhs.gov/programs/occ/resource/fy-2010-data-tables-final, Table 17.

[6]Source: http://www.acf.hhs.gov/programs/occ/resource/fy-2010-data-tables-final, Table 15.

household income. The lowest rate, which applies for families with a total household income above $43,000, is 20%.[7] As a result, a household with income above this limit and two or more children below age 12 can deduct up to $1,200 (20% of $6,000) from their tax liabilities. Since the CDCTC is not refundable, only households with positive tax liabilities benefit from it. As a result, household at the bottom of income distribution do not receive benefits from the CDCTC. More than 50% of benefits were received by households in the top two income quantiles in 2013, with an average benefit of $500 per receiving household (Maag 2013). We refer to this program as *childcare credit*. In terms of the taxonomy in Figure 1, this program is a universal, conditional, subsidy program.

Child Credits The Child Tax Credit (CTC) provides poor households a tax credit for each child, independent of their childcare expenditures and the labor market status of parents. The CTC starts at $1,000 per qualified children under age 17, and stays at this level up to a household income level of $75,000 for single and $110,000 for married couples. Beyond this income limit, the credit declines at a 5% rate until it is completely phased out when the household income is more than $40,000 the income limit ($115,000 for single and $150,000 for married couples).

Like the CDCTC, the CTC is non-refundable, and, as a result, it does not provide benefits for poor households with zero or low tax liabilities. This is partly compensated by the Additional Child Tax Credit (ACTC) that gives part or full of the unused portion of the CTC back to families.[8] In 2013, close to 50% of benefits under the CTC and the ACTC were received by households in the bottom two income quantiles, but given the way the ACTC works, the largest share of benefits were still collected by households who are in the second income quantile (Maag 2013). The average amount of benefits per receiving household was about $1,500. We refer to this program as *child credit*. In the taxonomy of Figure 1, it is a means-tested and unconditional transfer program.

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

[8] The ACTC does not make the CTC fully refundable since only households with some minimum earnings start getting the ACTC. If a household's earnings exceed this minimum earnings, it receives 15% of the difference between its earnings and the threshold or the unused portion of the CTC, whichever is smaller. The minimum earnings to qualify for the ACTC was $11,000 in 2005. The 2009 American Recovery and Reinvestment Act lowered this minimum income to $3,000 and this was extended through 2017 as part of the 2012 American Taxpayer Relief Act. This increased the number of poor families getting transfers from the CTC significantly. See http://www.taxpolicycenter.org/briefing-book and https://www.irs.gov/uac/Ten-Facts-about-the-Child-Tax-Credit.

Current Policy Debate and Reforms Expansion of child-related transfers to working families with children is at the center of the policy debate in the U.S. today. An important division is between proposals that support the expansion of child-related transfers that are conditional on work, and those that support unconditional transfers.

1. *Expansion of Childcare Subsidies:* Since the current program serves only a small fraction of families that it is intended to serve, there have been several calls for providing further funding for the program and making it more accessible to poor families. As part of his 2015 State of the Union initiative, for example, former President Obama proposed to expand childcare subsidies so that it covers about 1 million additional children, an almost 60% increase in the number of children covered (White House, 2015). We consider the expansion (universalization) of childcare subsidies in our main exercises.

2. *Increasing the Childcare Credits:* Former President Obama suggested to increase childcare credits such that any family with young (0 to 5 years old) children whose income is below $120,000 qualifies for a $3,000 per child tax credit (White House 2015). Such a family would get $1,200 credit under the current system.

3. *2017 Expansion of Child Credits:* The recent tax reform bill enacted in 2017 makes child credits more generous. The credit has been increased from $1,000 to $2,000 for each qualifying child. Likewise, the phaseout income levels have been increased substantially – it is now $400,000 for married households and $200,000 for the rest. The phaseout rate is still the same, implying that the child credit becomes zero at much higher income levels than before. The earned income threshold for the refundable portion of the income is reduced from $3,000 to $2,500, and up to $1,400 of each child credit is refundable. We evaluate these policy changes in section 6.

3 The Economic Environment

We study a stationary overlapping generations economy populated by a continuum of males (m) and a continuum of females (f). Let $j \in \{1, 2, ..., J\}$ denote the age of each individual. Population grows at rate n. Population structure is stationary so that age-j agents are a fraction μ_j of the population at any point in time. The weights are normalized to add up to one, and obey the recursion, $\mu_{j+1} = \mu_j/(1+n)$.

Each individual is born with a given type (education level). Individuals also differ in terms of their marital status: they are born as either single or married and their marital status does not change over time. Each agent starts life as a worker, retire at age J_R, and collects pension benefits until age J. We assume that married households are comprised by individuals who are of the same age. As a result, members of a married household experience identical life-cycle dynamics. At any point in time, the model economy is populated by married and single households that differ by the age and education levels of their members.

Married households and single females also differ in terms of the number of children attached to them. They can be childless or endowed with children. The number of children that a household has depends on its marital status, as well as on education levels of its members. Children appear either early or late in the life-cycle exogenously and stay with their parents for three periods. Children do not provide any utility.

Each period, working households (married or single) make labor supply, consumption and savings decisions. Households cannot borrow. Young children imply a fixed time cost for females. If a female with children, married or single, works, then the household also has to pay childcare costs. Households differ according to their access to informal childcare (care provided, for example, by grandparents and other relatives), and the childcare costs depend on the availability of informal care, the marital status of the household, and the education levels of household members. The heterogeneity in childcare costs captures differences in childcare demand by households, both in quantity and quality. Childcare costs are mitigated partially or fully by child-related transfer programs. On top of childcare costs, if the female member of a married household works, then the household incurs a utility cost. This utility cost captures the residual heterogeneity in labor force participation decisions of married females. Not working for a female is, however, also costly; if she does not work, she experiences losses of labor efficiency units for next period.

A government taxes households and provides transfers. Child-related transfers are childcare subsidies, child tax credits, and childcare tax credits. The government also administers the Earned Income Tax Credit (EITC), which works as a wage subsidy for households below a certain income, and a means-tested welfare system, which provides transfers for low income households.

Production and Markets There is an aggregate firm that operates a constant returns to scale technology. The firm rents capital and labor services from households at rates R and w, respectively. Using K units of capital and L_g units of labor, firms produce $F(K, L_g) = K^{\alpha} L_g^{1-\alpha}$ units of consumption (investment) goods. Capital depreciates at rate δ_k. Childcare services are provided using labor services only. Thus, the price of childcare services is the wage rate, w. Total labor services available are split between childcare services and the production of goods, L_g. Households save in the form of a risk-free asset that pays the competitive rate of return $r = R - \delta_k$.

Heterogeneity and Demographics Individuals differ in terms of their labor efficiency units in two respects. First, at the start of life, each male is endowed with an exogenous type z that remains constant. Let $z \in Z$ and $Z \subset R_{++}$ be a finite set. We refer to this type of heterogeneity as the education type. Second, within each education type, there is further heterogeneity; some agents with the same education are more productive than others. This additional level of heterogeneity is denoted by ε_z. Let $\varepsilon_z \in E_z$ and $E_z \subset R$ be a finite set. Like z, ε_z is drawn at the start of an agent's life and remains constant over his life cycle. This additional heterogeneity allows us to generate a level of inequality that is consistent with the data. In particular, the model can capture the lower tail of the income distribution where the child-related transfers matter most.

The productivity of an age-j, type-z agent with ε_z is given by $\varpi_m(z, j)\varepsilon_z$. Let $\Omega_j(z)$ denote the fraction of age-j, type-z males in male population, with $\sum_{z \in Z} \Omega_j(z) = 1$. We assume that ε_z is distributed symmetrically around 1, and let $\Xi_z(\varepsilon_z)$ be the fraction of type ε_z agents such that $\sum_{\varepsilon_z \in E_z} \Xi(\varepsilon_z)\varepsilon_z = 1$. Hence, while some type-z agents have productivity levels above the mean along their life-cycle, others have productivity levels below the mean.

As males, each female starts her working life with a particular education type, which is denoted by $x \in X$, where $X \subset R_{++}$ is a finite set. Let $\Phi_j(x)$ denote the fraction of age-j, type-x females in female population, with $\sum_{x \in X} \Phi_j(x) = 1$. Again as males, each female is also assigned a particular ε_x value at the start her life. Let $\varepsilon_x \in E_x$ and $E_x \subset R$ be a finite set with $\sum_{\varepsilon_x \in E_x} \Xi(\varepsilon_x)\varepsilon_x = 1$.

As women enter and leave the labor market, their labor market productivity levels evolve endogenously. Each female starts life with an initial productivity that depends on her education level, denoted by $h_1 = \varpi_f(x, 1) \in H$. After age-1, the next period's productivity level (h') depends on the female's education x, her age (j), the current level of h and current labor supply (l), and is given by

$$h' = \mathcal{H}(x, h, l, j) = \exp\left[\ln h + \alpha_j^x \chi(l) - \delta_x (1 - \chi(l))\right],$$

where $\chi\{.\}$ denotes the indicator function, α_j^x is the growth rate associated with work, and δ_x is the depreciation rate for not working. The growth and the depreciation rates depend on education, x, which allows us to capture differences in age-earnings profiles of females by education. The labor market productivity for a female with human capital level h and a productivity realization ε_x is $h\varepsilon_x$.

Children and Childcare Costs Children are assigned exogenously to married couples and single females at the start of life, depending only on the education of parents. Each married couple and single female can be of three types: *early* child bearers, *late* child bearers, and those *without* any children. Let $k(x)$ and $k(x, z)$ denote the number of children that a single female of type-x and a married couple of type (x, z) have, if they are early or late childbearers. Early child bearers have these children in ages $j = 1, 2, 3$ while late child bearers have children attached to them in ages $j = 2, 3, 4$.

If a female with children works, married or single, then the household has to pay for childcare costs. These costs are independent of how many hours a female decides to work and only depend on whether or not she participates in the labor market. This captures the fixed cost associated with many paid childcare arrangements.[9] Single-female and married-couple households differ by whether they have access to informal childcare, denoted by $g \in \{0, 1\}$. The childcare costs depend on the age of the child (s), the type (education) level of parents and their access to informal childcare. Let $d(s, x, g)$ and $d(s, x, z, g)$ be the per-child childcare costs for a single female of type-x and a married couple of type-(x, z), respectively. The dependence of childcare costs on parental education and access to informal care is intended to capture differences in the quality and quantity of childcare that different households might choose. Since the competitive price of childcare services is the wage rate w, the total cost of childcare for a single-female and married-couple household with age-s children is given by $wk(x)d(s, x, g)$ and $wk(x, z)d(s, x, z, g)$, respectively.

[9]Most common childcare arrangements for working mothers (i.e. day care centers, nurseries and preschools, and family day care centers) require a weekly or monthly contract (Laughlin, 2013).

Utility Cost of Joint Work We assume that at the start of their lives married households draw a q that represents the utility costs of joint market work. For a given household, the initial draw of utility cost depends on the education of the husband. Let $\zeta(q|z)$ denote the probability that the cost of joint work is q, with $\sum_{q\in Q}\zeta(q|z)=1$, where $Q\subset R_{++}$ is a finite set.

Preferences The momentary utility function for a single female is given by

$$U_f^S(c,l,k_y)=\log(c)-\varphi(l+k_y\eta)^{1+\frac{1}{\gamma}},$$

where c is consumption, l is time devoted to market work, φ is the parameter for the disutility of work, η is fixed time cost of having age-1 (young) children for a female, and γ is the intertemporal elasticity of labor supply. Here $k_y\in\{0,1\}$ is an indicator for the presence of age-1 (young) children in the household. For a single male, the utility function looks exactly the same with $k_y=0$.

Married households maximize the sum of their members utilities, given by

$$U_f^M(c,l_f,q,k_y)+U_m^M(c,l_m,l_f,q)=2\log(c)-\varphi(l_f+k_y\eta)^{1+\frac{1}{\gamma}}-\varphi l_m^{1+\frac{1}{\gamma}}-\chi\{l_f\}q.$$

If a female member works, when $\chi\{.\}=1$, the household incurs the utility cost q. Note that consumption is a public good within the household. Note also that the parameter γ, the intertemporal elasticity of labor supply, and φ, the weight on disutility of work, are independent of gender and marital status. As a result, gender differences in labor supply behavior emerge as a result of households' optimal decisions given the constraints they face.

Following the tradition in macroeconomics literature, we restrict the preferences to be consistent with a balanced-growth path. An alternative specification would allow the marginal utility of consumption to be affected by demographics (e.g. household size) and the female labor force participation decision.[10] In the current specification, the female labor force participation affects the level of utility through the cost of joint work, q.

[10] See, for example, Attanasio, Banks, Meghir and Weber (1999) and Attanasio, Low and Sanchez-Marcos (2008). If the level of childcare expenditure was a choice variable, such a flexible specification would help us to generate the right level of childcare expenditure along the life-cycle for different types of households, and would provide us with more flexibility in matching the life-cycle patterns of married females labor supply. Our model, however, performs well in matching different aspects of married female labor supply along the life-cycle (see Table 2 and Figures 3 and 4 below).

3.1 Government

The government taxes labor and capital income, and uses these tax collections to pay for government consumption, tax credits, transfers and childcare subsidies. It also collects payroll taxes and pays for social security transfers.

Incomes, Taxation and Social Security Income for tax purposes, I, is defined as total labor and capital income. Let a stand for household's assets. Then, for a single male worker, taxable income equals $I = ra + w\varpi_m(z,j)\varepsilon_z l_m$, while for a single female worker, it reads as $I = ra + wh\varepsilon_x l_f$. For a married working household, taxable income equals $I = ra + w(\varpi_m(z,j)\varepsilon_z l_m + h\varepsilon_x l_f)$. We assume that social security benefits are not taxed, so income for tax purposes is simply given by ra for retired households. The total income tax liabilities of married and single households, before any tax credits, are affected by the presence of children in the household, and are represented by tax functions $T^M(I,k)$ and $T^S(I,k)$, respectively, where k stands for the number of children. These functions are continuous in I, increasing and convex.

There is a payroll tax on labor incomes (τ_p) to fund social-security transfers. Moreover, each household pays an additional flat capital income tax (τ_k) on the returns from asset holdings. The social security system balances its budget every period.

Retired households have access to social security benefits. We assume that social security benefits depend on agents' education types, i.e. more productive agents potentially can receive larger social security benefits. This allows us to capture in a parsimonious way the positive relation between lifetime earnings and social security transfers, as well as the intra-cohort redistribution built into the system. Let $p_f^S(x)$, $p_m^S(z)$, and $p^M(x,z)$ indicate the level of social security benefits for a single female of type x, a single male of type z and a married retired household of type (x,z), respectively. Hence, retired households pre-tax resources are simply $a + ra + p_f^S(x)$ and $a + ra + p_m^S(z)$ for singles, and $a + ra + p^M(x,z)$ for married ones.

Child-Related Transfers Each household, married or single, with total income level below $\widehat{I}$ and with a working mother receives a subsidy of θ percent for childcare payments. As a result, effective childcare expenditures for a single-female household of type-(x,g) with $k(x)$ children of age s is given by $wk(x)d(s,x,g)(1-\theta)$, if the household qualifies for a subsidy, and $wk(x)d(s,x,g)$, otherwise. For a married couple household, the effective expenditures for a household that do and do not qualify for childcare subsidies are given by $wk(x,z)d(s,x,z,g)(1-\theta)$ and $wk(x,z)d(s,x,z,g)$, respectively. In the model economy, $\widehat{I}$ determines directly how many households get a subsidy, since we abstract from frictions, e.g. red tape or lack of information, that limit the caseload in practice.[11] Each household can also receive *child credits* or *childcare credits.* Details of these programs are provided in Section 2 and in the Online Appendix.

Other Credits and Transfers Each household also can receive the Earned Income Tax Credit (EITC). The EITC, a fully-refundable tax credit, works as a wage subsidy for households below a certain income level. Finally, each household below a certain income level receives a transfer from the government as a function of its marital status and income. Details are provided in the Online Appendix. While our quantitative exercises focus on child-related transfers, the presence of the EITC and a welfare system allows us to capture the existing level of redistribution in the U.S. tax and transfer system. For single-male, single-female, and married-couple households with income level I, number of children k and total childcare expenditure D, the total tax credits and transfers (including child credits and childcare credits) are represented by $TR_f^S(I,D,k)$, $TR_m^S(I,D,k)$ and $TR^M(I,D,k)$, respectively.

3.2 Decision Problem

We now present the decision problem for different types of households in the recursive language. For single females, the individual state is given by $(a,h,x,\varepsilon_x,b,g,j)$. For married couples, the state is given by $(a,h,x,z,\varepsilon_x,\varepsilon_z,q,b,g,j)$. Note that the dependency of taxes on the presence of children in the household is summarized by age (j) and childbearing status (b): (i) if $b=\{1,2\}$ and $j=\{b,b+1,b+2\}$, then a household has children, and (ii) there is no child in the house, if $b=2$ and $j=1$, or $b=\{1,2\}$ for all $j>b+2$, or $b=0$ for all j. Similarly, the presence of age-1 (young) children (k_y) depends on b and j.

For expositional purposes, we collapse the permanent characteristics in the household problems in single vector of state variables. Let $\mathbf{s}^M \equiv (x,z,\varepsilon_x,\varepsilon_z,q,b,g)$ be the vector of exogenous states for married households, and let $\mathbf{s}_f^S \equiv (x,\varepsilon_x,b,g)$ be the vector of exogenous

[11] An alternative would be to choose a larger $\widehat{I}$, but impose a probability of not getting a subsidy.

states for single females. We present the problems of single females and married couples. The problem of a single male, with state $\mathbf{s}_m^S \equiv (z, \varepsilon_z)$, is standard.

The Problem of a Single Female Household A single female's decisions depend on $\mathbf{s}_f^S \equiv (x, \varepsilon_x, b, g)$, her assets a, and her current human capital h, and are determined by

$$V_f^S(a, h, \mathbf{s}_f^S, j) = \max_{a', l} \{U_f^S(c, l, k_y) + \beta V_f^S(a', h', \mathbf{s}_f^S, j+1)\},$$

subject to

(i) With kids: if $b = \{1, 2\}$, $j \in \{b, b+1, b+2\}$, then there are $k(x)$ children in the household and

$$c + a' = \begin{cases} a(1 + r(1 - \tau_k)) + wh\varepsilon_x l(1 - \tau_p) - T^S(I, k(x)) \\ +TR_f^S(I, D(1 - \theta), k(x)) \\ -D(1 - \theta)\chi(l), \text{ if } I \leq \widehat{I} \\ \\ a(1 + r(1 - \tau_k)) + wh\varepsilon_x l(1 - \tau_p) - T^S(I, k(x)) \\ +TR_f^S(I, D, k(x)) \\ -D\chi(l), \text{ otherwise} \end{cases},$$

where $I = wh\varepsilon_x l + ra$ and D, childcare expenditures, are $D = wd(j + 1 - b, x, g)k(x)$. Furthermore, if $b = j$, then $k_y = 1$.

(ii) Without kids but not retired: if $b = 0$, or $b = \{1, 2\}$ and $b + 2 < j < J_R$, or $b = 2$ and $j = 1$, then there are no children at home and

$$\begin{aligned} c + a' &= a(1 + r(1 - \tau_k)) + wh\varepsilon_x l(1 - \tau_p) - T^S(wh\varepsilon_x l + ra, 0) \\ &\quad +TR_f^S(wh\varepsilon_x l + ra, 0, 0). \end{aligned}$$

(iii) Retired: if $j \geq J_R$, then $k(x) = 0$, and

$$c + a' = a(1 + r(1 - \tau_k)) + p_f^S(x) - T^S(ra, 0) + TR_f^S(ra, 0, 0).$$

In addition,

$$h' = \mathcal{H}(x, h, l, j),$$

and

$$l \geq 0,\ a' \geq 0 \text{ (with strict equality if } j = J).$$

Note how the cost of children depends on the age of children, the availability of grandparents and the education of the mother. Consider a single female of type-x with available informal care, $g = 1$, whose income is low enough to qualify for the subsidy. If $b = 1$, the household has $k(x)$ children at ages 1, 2 and 3, then $wd(j + 1 - b, x, g)k(x)(1 - \theta)$ denotes childcare costs for ages 1, 2 and 3 with $j = \{1, 2, 3\}$. If $b = 2$, the household has children at ages 2, 3 and 4, then $wd(j + 1 - b, x, g)k(x)(1 - \theta)$ denotes the cost for children of ages 1, 2 and 3 with $j = \{2, 3, 4\}$ again assuming that she receives the subsidy θ. A female only incurs the time cost of children, i.e. $k_y = 1$, if her kids are 1 model-period old, and this happens if $b = j = 1$ or $b = j = 2$.

The Problem of Married Households Like singles, married couples decide how much to consume, how much to save, and how much to work. They also decide whether the female member of the household should work. Their problem is given by

$$V^M(a, h, \mathbf{s}^M, j) = \max_{a',\, l_f,\, l_m} \{[U_f^M(c, l_f, q, k_y) + U_m^M(c, l_m, l_f, q)] + \beta V^M(a', h', \mathbf{s}^M, j+1)\},$$

subject to

(i) <u>With kids:</u> if $b = \{1, 2\}$, $j \in \{b, b+1, b+2\}$, then the household has $k(x, z)$ children and

$$c + a' = \begin{cases} a(1 + r(1 - \tau_k)) + w(\varpi_m(z, j)\varepsilon_z l_m + h\varepsilon_x l_f)(1 - \tau_p) \\ -T^M(I, k(x, z)) + TR^M(I, D(1 - \theta), k(x, z)) \\ -D(1 - \theta)\chi(l_f), \text{ if } I \leq \widehat{I} \\ \\ a(1 + r(1 - \tau_k)) + w(\varpi_m(z, j)\varepsilon_z l_m + h\varepsilon_x l_f)(1 - \tau_p) \\ -T^M(I, k(x, z)) + TR^M(I, D, k(x, z)) \\ -D\chi(l_f), \text{ otherwise} \end{cases},$$

where $I = w\varpi_m(z, j)\varepsilon_z l_m + wh\varepsilon_x l_f + ra$ and $D = wd(j + 1 - b, x, z, g)k(x, z)$. Furthermore, if $b = j$, then $k_y = 1$.

(ii) <u>Without kids but not retired:</u> if $b = 0$, or $b = \{1, 2\}$ and $b + 2 < j < J_R$, or $b = 2$, $j = 1$, then $k(x, z) = 0$ and

$$\begin{aligned} c + a' &= a(1 + r(1-\tau_k)) + w(\varpi_m(z,j)\varepsilon_z l_m + h\varepsilon_x l_f)(1-\tau_p) \\ &- T^M(I,0) + TR^M(I,0,0), \end{aligned}$$

where $I = w\varpi_m(z,j)\varepsilon_z l_m + wh\varepsilon_x l_f + ra$.

(ii) Retired: if $j \geq J_R$, then $k(x,z) = 0$ and

$$c + a' = a(1 + r(1-\tau_k)) + p^M(x,z) - T^M(ra,0) + TR^M(ra,0,0).$$

In addition,

$$h' = \mathcal{H}(x,h,l_f,j),$$

and

$$l_m \geq 0,\ l_f \geq 0, a' \geq 0 \text{ (with strict equality if } j = J).$$

We present a formal notion of a stationary equilibrium in the Online Appendix.

4 The Benchmark Economy

In this section, we first briefly discuss how we assign parameter values to the endowment, preference, and technology parameters. We leave details to the Online Appendix. We then comment on how the model performs in terms of variables that are pertinent for the main questions of this paper.

We set the length of a model period to be five years. The first model period ($j = 1$) corresponds to ages 25-29, while the first model period of retirement ($j = J_R$) corresponds to ages 65-69. After working 8 periods, agents retire at age 65 and live until age 80 ($J = 11$). There are 5 education types. Each type corresponds to an educational attainment level: *less than high school* (HS<), *high school* (HS), *some college* (SC), *college* (COL) and *post-college* (COL+) education.

Our calibration strategy is as follows. First, we take the demographic structure of the population (who is single, who is married and who is married with whom) from the data. We also take from the data childbearing status and the number of children for different types of households and the fraction of them who has access to informal childcare.

Second, we model all child-related transfers as closely as possible to how they are present in the U.S. Similarly, we model federal income taxes, the EITC, means-tested welfare transfers, and the social security system to reflect the current U.S. public policy. For childcare subsidies, following our discussion in Section 2, we set $\theta = 0.75$, i.e. a 75% subsidy rate, and set $\widehat{I}$ such that the poorest 5.5% of families with children receive a subsidy from the government in line with data. This procedure sets $\widehat{I}$ at about 15.8% of mean household income in the benchmark economy. In the policy experiments below, we make the childcare subsidies universal by setting $\widehat{I}$ to an arbitrarily large number. Child credits operate as means-tested transfers to households with children. If a household's income is below a certain limit, $\widehat{I}_{CTC}$, then the potential credit is $\$1,000$ per child. If the household income is above the income limit, then the credit declines by 5% for each additional dollar of income. Unlike child credits, all households with positive childcare expenditures can qualify for childcare credits. Potential childcare credits are calculated in two steps: First, for each household, the level of childcare expenditures that can be claimed against credits is determined. This expenditure is simply the minimum of the earnings of each parent in the household, a cap, and actual childcare expenditures. The cap is set $3,000 and $6,000 for households with one child and with more than one children. Second, each household can claim a certain fraction of this qualified expenditure as a tax credit. This fraction starts at 35%, and declines by 1% for each $2,000 of household income above $15,000 until it reaches 20%, and then remains constant at this level.[12]

Figure 2 shows the potential child credits and childcare credits for a married household with two children.[13] The actual credits that a household receives depend on the total tax liabilities of the household. Further details are presented in the Online Appendix. As Figure 2 shows, the child credit has a very clear structure: all households up to an income threshold are potentially qualified for about $2,000 (about 3.3% of mean household income in the US in 2004) and above this threshold the credit starts declining until it hits zero. The potential childcare credit is small for households with very low incomes as the earnings of the wife are likely to be less than the maximum credit. It first peaks and then declines as the earnings of the wife increase, and all households above an income threshold get $1,200 (2% of mean

[12] We present the programs in terms of actual dollar values for expositional purposes. These values are then converted into multiples of mean income.

[13] For Figure 2, we assume that at each income level the husband and the wife earn 60% and 40% of the household income, respectively, and that all households spend 10% of their income on childcare.

household income).

Finally, we select the remaining parameters to match jointly several targets. (i) We choose the residual heterogeneity within educational types, ε_x and ε_z, to reproduce the variance of log-wages for males in the first age group (ages 25-29). (ii) We set initial values of human capital for each skill level for females to match the wage gender gap at ages 25-29. We then select α_j^x so that if a female of a particular type works in every period, her wage profile has exactly the same shape as a male of the same type, i.e. we set α_j^x values equal to the growth rates of male wages at each age.[14] We choose skill-dependent depreciation rates, δ_x, so as to match the change in the gender gap between ages 25-29 and 30-34 for skilled and unskilled married women. We find a yearly depreciation rate of 2.5% for unskilled women, and a larger one (5.6%) for skilled women.[15] (iii) We choose $d(s, x, g)$ and $d(s, x, z, g)$, the efficiency units of labor required for childcare for a single female of type-(x, g), and for a married couple of type-(x, z, g), to match the aggregate spending on childcare as well as the relative spending by different types of households. (iv) We choose the discount factor to match capital-to-output ratio. (v) We select the disutility from market work, φ, to match hours per worker, and the time cost of young (age 1) children, η, to match labor force participation of married females with young children. (vi) We pick the additional proportional tax, τ_k, on capital so that the model matches corporate tax collections from data. Similarly, we select the social security benefits, b, for a given tax rate from the US data, to balance the social security budget. (vii) Finally, we parameterize the distribution of the disutility of joint market work, q, and infer its parameters so as to generate the observed female force participation by married females conditional on the husbands' types. Table 1 summarizes our parameter choices. Table 2 illustrates the performance of the model in relation to data.

Participation Rates As Table 2 shows, the model reproduces very well the aggregate facts for labor-force participation rates. The table shows that in the model, participation rates for married females by skill rise from about 47.2% for less than high school females,

[14] Table A2 in the Online Appendix shows the calibrated values for α_j^x. The returns to experience are larger for women with higher skills. Blundell et al (2016) find similar results for the UK.

[15] For the purposes of setting depreciation rates, we divide women in two groups, 'unskilled' and 'skilled'. Unskilled women are those with less than high school education, high school education and some college. Skilled females are those with college education and more than college education. Depreciation rates are the same within each group. Our estimates of depreciation rates are lower than those in Attanasio, Low and Sanchez-Marcos (2008), who calibrate a depreciation rate of 7.6% for all women in the United States.

to about 79.9% for those with more than college education. In the data, participation rates rise from 46.7% to 82.2%, respectively.

Figure 3 shows how the labor force participation of females changes by age in the model and in the data. These patterns were not explicitly targeted in the calibration and serve as an external validity check on our model economy. Moreover, the conformity of the model with the data in terms of participation rates is important as policies towards households with children are expected to have substantial effects on this variable. Both in the data and in the model, for skilled married women (those with college and more than college education), participation rates are roughly constant over the life cycle while for the unskilled ones (those with less than college education), participation rates slightly increase with age. Figure 4 shows the patterns of participation rates by childbearing status. We divide married females in two different groups in this case; those with children and those without. The figure shows that participation rates for women with children increase during childbearing age, while the opposite occurs for childless married women. Once again, the figures demonstrate that the model can reproduce the empirical patterns.[16]

Gender-Wage Gap By construction, our calibration matches the gender gap in the first model period, for ages 25-30. Afterwards, the gender wage gap evolves endogenously as married females decide whether to work or not and their wages change accordingly. In particular, if a female does not participate in the labor market, her human capital depreciates and the gender wage gap grows with age. Figure 5 shows how the gender gap evolves over the life-cycle for skilled married females – with college and more than college education – as well as for unskilled married females – with less than college education.

The reader should recall that we set δ_x for skilled and unskilled females to match the change in the gender gap between ages 25-29 and 30-39. As we illustrate in Figure 5, the increase in the gender gap in the model over the entire set of prime working years (ages 25-29 to 50-55) is more or less the same for both skill groups – about 12 percentage points. In the data, however, the increase is stronger for skilled married females whereas it is weaker for unskilled ones.[17]

[16] In the Online Appendix we report two additional figures on married female labor force participation; one for skilled and one for unskilled ones by the presence of children (Figures A11 and A12).

[17] In the model economy, we observe the labor market productivity levels for all married females whether or not they participate in the labour market. Since this is a more informative statistics about how the model economy works, we report the gender gap from the model for all married females. In order to produce a

5 Understanding Child-Related Transfers

We now use our calibrated model economy as a laboratory to understand the aggregate and welfare effects of child-related transfers. We focus on the effects of these arrangements on household labor supply and welfare, highlight the mechanisms at work, and provide foundations for the actual policy analysis that we conduct in the next section. To this end, we evaluate a *hypothetical* reallocation of current resources used for child-related transfers to expand each transfer program, one at a time.

The reader should recall that the child-related transfer programs discussed in Section 2 have a number of prominent features. These programs provide subsidies at given rates for households whose income is below a threshold (childcare subsidies), allow all household to recover part of their childcare expenses (childcare credits), or provide a lump-sum transfer, again for households whose income is below a threshold (child credits). Childcare credits and childcare subsidies are conditional on market work, while child credits are independent of market work. Motivated by these features, our analysis is structured to answer three questions:

1. Should transfers be universal or means-tested?

2. Should transfers be conditional on work or independent of mothers' labor supply?

3. If transfers are conditional, should they be in the form of a subsidy (and depend on how much a household spend on childcare) or lump sum?

The answers to these questions are key to design effective child-related transfer programs and to understand the policy experiments for the US economy that we study in the next section.

5.1 Reallocation of Child-Related Transfers

In light of the questions above, we design exercises in order to gauge the different attributes of child-related transfers. We consider three transfer schemes that take *all* the resources devoted to child-related transfers in the benchmark economy (i.e. total resources used by

comparable measure from the data, we impute wages for females who do not participate in the labor market using a standard Heckman selection model. We report details of this procedure in the Online Appendix.

childcare subsidies, child credits and childcare credits), and allocate them to a single program. These programs do not imply any additional taxes on households, and if a household does not qualify for any child-related transfer in the benchmark economy, it is indifferent to alternative programs.

The first scheme is a *childcare subsidy*, which subsidizes childcare payments for married and single female households, under the condition that the female member of the household works. We consider two cases: a universal subsidy, which is available to all households with children, and a 75% subsidy, which is only available to households whose income is below a threshold. The second one is a lump-sum transfer per child that is conditional on work of adult members of the household. A household qualifies for such transfers if both adults supply positive amounts of labor.[18] We dub this case *conditional transfers*. We consider again two cases: one in which the transfer is universal, and another one that doubles the size of the universal transfer but only serves households with an income below a threshold. The last one pertains to a transfer per child that is unconditional on work, as the child tax credit in the U.S. We dub this case simply *unconditional transfers*. Again, we evaluate two cases: one in which the transfer is universal, and another one that doubles the size of the universal transfer but targets households with an income below a threshold. These (six) cases exhaust all the possibilities in the taxonomy depicted in Figure 1.

We evaluate the implications of these changes assuming a small-open economy (fixed factor prices). We assume that changes occur at a given date (t_0, say), in a permanent and non-anticipated fashion and compute the implied transitional dynamics. For welfare, we focus in this section and in the next one on newborn households at t_0. Table 3 presents our findings, where each column reports percentage changes with respect to the benchmark economy.

Childcare Subsidies When child-related transfers are replaced by a universal childcare subsidy, all households with children where adult members work receive a subsidy at a uniform rate of about 50% in the new steady state. Since this program subsidizes market work, the participation rate of married females expands by 5.7%, total hours worked by

[18] In the benchmark economy, conditional on working, most married females supply hours of work that are significantly above zero. Only 0.1% of married women supply less than 1/2 of mean hours in the benchmark economy.

married females do so by 5.5%, while aggregate hours expand by 1.5%. When the subsidy rate is larger (75%), only households with incomes lower than the mean household income qualify. In this case, the expansion in participation rates of married females is larger (6.8%) even though fewer households with working parents qualify.

Table 3 also shows that low-skilled married females react more. When subsidies are universal, married females with less than high school education increase their participation by 9% while those with more than college do so by 3.9%. When the subsidy rate is 75%, the differences in participation rates become even sharper; they decline monotonically from 19.1% at the bottom to about 1.1% at the top of the skill distribution. These asymmetries between skill groups and between cases are expected. Childcare costs disproportionately affect poorer households, and, as a result, the impact on their participation is larger. In addition, since less-skilled married females are less likely to participate in the benchmark economy, there is more room to expand their participation. These forces are stronger under a more generous subsidy at a 75% rate. While fewer two-earner households qualify in this case, the impact of bigger subsidies at the bottom dominates. The net result is even larger differences between the bottom and the top of the skill distribution as Table 3 demonstrates.

Conditional Transfers These transfers are similar to childcare subsidies, but their redistributive impact is more substantial as the transfer is lump-sum, common to all who qualify. Hence, conditional transfers can be larger than subsidies for households who spend relatively little on childcare, e.g. low educated household with access to informal care. For such households, a conditional transfer provides stronger incentives for the secondary earner to enter into the labor force. Thus, in the case of universal conditional transfers, the reaction at the bottom of the skill distribution in terms of participation rates of married females is much larger than it is under a universal subsidy, while the reaction at the top of the skill distribution is smaller. The net result is an aggregate increase in participation, which turns out to be larger than under universal subsidies.

Under a universal conditional transfer, the change in participation for married females with less than high school education is about 25% and declines monotonically to 2.8% for those with more than college education. These asymmetric effects across the skill distribution are even sharper when the size of the lump-sum transfer is twice as large and fewer, poorer households qualify. In this case, the aggregate effects on participation rates are smaller than under a universal transfer (6.2% vs 8.1%).[19]

Unconditional Transfers This case involves a transfer to households with children, regardless of the labor market participation of mothers. Hence, it has a negative income effect on labor supply. In the context of our model, unconditional transfers lead to a disincentive to joint participation for married households at the margin and to fewer hours worked along the intensive margin. This disincentive is relatively more important for households at the bottom of the skill distribution. When the unconditional transfer is universal, the participation rate of married females drops by 5.1%, while total hours worked by married females drop by more (5.3%), as households reduce hours on the intensive margin as well. As a result of all these changes, aggregate output falls by about 0.8%.[20]

As the unconditional transfer is disproportionately more important for less-skilled households (relative to their income), the negative effects on participation changes are larger for less-skilled married households. Table 3 shows that the drop in participation ranges from 8.8% for the least skilled females to 1.6% at the very top. Hours worked also decrease across the board. The same logic applies when the child transfer is twice as large. In this case, the drop in participation ranges from 18.1% at the bottom to 3.9% at the top.

Our findings indicate that reallocating child-related transfers in different directions can have significant consequences that differ both qualitatively and quantitatively. Two elements are key in understanding these differences: work requirements (conditional vs. unconditional transfers) and redistribution (universal vs. means-tested transfers). These elements are also key in assessing the welfare effects of child-related transfers, which we analyze next.

5.2 Work Requirements, Redistribution and Welfare

In Table 3 we also show the effects on welfare (consumption compensations) for all newborn households and for different subgroups. Several findings emerge. First, it is clear that reallocating resources towards transfers that have a work requirement is not necessarily preferred by newborn households as a group. As the table indicates, a reallocation towards

[19] The universal conditional transfer amounts to 2.4% of mean household income – about $1,995 per child in 2016 dollars. When the transfer is doubled, only households with incomes less than 58.5% of mean household income qualify.

[20] The universal unconditional transfer amounts to about 1.9% of mean household income – about $1,605 per child in 2016 dollars. When the transfer is doubled, only households with incomes less than 55% of mean household income qualify.

childcare subsidies leads to significant welfare losses; they lead to losses of 1.7% when they are universal and 0.9% when they are means-tested. Conditional transfers also lead to a welfare loss of 0.9% when they are universal and a marginal gain of 0.05% when they are means-tested. When we expand childcare subsidies in the expense of other programs, households that do not have any childcare expenditures lose other programs, e.g. child credits, that they value.

Second, preferences over this reallocation vary by subgroups, both by marital status and skills. Less-skilled single females dislike a universal childcare subsidy, since most of them have access to one at higher rate under the benchmark arrangement. Those with a college education or more, on the other hand, like it as they now qualify for the program. All single females experience welfare gains as a group under a subsidy at the benchmark 75% rate, with a magnitude that roughly declines as their skills go up. This occurs as more of them qualify for the childcare subsidies relative to the benchmark, and the subsidies are disproportionately more important for those who are less-skilled. Similarly, almost all single females experience welfare gains with universal or means-tested conditional transfers. All single females in the benchmark economy work and conditional subsidies or transfers simply imply an income transfer for these households. Married households, on the other hand, almost uniformly dislike childcare subsidies or conditional transfers.

Finally, our welfare findings show that *unconditional transfers* generate welfare gains, despite their depressing effects on household labor supply and output. Universal, unconditional transfers generate welfare gains for newborns of about 0.4%. Less skilled single females experience welfare gains while more skilled ones lose. The bulk of married households experience welfare gains. This is expected given the redistributive aspect of unconditional transfers, i.e. a lump-sum amount regardless of household income. In turn, when the size of the transfer doubles and not all households with children qualify, the effects on welfare for newborns are larger (1.5% vs 0.4% under a universal transfer). This generates asymmetries in welfare gains: households at the bottom of the skill distribution gain more under a universal transfer, while those at the top, who do not qualify, lose.

Welfare-Maximizing Unconditional Transfers Since we find that unconditional transfers generically lead to welfare gains for all newborn households, and that these gains depend on the generosity and income eligibility of the scheme, we conduct a natural exercise.

We ask: given a fixed budget for child-related transfers, what is the unconditional transfer arrangement that maximizes welfare gains? We find that welfare gains are maximized by a per-child transfer of about $3,850 in 2016 dollars – about 2.4 times the size of the universal unconditional transfer – with a corresponding income level threshold of about 40% of mean income. The ex-ante gains for newborn households are largest among all programs considered (about 1.6%). The fact that welfare-maximizing arrangement is far from universal suggests that targeting low income (less educated) households plays a central role in understanding the welfare effects of child-related transfers.

5.3 What Have We Learned?

We summarize our findings by providing answers to the questions that we posed at the start. The answer to the first question ('Should transfers be universal?') is *no* in terms of the welfare of newborn households. As our results show, means-tested transfers lead to higher welfare gains (or lower losses). This holds independently whether transfers are conditioned on market work or not. The answer is, however, different if policymakers are interested in boosting female labor supply. Table 3 illustrates that a universal, conditional transfer can lead to much larger labor-supply responses of married females in the aggregate. Since participation rates are lower to start with for less-skilled (poorer) females, means-tested subsidies or conditional transfers naturally imply larger responses among less-skilled types.

In terms of the second question ('Should transfers be conditional on work?'), the answer is also *no*. Our findings in Table 3 show that unconditional transfers deliver welfare gains to newborns and gains are even larger when such transfers are means-tested. Nevertheless, if instead policymakers aim at increasing female labor supply, the answer is strictly the opposite. Unconditional transfers depress labor supply across the board. Quantitatively, as Table 3 demonstrates, our findings imply substantial negative effects on hours worked and participation rates associated to a reallocation of resources towards unconditional transfers.

Finally, in terms of the third question ('If transfers are conditional, should they be in the form of a subsidy or lump-sum?'), the answer is that lump-sum transfers deliver the largest labor supply responses while minimizing welfare losses among newborns – and even delivering marginal gains. The reason is simple: since less-skilled (poorer) households typically spend little on childcare in absolute amounts, lump-sum conditional transfers have the largest potential impact. Moreover, this higher redistributive power of lump-sum transfers generates larger participation responses among less-skilled married households. The net result is larger labor supply responses associated to lump-sum conditional transfers relative to a childcare subsidy.

6 Expanding Child-Related Transfers

We now build on the findings of the previous section and evaluate the macroeconomic and welfare implications of expanding the *actual* set of child-related transfers in the U.S. Our policy experiments are conducted under the assumption of a small-open economy, where the rate of return on capital, and thus the wage rate, are unchanged across steady states. The reforms that we consider are expenditure equivalent, and are financed via a proportional flat-rate income tax applied to all households. We conduct three experiments that broadly encompass proposals discussed in policy circles. We first expand the childcare subsidy in the U.S. and make it universal. We then expand the child credit and the childcare credit.

Specifically, we first make the existing 75% childcare subsidy universal, which requires a proportional tax rate of 1.2% to balance the budget. To preserve comparability, we conduct the expansions of the child credit and the childcare credit under the same tax rate, i.e. they both require a 1.2% proportional tax rate to be financed. For the child credit, we simply expand the basic per-child transfer built into the system. In the benchmark economy, households receive a benefit of about $1,000 per child if their income is below a threshold. After that threshold the transfer declines and becomes eventually zero – see Figure 2. Given the 1.2% tax rate, we increase the per-child transfer to about $1,800 per child and keep the income threshold unchanged. Similarly, for the childcare credits, we shift up the entire schedule in Figure 2 by a factor of about 2. This involves doubling the basic transfer in the program and substantially increasing the threshold income level at which the transfer starts declining. If a household qualifies for a transfer that exceeds their childcare expenditure, the difference is simply returned as a direct transfer.[21]

Table 4 summarizes our results, where again each column reports percentage changes with respect to the benchmark economy. A universal childcare subsidy leads to sharp increases in the labor supply (8.6%), participation (10.2%), and human capital (2.8%) of married females.

[21] When we consider these expansions, we also make the programs fully refundable. In the Online Appendix (Table A16), we also show the results when we make child credits and childcare credits fully refundable without any expansion.

Furthermore, married households reallocate hours of work from males to females.[22] Table 4 also reports hours per worker for single females. Unlike married females, hours worked for single females increase when we make the subsidy universal. This occurs since in the benchmark economy there are single females who choose to reduce their hours to qualify for the subsidy (i.e. to have an income below $\widehat{I}$). In contrast, the expansion of child credits depresses labor supply across the board, for married and single females and for married males, and reduces the human capital of married females. The difference between these two reforms is also reflected in aggregate output: output increases by 0.5% with the universal subsidies but declines sharply by 1.7% with the expansion of child credits. The expansion of childcare credits leads to the largest increase in the participation rates of married females (10.6%).[23] These findings are in line with what we find in hypothetical reforms in Section 5: programs that are conditional on work generate increases in female labor supply while unconditional programs have the opposite effect.

Changes in Participation and Human Capital by Skill Table 4 shows changes in the labor force participation of married females relative to the benchmark economy, for women with different education levels and by child-bearing status. In line with our previous findings, the consequences of more generous transfer programs are not symmetric across married women of different education. Changes are greater for women with less education, with percentage changes that decline as the level of education increases. Note that the impact of childcare subsidies and childcare credits is particularly large on less-skilled women; about 25.4% and 32.0%, respectively, for those with less than high school education. Equivalent findings hold for married women according to child-bearing status. Married women with children arriving earlier in their life cycle increase their participation rates more than those with children late. Married women in households with early childbearing are disproportionately less skilled and have more children, whereas the opposite is true for women in households with late childbearing.[24] The effects of child-related transfers on the human

[22] As we document in Figure A10 in the Online Appendix, these findings are broadly consistent with cross-country evidence. For a group of high income countries, public spending on childcare has a positive relation with labor force participation and a negative one with hours worked for married females.

[23] In the Online Appendix, we discuss how the expansion of different programs affect poverty.

[24] As we show in Table A21 in the Online Appendix, even conditional on education, the effects on participation are larger for early childbearers. Early childbearers have a longer working life after their childbearing years and hence, more to benefit from increasing their participation.

capital of married females by skill mirror the effects on participation rates.

In the Online Appendix, we evaluate the importance of different features of our model for the implications of our child-related transfers. In particular, we ask: what is the role associated to the reallocation of hours worked (from males to females) within couples (Table A18)? What is the quantitative importance of the small open-economy assumption in the benchmark case (Table A19)? What is the importance of imperfect substitutability of skills in production (Table A20)? Overall, we conclude that our benchmark findings on female labor supply are largely robust to deviations from our benchmark assumptions.

6.1 Welfare

We now concentrate on the welfare effects associated to the expansion of child-related transfers. We compute the transitional dynamics between steady states implied by the policy change under consideration, when the policy change is unanticipated at, say, $t = t_0$. The focus of our analysis is on newborn households at $t = t_0$. We balance the budget in each period by adjusting an additional flat-rate income tax that applies to all households.

Our findings are displayed in Table 5. Newborn households, as a group, experience welfare gains associated to the expansion of child-related transfers. Gains for all newborn households range from about 0.8% for the universalization of childcare subsidies, to 1.3% and 2.5% in the case of the child credit and childcare credit expansions, respectively. Hence, childcare subsidies provide the lowest welfare gains among all expansions, while the expansion of the childcare credit leads to the highest gains.

While the gains for the newborns as a whole can be substantial, not all newborns gain, and there is heterogeneity among those who do. Single females who have children early in the life cycle gain more than those who tend to have their children late. This follows from the fact that the early childbearing group contains a disproportionate fraction of less skilled females, and of child-related transfers are highly valuable for them. Likewise, those with access to informal care gain less than those without access to informal care. These patterns are also repeated for married households according to childcare status. Welfare gains are also increasing in the number of children. When we expand childcare transfers, for example, households who have two children gain about 4.6%, while those with more than two children gain significantly more, about 6.8%. In the Online Appendix (Table A22), we show in detail the rich patterns of welfare gains and losses among married households by their type (education).

Redistribution and Welfare In order to highlight the importance of redistributive effects for our welfare results, we report an alternative notion of welfare that aims at removing the redistributive effects of policy changes. Motivated by Domeij and Klein (2013), we weight the discounted utility of a newborn household by the inverse of the shadow value of a dollar transfer at birth. Since this shadow value is higher for poorer households, the resulting value of a transfer to a poorer (richer) household is smaller (higher) than in standard welfare calculations. We refer to this notion as *weighted* welfare in Table 5, and present it formally in the Online Appendix. Our findings show that when redistributive effects are accounted for, welfare gains for newborns become quite smaller. Welfare gains for childcare subsidies and child credits become almost negligible (0.04%). The weighted welfare gains for childcare credits are larger, about 0.14%.

These results suggest that redistribution is important in accounting for the welfare gains associated with the expansion of child-related transfers; once we remove the redistribution effects, only the expansion of childcare credits generates noticeable welfare gains. Indeed, for the expansion of childcare credits, we calculate that low skilled females experience non-trivial welfare gains under the weighted notion of welfare. Single females with less than high school, high school and some college education, for example, gain 0.53%, 0.52% and 0.58%, respectively, under the weighted notion of welfare. The weighted welfare gains for married females with high school, high school and some college education are 0.22%, 0.26% and 0.22%, respectively, which are gains that are realized above and beyond those emerging from redistribution across groups.[25] While redistribution forces dominate, these results also indicate that other factors are behind the welfare gains of different groups. One of these is potentially binding borrowing constraints for less skilled households, given the high cost of childcare services that they face. As we mentioned earlier, some of these households would like to borrow to cover childcare expenses, so the female member of the household can enhance her skills by working.

[25] In the Online Appendix (Table A23), we also document how much childcare subsidies and direct transfers each program delivers for households at different income levels. In particular, with the childcare credit expansion, subsidies are 100% for low income levels and subsequently decline to values below, but close, to the universal subsidy rate (75%). Transfers in this case, or credits in excess of childcare expenditures, emerge for low income levels and then decline and vanish as income increases.

6.2 Discussion

Quantitatively, the changes on female labor supply induced by large-scale expansions of transfers conditional on market work are large and comparable to the effects of some fundamental tax reforms in the United States. In related work and using a version of this framework (Guner et al, 2012-a) we found, for example, that fully eliminating joint filing in the U.S. income tax system leads to long-run changes in the participation rates of married females of about 11.1%. The largest expansion in participation in Table 5 via childcare credits is very similar – 10.6%.

The Role of Endogenous Skills A novel aspect of our analysis is the explicit consideration of the depreciation of female skills due to non participation. How important is this channel? To answer this question, we shut down the endogenous skill channel, and study the expansion of child-related transfers in an economy in which each married female type has exogenously the same skill profile that she had in the benchmark economy. Hence, her skills do not change if she chooses to change her participation decision in response to the policy changes.

We find that the endogeneity of female skills plays a crucial role for our results on labor supply. Without it, the labor supply of married females increases much less under an expansion of childcare subsidies or childcare credits and decreases much more under the child credit expansion. Table A17 in the Online Appendix documents our findings. With the universalization of subsidies, the participation rate of married females increases by 6.1% for the case of exogenous skills, whereas it increases by about 10.2% when the endogenous skill channel is operative. Under the expansion of child credits, the participation rate decreases by 2.2% when skills are exogenous and by 2.4% when skills are endogenous in the benchmark case.

Majority Support? A prominent aspect of our findings in Table 5 is that despite sizeable welfare gains in all policy exercises, a majority of newborn individuals who benefit from the expansion of child-related transfers does not emerge easily. This reflects the fact that those who gain, gain a lot, while there are many who lose marginally. Only 48% of newborns support the expansion of childcare subsidies. In contrast, both child credits and childcare credits are supported by a majority of newborns. The majority is, however, only marginal

(51%) for childcare credits, and only the expansion of child credits generates a majority non-trivially away from 50%, about 54%. Why is majority support hard to achieve? First, note that a fraction of newborns (males and females either married or single) are childless. Second, in the case of transfers conditional on work, only those who work can benefit. This explains why the child credit expansion generates the strongest majority support. Finally, even if transfers accrue to a household, they are concentrated only over a fraction of the life-cycle, while taxes are paid over the entire life cycle. Hence, many individuals with children need not benefit in net terms from the policy expansions.

If we take simple majority support among newborns as an additional criteria, the expansion of childcare credits is a clear winner among the cases considered. It generates the largest welfare gain (2.5%), delivers gains for a majority of newborn households, while leading to the largest increase in participation rates. In the hypothetical reforms of Section 5, means-tested, unconditional transfers generated largest welfare gains, followed by means-tested, conditional transfers (lump-sum or subsidy). When it comes to expansion of actual programs, the dominant policy is the expansion of childcare credits, which combines features of best hypothetical reforms: transfers to poor households and work requirements. Childcare credits are conditional on work. Furthermore, we implement the expansion such that poor households can receive more than what they spend on childcare, which, generates welfare gains for these households.

Welfare: All Households What are the welfare effects for all households alive date $t = t_0$? Table 6 shows our findings for households of different ages (aggregated across all educational types, childbearing, and marital status) as well as for all households alive. The results show sharp differences between groups. Younger households as a group win whereas older households lose. This occurs for the expansion of all transfer programs. For instance, in the case of the childcare credit expansion, the consumption compensation decreases monotonically from 2.5% for newborns (aged 25-29), to -2.0% for those aged 50-54. These results are driven by the fact that at the time of the policy change, younger households tend to be net beneficiaries as child-related transfers are concentrated at young ages. For older age groups, these transfers become less important for those alive at the date of the introduction of the policy, while higher taxes affect all households. Hence, welfare gains become lower with the group age and eventually become negative. Not surprisingly, no transfer expansion generates majority support when all households are considered.[26]

2017 Expansion of Child Credits We outlined in section 2 the changes in the child credit under the Tax Cut and Jobs Act of 2017. While this expansion took place in the context of broader changes to the tax code, our model economy can shed light on its effects on aggregates and welfare. We implement the new policy as a fully-refundable one, and find the tax rate that balances the budget in steady state. We dub the new policy *new child credit*. The new child credit is more generous than our baseline child credit expansion (it doubles the size of the basic transfer per child and the basic transfer remains constant for a wider range of income levels). Tables 4 and 5 show the results. As Table 4 shows, the negative effects of the new child credit on female labor supply and output are substantial, and require a tax rate of 1.35%, higher than the 1.2% rate of our baseline child credit expansion. Table 5 shows that the new childcare credit generates substantial welfare gains among newborns, 1.7%. These gains are larger than for our baseline expansion of child credits (1.3%). There is also stronger majority of newborn households in support of the changes. These large welfare gains, however, are almost entirely due to the redistribution of resources toward poorer households. Once we remove the redistribution effects, the welfare gains are practically zero (0.0007%). Overall, our findings indicate that the 2017 reform to the child credit is a quantitatively important one, despite the scant attention received so far.

7 Concluding Remarks

We evaluate the macroeconomic implications of expanding child-related transfers in a rich equilibrium environment with multiple features that make it suitable for policy analysis. We find that an expansion of current arrangements have substantial effects on participation rates and hours worked across steady states. As we extensively discuss in the paper, we find that the aggregate effects of these policies depend critically on whether they are tied to market work, or not. Similarly, we find large asymmetries in terms of welfare. For newborn households, welfare gains range from about 0.8% (the universalization of childcare subsidies) to 1.3% and 2.5% (the child credit and childcare). Behind these relatively large aggregate welfare gains, there is significant heterogeneity among households, as some (poorer

[26] Table 6 also shows the welfare gains in each new steady state for newborns in each expansion, which are closely aligned with the welfare gains for newborns reported in Table 5.

households with children) gain, and others lose. As a result, only 48% of newborns support an expansion of child care subsidies. In contrast, both child credits and childcare credits are supported by a majority of newborns. The majority is, however, marginal for childcare credits (51%), and more substantial for the expansion of child credits (54%). Overall, the expansion of childcare credits generates the largest welfare gains (2.5%), delivers gains for a majority and yields the largest increases in labor supply.

Our analysis treats childcare expenses per child and the number of children per household as exogenous. It is not clear that the inclusion of endogenous parental choices in the analysis will change our quantitative findings in a significant way. Specifically on fertility, child-related policies that lead to higher participation rates are unlikely to alter parental decisions. There are countervailing effects that are expected to cancel each other out. Childcare costs are only a small fraction of the lifetime costs of raising children, and a reduction in these costs is balanced by increases in tax rates needed to finance the expansion of childcare subsidies. Along these lines, Bick (2016, Table 4) finds that childcare subsidy expansions in Germany lead to negligible changes in the overall fertility rate. Furthermore, child-related transfers might affect how much time and resources children receive from their parents, which can affect the outcomes of children in the future. In this regard, the available evidence is mixed. Baker, Gruber and Milligan (2008) and Herbst and Tekin (2010) document that childcare subsidies can worsen outcomes for children, while Griffen (2018) and others estimate small but positive effects on children's cognitive skills.

Finally, we abstract from income risk that households face and as a result, the analysis do not capture possible gains that some transfer programs can generate by making household labor supply more flexible. Blundell, Pistaferri and Saporta-Eksten (2016) show that female labor supply plays an important role in insuring households against labor market shocks. In ongoing work, Guner, Kaygusuz and Ventura (2019), we explore this issue by modeling household labor supply and the extensive margin in female labor supply, when households are heterogeneous, experience uninsurable shocks and government transfers are operative. An analysis incorporating these features may make an expansion of child-related transfers even more appealing.

Table 1: Parameter Values

Parameter	Value	Comments
Population Growth (n)	0.01	U.S. Data
Discount Factor (β)	0.9696	Calibrated - matches K/Y
Labor Supply Elasticity (γ)	0.4	Literature estimates.
Disutility of Market Work (φ)	7.63	Matches hours per worker
Time cost of Children (η)	0.038	Matches LFP of married females with young children
Skill depreciation, females (δ_x)	0.025, 0.056	Calibrated
Growth of skills (α_j^x, α_j^z)	-	See text - CPS data
Distribution of utility costs $\zeta(.\|z)$ (Gamma Distribution)	-	See text - matches LFP by education conditional on husband's type
Within group heterogeneity (ε)	0.388	Calibrated
Capital Share (α)	0.343	Calibrated
Depreciation Rate (δ_k)	0.055	Calibrated
Childcare costs for single females, $d(s, x, g)$	-	See text - matches expenditure by age, skills and access to informal care.
Childcare costs for married females $d(s, x, z, g)$	-	See text - matches expenditure by age, skills and access to informal care.
Childcare subsidy (θ)	75%	U.S. Data
Income threshold ($\widehat{I}$) (as a % of mean household income)	15.8%	Calibrated
Tax functions $T^M(I, k)$ and $T^S(I, k)$		See Online App. - IRS Data
Transfer functions $TR^M(I, D, k)$, $TR_f^S(I, D, k)$ and $TR_m^S(I, D, k)$		See text and Online App.
Payroll Tax Rate (τ_p)	0.086	See Online App.
Social Security Incomes, $p_m^S(z)$, $p_f^S(x)$ and $p^M(x, z)$	-	See Online App. - U.S. Census
Capital Income Tax Rate (τ_k)	0.097	See Online App. - matches corporate tax collections

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

Table 2: Model and Data

Statistic	Data	Model
Capital Output Ratio	2.93	2.93
Labor Hours Per-Worker	0.40	0.40
LFP of Married Females with Young Children (%)	62.6	63.8
Variance of Log Wages (ages 25-29)	0.227	0.227
Participation rate of Married Females (%), 25-54	72.4	71.5
Less than High School (<HS)	46.7	47.2
High School (HS)	69.7	66.4
Some College (SC)	74.0	73.4
College (COL)	74.7	73.6
More than College (COL+)	82.2	79.9
Total	72.4	71.5
With Children	68.3	66.1
Without Children	85.9	83.3

Note: Entries summarize the performance of the benchmark model in terms of empirical targets and key aspects of data. Total participation rates, with children and without children are not explicitly targeted.

Table 3: Reallocation of Child-Related Transfers (% changes relative to benchmark)

	Conditional on Work				Unconditional	
	Subsidy		Transfer		Transfer	
	Universal	Means-Tested	Universal	Means-Tested	Universal	Means-Tested
LFP (MF)	5.7	6.8	8.1	6.2	-5.1	-8.9
Hours	1.5	1.3	1.9	0.4	-1.4	-3.0
Hours (MF)	5.5	6.0	7.5	4.4	-5.3	-10.0
Output	0.8	-0.2	1.0	-0.9	-0.8	-3.0
LFP						
< HS	9.0	19.1	25.1	37.8	-8.8	-18.1
HS	6.3	10.5	11.8	12.7	-9.1	-13.0
SC	4.9	7.1	7.6	5.2	-5.4	-8.8
COL	6.2	4.7	5.8	0.4	-3.5	-7.4
COL+	3.9	1.1	2.8	-1.0	-1.6	-3.9
Welfare						
Single F						
Early	-0.3	2.5	1.5	8.6	0.1	5.6
Late	-0.2	1.9	0.9	5.5	-0.1	3.3
< HS	-0.8	1.6	3.2	11.6	1.5	8.3
HS	-0.6	1.5	1.5	7.5	0.5	5.3
SC	-0.2	1.6	0.5	4.6	-0.4	2.8
COL	0.3	1.3	0.3	1.5	-0.1	0.8
COL+	0.2	0.8	-0.1	0.5	-0.3	0.0
Married						
Early	-3.5	-2.1	-2.0	-0.3	1.1	3.3
Late	-2.6	-2.3	-2.1	-2.6	0.5	-0.1
< HS	-5.1	-3.6	-2.8	3.6	4.8	14.2
HS	-3.8	-2.3	-2.1	0.1	1.1	4.0
SC	-3.0	-1.8	-1.7	-2.0	0.5	0.3
COL	-2.0	-1.7	-1.9	-3.2	0.0	-1.1
COL+	-0.8	-1.4	-1.5	-2.7	-0.1	-1.5
All Newborns	-1.7	-0.9	-0.9	0.05	0.44	1.5

Note: Entries show the effects (percentage changes) on selected variables driven by reallocation of resources devoted to child-related transfers towards a childcare subsidy, a conditional transfer and an unconditional transfer. Welfare stands for the consumption compensation that makes a newborn household indifferent between two alternatives. See text for details.

Table 4: Expansion of Child-Related Transfers (% changes relative to benchmark)

	Universal Subsidies (75%)	Child Credit Expansion	Childcare Credit Expansion	New Child Credit
Participation of Married Females	10.2	-2.4	10.6	-2.6
Total Hours	1.8	-1.4	1.5	-1.5
Total Hours (Married Females)	8.6	-3.1	8.6	-3.3
Hours per worker (All Females)	-1.1	-1.1	-1.6	-1.3
Hours per worker (Married Females)	-1.8	-0.7	-2.2	-0.9
Hours per worker (Single Females)	0.2	-1.5	-0.3	-1.9
Hours per worker (All Males)	-1.5	-0.7	-1.7	-0.7
Human Capital (Married Females)	2.8	-0.8	2.5	-0.8
Output	0.5	-1.7	0.7	-1.5
Tax Rate (%)	1.2	1.2	1.2	1.35
Participation of Married Females:				
By Education				
< HS	25.4	-6.4	32.0	-7.2
HS	13.3	-4.4	16.9	-4.8
SC	9.1	-2.5	10.4	-2.8
COL	9.4	-1.2	7.0	-1.3
COL+	5.2	-0.7	2.8	-0.3
By Child Bearing Status				
Early	14.9	-4.0	17.0	-4.4
Late	8.2	-1.5	6.9	-1.4
Human Capital of Married Females:				
By Education				
< HS	5.7	-2.2	7.0	-2.5
HS	3.5	-1.5	4.2	-1.6
SC	2.7	-1.1	2.9	-1.2
COL	3.4	-0.7	2.5	-0.6
COL+	2.0	-0.4	1.0	-0.2
By Child Bearing Status				
Early	4.0	-1.4	4.1	-1.6
Late	2.5	-0.5	1.8	-0.4

Note: Entries in the top panel show effects (percentage changes) across steady states on selected variables driven by the expansion of each program. The values for "Tax Rate" correspond to the values that are necessary to balance the budget. The bottom panel shows the effects on the participation rates of married females of different schooling levels. See text for details.

Table 5: Expansion of Child-Related Transfers: Welfare Effects (Newborns, %)

	Childcare Subsidy (75%)	Child Credit	Childcare Credit	New Child Credit
Single F				
No Children	-1.41	-1.40	-1.46	-1.62
Early	4.25	5.99	10.06	6.71
Late	3.40	3.58	7.40	4.25
Informal Care	4.15	5.44	9.62	6.03
No Informal Care	3.69	5.23	8,84	6.15
< HS	1.85	8.43	6.95	9.55
HS	2.54	4.93	6.66	5.62
SC	2.41	2.39	6.40	2.65
COL	1.08	0.33	2.43	0.37
COL+	0.56	-0.54	1.19	-0.56
Married				
No Children	-3.16	-3.14	-3.29	-3.61
Early	2.90	3.59	5.80	4.76
Late	0.50	0.85	1.51	1.41
Informal Care	2.02	2.09	3.84	3.96
No Informal Care	1.18	2.95	3.74	2.93
All Newborns	0.84	1.28	2.51	1.73
(%) Winners	48.0	54.3	50.9	57.7
All Newborns				
(Weighted Welfare)	0.04	0.04	0.14	~ 0

Note: Entries show the welfare effects (consumption compensation) driven by the expansion of child-related transfers, for young households (newborns) of different marital status, by educational types, childbearing status and availability of informal care. Calculations take into account transitions between steady states.

Table 6: Welfare Effects (All Households, %)

	Childcare Subsidy (75%)	Child Credit	Childcare Credit	New Child Credit
Age				
25-29	0.84	1.28	2.51	1.73
30-34	0.38	0.39	1.46	0.72
35-39	-0.81	-0.76	-0.23	-0.60
40-44	-1.84	-1.88	-1.84	-2.06
45-49	-2.39	-2.36	-2.51	-2.78
50-54	-1.86	-1.88	-1.99	-2.17
All	-0.82	-0.74	-0.36	-0.73
(%) Winners	14.6	13.6	15.5	15.5
Steady States:				
Newborns	0.77	1.19	2.54	1.71
(%) Winners	47.5	51.8	51.0	57.0

Note: Entries show the welfare effects (consumption compensation) driven by the expansion of child-related transfers, for different age groups and in the aggregate, as well as the aggregate percentage of winners. The entries in the top panel show results taking into account the transition between steady states. The entries in the bottom panel show the corresponding results across steady states.

References

[1] Adams, Gina and Monica Rohacek, “Child Care andWelfare Reform,” Welfare Reform & Beyond Policy Brief No. 14 (February 2002), The Brookings Institution.

[2] Adams, Gina and Caroline Heller, “The Child Care Development Fund and Workforce Development for Low-Income Parents,” Urban Institute, 2015.

[3] Attanasio, Orazio, James Banks, Costas Meghir, Guglielmo Weber. 1999. "Humps and Bumps in Lifetime Consumption." *Journal of Business and Economic Statistics*, Vol. 17, no. 1 (January 1999): 22-35.

[4] Attanasio, Orazio, Low, Hamish and Virginia Sánchez Marcos, “Explaining Changes in Female Labor Supply in a Life-Cycle Model,” *American Economic Review*, vol. 98, no. 4 (September 2008), 1517-42.

[5] Baker, M., Gruber, J. and K. Milligan, “Universal Child Care, Maternal Labor Supply, and Family Well-Being,” *Journal of Political Economy*, vol. 116, no.4 (August 2008), 709-745.

[6] Bick, Alexander, “The Quantitative Role of Child Care for Female Labor Force Participation and Fertility,” *Journal of the European Economic Association*, vol. 14, no. 3 (June 2016), 639-668.

[7] Bick, Alexander and Nicola Fuchs-Schundeln, “Taxation and Labor Supply of Married Women across Countries: A Macroeconomic Analysis,” *The Review of Economic Studies*, vol. 85, no. 1 (July 2018), 1543–1576,

[8] Blau, David M. “Child Care Subsidy Programs”, NBER Working Paper 7806, 2000.

[9] Blau, David M. “Child Care Subsidy Programs,” in *Means-Tested Transfer Programs in the United States* edited by Robert A. Moffitt, University of Chicago Press, 2003.

[10] Blau, David M. and J. Currie, “Preschool, Day Care, and After School Care? Who’s Minding the Kids” in E. Hanushek and F. Welch (editors) *Handbook on the Economics of Education*,Volume 2, Chapter 20, North Holland Press, 2006: 1164-1278.

[11] Blau, David M. and A. P. Hagy, "The Demand for Quality in Child Care," *Journal of Political Economy*, vol. 106, no. 1 (February 1998), 104-146.

[12] Blundell, Richard, Luigi Pistaferri and Itay Saporta-Eksten, "Consumption Inequality and Family Labor Supply." *American Economic Review*, vol. 106, no. 2, (February 2016), 387-435

[13] Blundell, Richard, Monica Costa Dias, Costas Meghir, and Jonathan Shaw, "Female Labor Supply, Human Capital and Welfare Reform," *Econometrica*, Vol. 84, No. 5 (September, 2016), 1705–1753.

[14] Burman, Leonard E., Elaine Maag and Jeffrey Rohaly, "Tax Subsidies to Help Low-Income Families Pay for Child Care," Discussion Paper No. 23, The Urban–Brookings Tax Policy Center, 2005.

[15] Chade, Hector and Gustavo Ventura, "Taxes and Marriage: A Two-Sided Search Analysis", *International Economic Review*, vol. 43, no. 3 (August 2002), 955-986.

[16] Cooley, Thomas F. and Ed Prescott, "Economic Growth and Business Cycles," in T. F. Cooley, ed., *Frontiers of Business Cycle Research*, (Princeton University Press, 1995), 1-38.

[17] Domeij, David and M. Floden, "The Labor-Supply Elasticity and Borrowing Constraints: Why Estimates are Biased", *Review of Economic Dynamics*, vol. 9, no. 2 (April 2006), 242-262.

[18] Domeij, D. and P. Klein, "Should day care be subsidized?," *Review of Economic Studies,* vol. 80, no 2 (April 2012), pages 568-595.

[19] Erosa, Andrés, Fuster, L. and D. Restuccia, "A General Equilibrium Analysis of Parental Leave Policies," *Review of Economic Dynamics*, vol. 13, no.4 (October 2010), 742-758.

[20] Greenwood, J,. N. Guner and J. Knowles, "More on Marriage, Fertility, and the Distribution of Income," *International Economic Review*, vol. 44, no. 3 (August 2003), 827–862.

[21] Griffen, Andrew S., "Evaluating the Effects of Child Care Policies on Children's Cognitive Development and Maternal Labor Supply," forthcoming, *Journal of Human Resources*, 2018.

[22] Guner, Nezih, Kaygusuz, Remzi and Gustavo Ventura, "Taxation and Household Labor Supply," *Review of Economic Studies*, vol. 79, no. 3 (July 2012), 1113–1149.

[23] Guner, Nezih, Kaygusuz, Remzi and Gustavo Ventura, "Taxing Women: A Macroeconomic Analysis," *Journal of Monetary Economics*, vol. 59, no. 1 (January 2012), 111-127.

[24] Guner, Nezih, Kaygusuz, Remzi and Gustavo Ventura, "Income Taxation of U.S. Households: Facts and Parametric Estimates," *Review of Economic Dynamics*, vol. 17, no. 4 (October 2014), 559-581.

[25] Guner, Nezih, Kaygusuz, Remzi and Gustavo Ventura, "Rethinking the Welfare State," Working Paper, 2019.

[26] Hannusch, Anne, "Taxing Families: The Impact of Child-related Transfers on Maternal Labor Supply,"Working Paper, 2018.

[27] Heathcote, J., K. Storesletten, and G. L. Violante, "The Macroeconomic Implications of Rising Wage Inequality in the United States," *Journal of Political Economy*, vol. 118, no. 4 (August 2010), 681-72

[28] Heckman, James J., "Effects of Child-Care Programs on Women's Work Effort," *The Journal of Political Economy*, vol. 82, no. 2 (March-April 1974), S136–S163.

[29] Herbst, Chris M., "Who are the eligible non-recipients of child care subsidies?" *Children and Youth Services Review* vol. 30, no. 9 (September 2008), 1037-1054.

[30] Herbst, Chris M. and E. Tekin, "The Impact of Child Care Subsidies on Child Well-Being: Evidence from Geographic Variation in the Distance to Social Service Agencies," NBER Working Papers 16250, 2010.

[31] Ho, Christine and Nicola Pavoni, "Efficient Child Care Subsidies," Working Paper, 2018.

[32] Hong, J. and J. V. Ríos-Rull, "Social Security, Life Insurance and Annuities for Families", *Journal of Monetary Economics*, vol. 54, no. 1 (January 2007), 118-140.

[33] Hotz, V. J., and R. A. Miller, "An Empirical Analysis of Life Cycle Fertility and Female Labor Supply," *Econometrica*, vol. 56, no.1 (1988), 91–118.

[34] Kaygusuz, R. "Taxes and Female Labor Supply," *Review of Economic Dynamics*, vol. 13, no. 4 (October 2010), 725-741.

[35] Kaygusuz, Remzi. "Social Security and Two-Earner Households," *Journal of Economic Dynamics and Control*, vol. 59 (October 2015) 163–178

[36] Lynch, Karen E. "The Child Care and Development Block Grant: Background and Funding", Congressional Research Service RL30785, 2011.

[37] Laughlin, Lynda. 2013. Who's Minding the Kids? Child Care Arrangements: Spring 2011. Current Population Reports, P70-135. U.S. Census Bureau, Washington, DC.

[38] Maag, Elaine, "Child-Related Benefits in the Federal I ncome Tax," Urban Institute, 2013.

[39] Maag, Elaine, "Reforming the Child Tax Credit," Urban Institute, 2015.

[40] Mincer, J. and H. Ofek, "Depreciation and Restoration of Human Capital", *Journal of Human Resources*, vol. 17, no. 1, 1982.

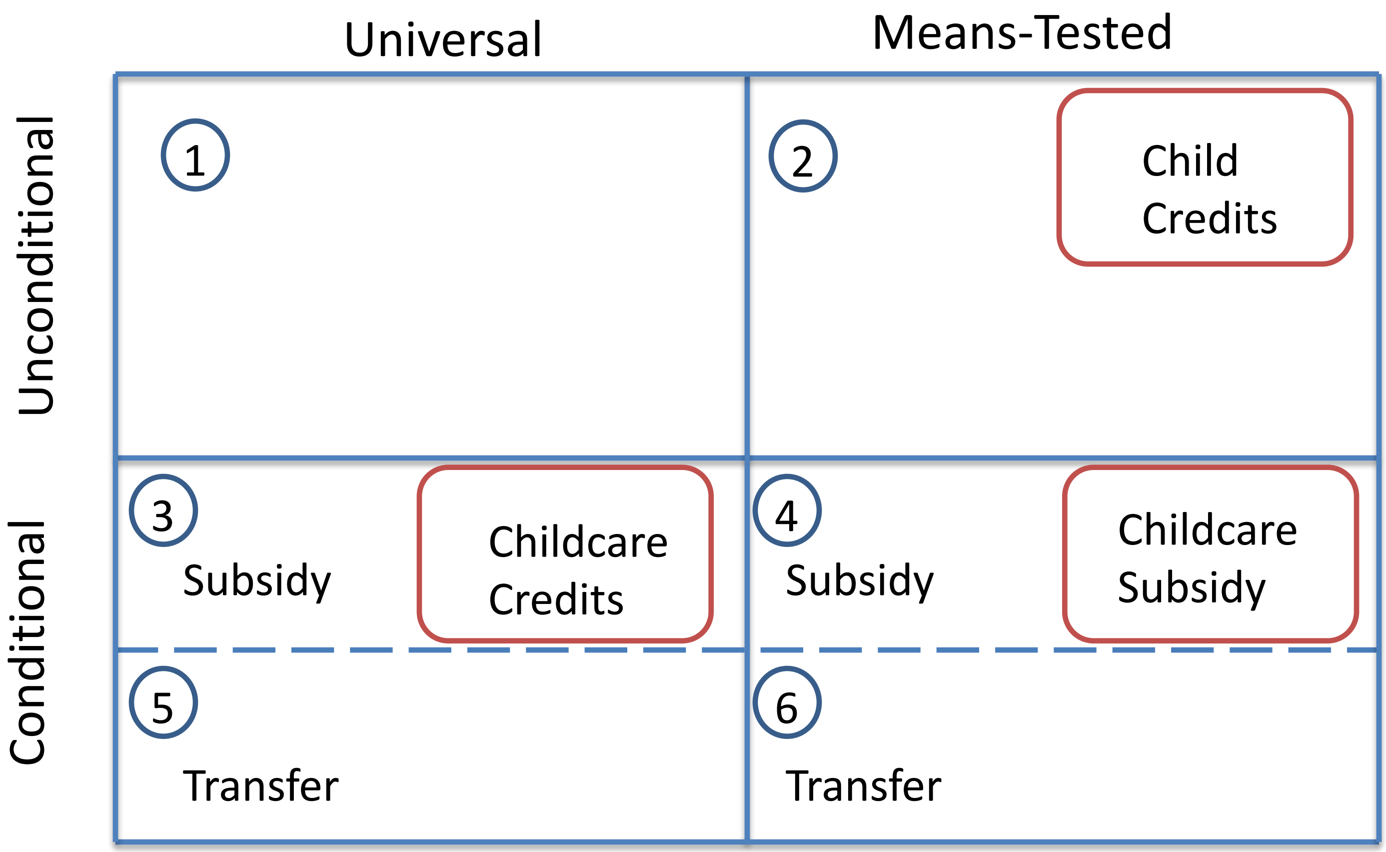
[41] Olivetti, C. "Changes in Women's Aggregate Hours of Work: The Role of Returns to Experience," *Review of Economic Dynamics* vol. 9, no. 4 (October 2006), 557-587.

[42] Rogerson, R. "Taxation and Market Work: is Scandinavia an Outlier?," *Economic Theory*, vol. 32, no.1 (July 2007), 59-85.

[43] Tekin, Erdal, "Childcare Subsidies, Wages, and Employment of Single Mothers," *Journal of Human Resources*, vol. XLII, no. 2 (Spring 2007), 453-487.

[44] White House, "Fact Sheet: Helping All Working Families with Young Children Afford Child Care," Press Release, January 21, 2015. https://www.whitehouse.gov/the-press-office/2015/01/21/fact-sheet-helping-all-working-families-young-children-afford-child-care

Figure 1: Taxonomy of Child-Related Transfers



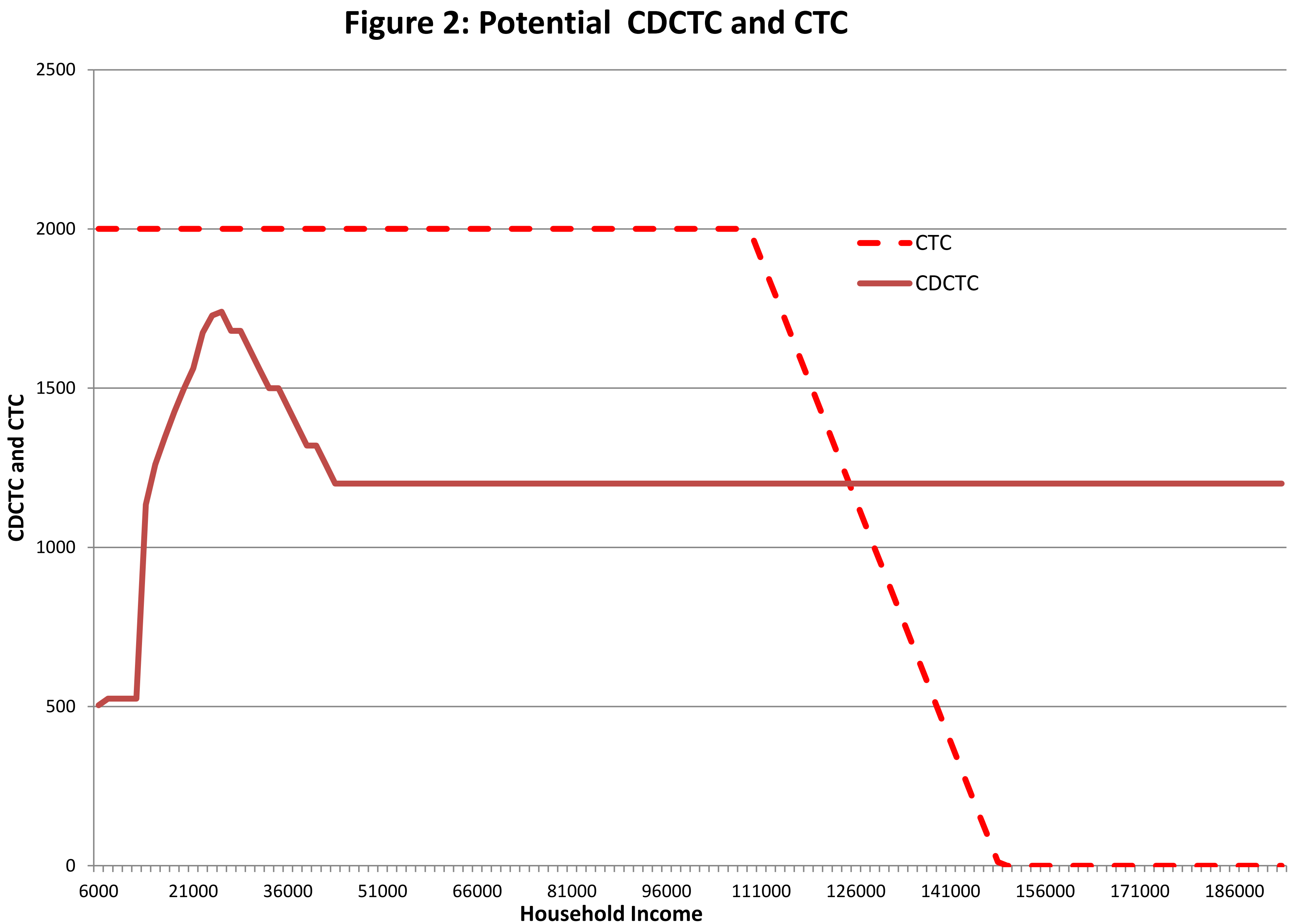
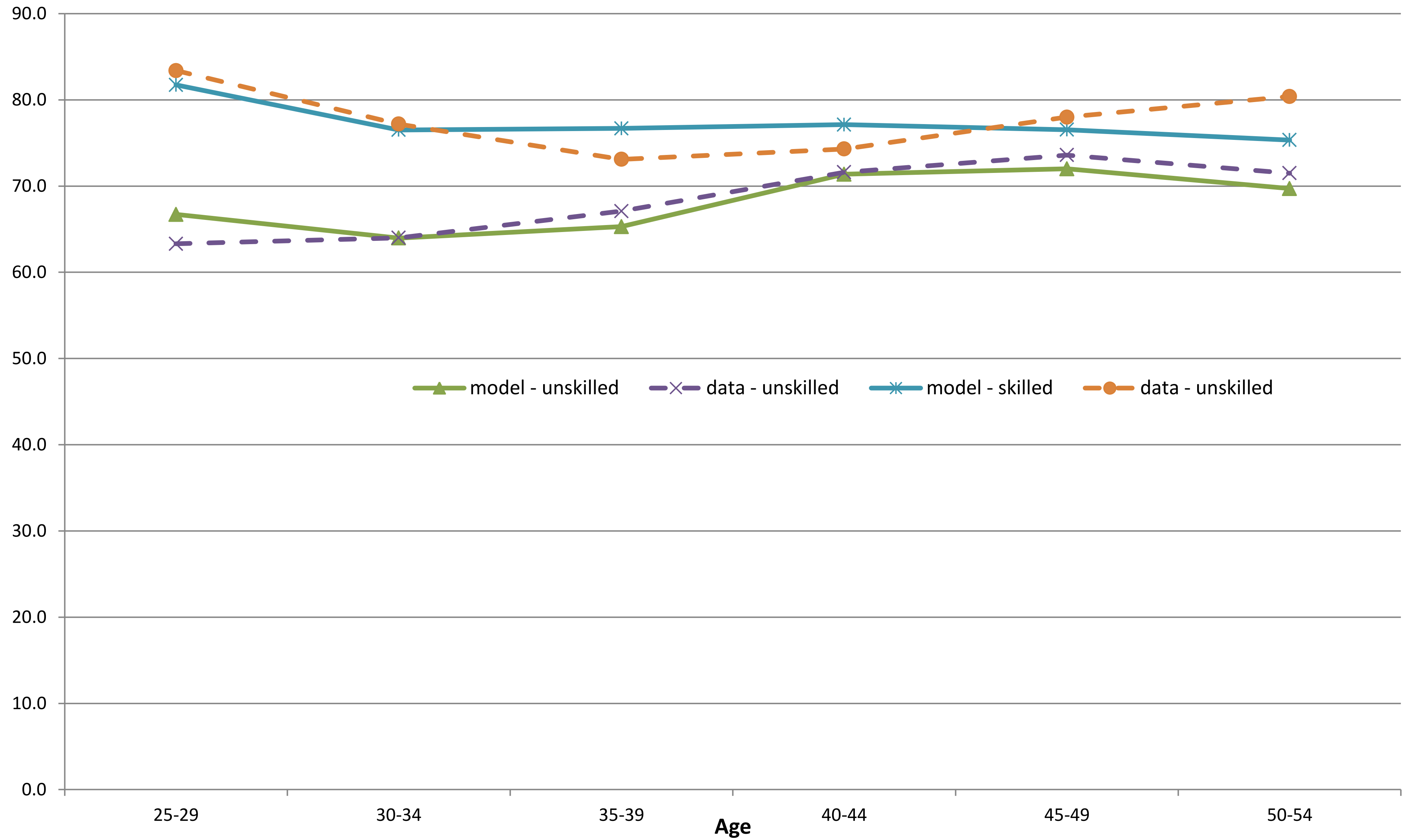


Figure 2: Potential CDCTC and CTC
2500
2000
1500
1000
500
0
CDCTC and CTC
CTC
CDCTC
6000
21000
36000
51000
66000
81000
96000
111000
126000
141000
156000
171000
186000
Household Income

Figure 3: Married Female Labor Force Participation by Skill



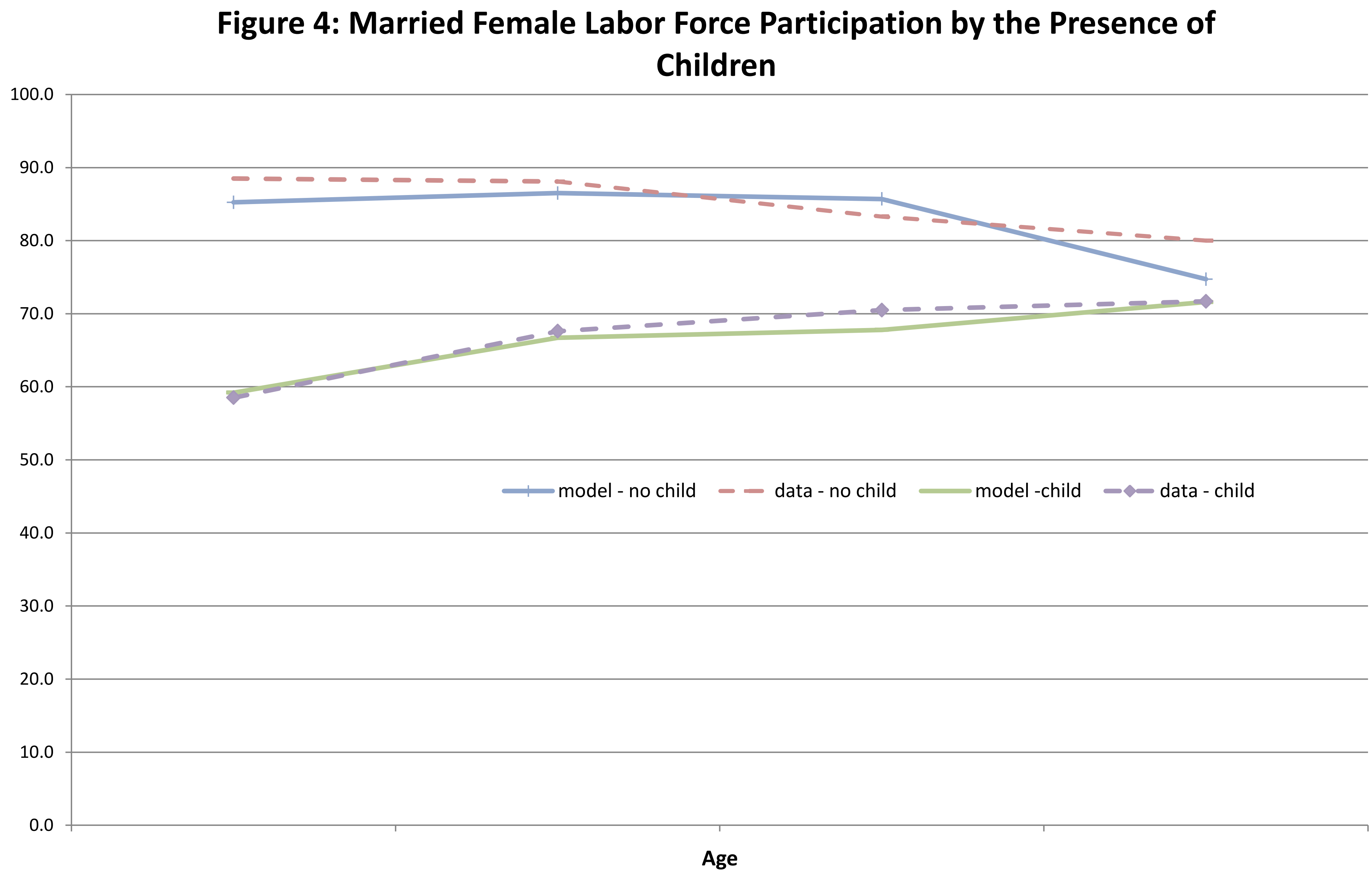


Figure 4: Married Female Labor Force Participation by the Presence of Children
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
model - no child
data - no child
model -child
data - child
Age

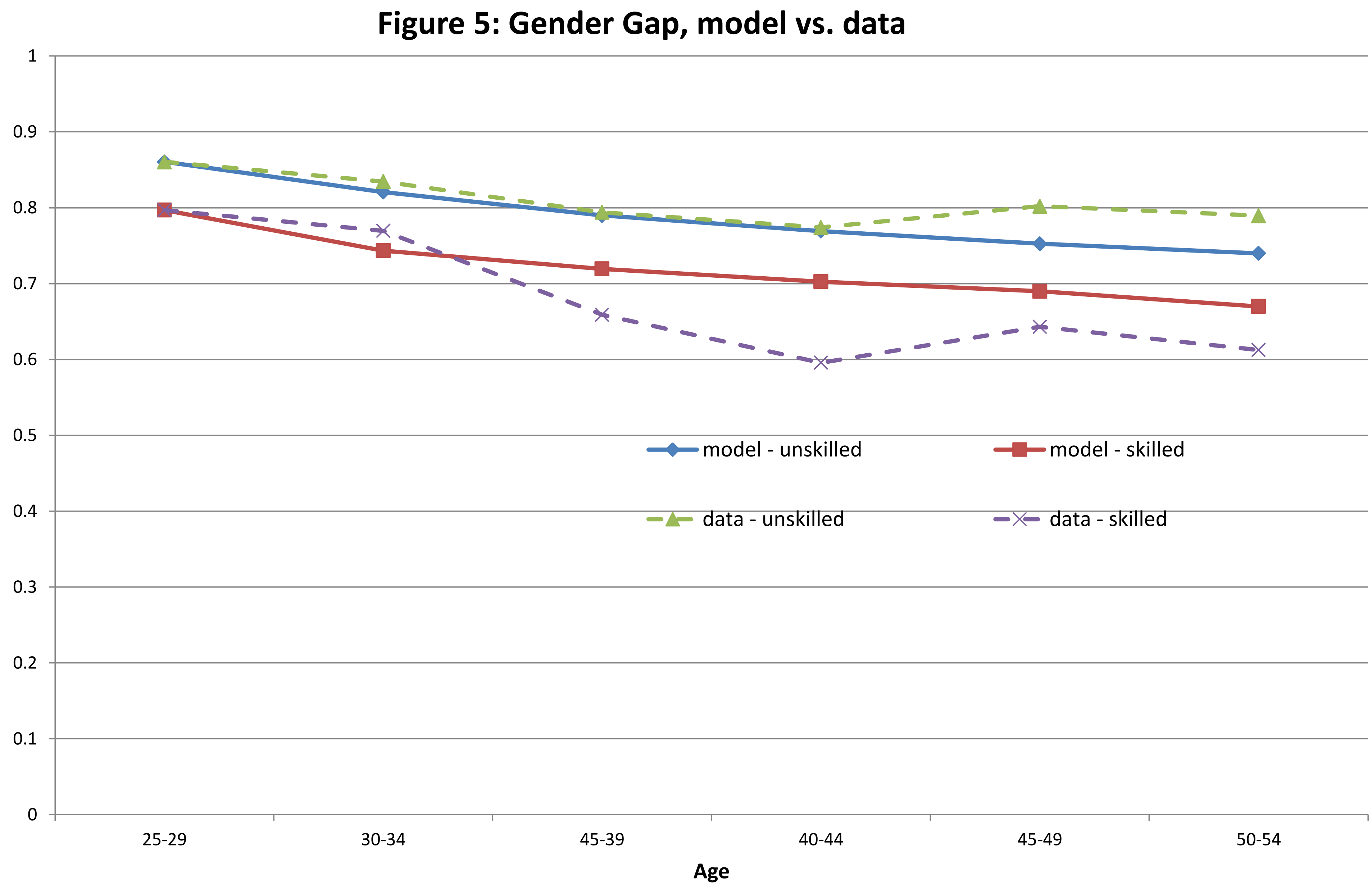


Figure 5: Gender Gap, model vs. data
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
model - unskilled
model - skilled
data - unskilled
data - skilled
25-29
30-34
45-39
40-44
45-49
50-54
Age

Online Appendix

for

Child-Related Transfers, Household Labor Supply and Welfare

by

Nezih Guner, Remzi Kaygusuz and Gustavo Ventura

February 2020

1 Definition of Equilibrium

In this section of the Online Appendix, we define a stationary equilibrium for our model economy. To this end, first let $M_j(x,z)$ denote the fraction of marriages between age-j, type-x females and age-j, type-z males, and let $\omega_j(z)$ and $\phi_j(x)$ be the fraction of single type-z males and the fraction of single type-x females, respectively. We assume that given their education types, individuals are matched randomly with respect to ε values. Hence, among $M_j(x,z)$ couples, a fraction $\Xi_z(\varepsilon_z)\Xi_x(\varepsilon_x)$ is formed by $(\varepsilon_x, \varepsilon_z)$-couples.

Then, the following accounting identity must hold

$$\Omega_j(z) = \sum_{x \in X} M_j(x,z) + \omega_j(z). \tag{1}$$

Furthermore, since marital status does not change, i.e. $M_j(x,z) = M(x,z)$ and $\omega_j(z) = \omega(z)$ for all j, we have $\Omega_j(z) = \Omega(z)$. Similarly, for age-j females, we have

$$\Phi_j(x) = \sum_{z \in Z} M_j(x,z) + \phi_j(x). \tag{2}$$

Again since marital status does not change $\phi_j(x) = \phi(x)$ and $\Phi_j(x) = \Phi(x)$ for all j

Let $\mathbf{s}^M \equiv (x, z, \varepsilon_x, \varepsilon_z, q, b, g)$ be the vector of exogenous states for married households. Similarly, let $\mathbf{s}_f^S \equiv (x, \varepsilon_x, b, g)$ and $\mathbf{s}_m^S \equiv (z, \varepsilon_z)$ be the vector of exogenous variables for single females and single males, respectively. In equilibrium, factor markets clear. The aggregate state of this economy consists of distribution of households over their types, asset and human capital levels. Let the function $\psi_j^M(a, h, \mathbf{s}^M)$ denote the number of married individuals of age j with assets a, female human capital level h, and exogenous states $\mathbf{s}^M$. The function $\psi_{f,j}^S(a, h, \mathbf{s}_f^S)$, for single females, and the function $\psi_{m,j}^S(a, \mathbf{s}_m^S)$, for single males, are defined similarly. Note that household assets, a, and female human capital levels, h, are continuous decisions. Let $a \in A = [0, \overline{a}]$ and $H = [0, \overline{h}]$ be the sets of possible assets and female human capital levels.

By construction, $M(x, z)$, the number of married households of type (x, z), must satisfy for all j

$$M(x, z) = \sum_{\varepsilon_x, \varepsilon_z, q, b, g} \int_{A \times H} \psi_j^M(a, h, \mathbf{s}^M) dh da.$$

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

$$\phi(x) = \sum_{\varepsilon_x, b, g} \int_{A \times H} \psi_{f,j}^S(a, h, \mathbf{s}_f^S) dh da,$$

and

$$\omega(z) = \sum_{\varepsilon_z} \int_A \psi_{m,j}^S(a, \mathbf{s}_m^S) da.$$

For married couples, let $\lambda_{b,g}^M(x, z)$ be the fraction of type-(x, z) couples who have child-bearing type b (where $b \in \{0, 1, 2\}$ denotes no children, early childbearing and late child-bearing, respectively) and informal care type g (where $g \in \{0, 1\}$ indicates whether or not the household has access to informal care), with $\sum_{b,g} \lambda_{b,g}^M(x, z) = 1$. Similarly, let $\lambda_{b,g}^S(x)$ be the fraction of type-x single females who have childbearing type b and informal care type g, with $\sum_{b,g} \lambda_{b,g}^S(x) = 1$.

Let the decision rules associated with the dynamic programming problems outlined in Section 3.2 of the paper be denoted by $a_m^S(a, \mathbf{s}_m^S, j)$ and $l_m^S(a, \mathbf{s}_m^S, j)$ for single males, by $a_f^S(a, h, \mathbf{s}_f^S, j)$ and $l_f^S(a, h, \mathbf{s}_f^S, j)$ for single females, and by $a^M(a, h, \mathbf{s}^M, j)$, $l_f^M(a, h, \mathbf{s}^M, j)$ and $l_m^M(a, h, \mathbf{s}^M, j)$ for married couples.

Finally, let the functions $\mathfrak{h}^S(a, h, \mathbf{s}_f^S, j)$ and $\mathfrak{h}^M(a, h, \mathbf{s}^M, j)$ describe the age-j level of human capital for a single and married female, respectively. For $j > 1$, they are defined as

$$\mathfrak{h}^M(a, h, \mathbf{s}^M, j) = \mathcal{H}(x, h, l_f^M(a, h, \mathbf{s}^M, j-1), j-1),$$

and

$$\mathfrak{h}^S(a, h, \mathbf{s}_f^S, j) = \mathcal{H}(x, h, l_f^S(a, h, \mathbf{s}_f^S, j-1), j-1),$$

where $\mathcal{H}$ is the human capital accumulation function.

Let $\chi\{.\}$ denote the indicator function.

In equilibrium, the distribution functions $\psi_j^M(a,h,\mathbf{s}^M)$, $\psi_{f,j}^S(a,h,\mathbf{s}_f^S)$, and $\psi_{m,j}^S(a,\mathbf{s}_m^S)$ must obey the following recursions:

Married agents

$$\psi_j^M(a',h',\mathbf{s}^M) = \int_{A\times H} \psi_{j-1}^M(a,h,\mathbf{s}^M)\chi\{a^M(a,h,\mathbf{s}^M,\ j-1)=a',\ \mathfrak{h}^M(a,h,\mathbf{s}^M,j-1)=h'\}dhda, \tag{3}$$

for $j>1$, and

$$\psi_1^M(a,h,\mathbf{s}^M) = \begin{cases} M(x,z)\lambda_{b,g}^M(x,z)\zeta(q|z)\Xi(\varepsilon_x)\Xi(\varepsilon_z) \text{ if } a=0,\ h=\eta(x), \\ 0,\ \text{otherwise} \end{cases},$$

where $\eta(x)$ is a function that maps female types their initial human capital, $\zeta(q|z)$ is the fraction of households that draw q (given z) and $\Xi(.)$ is the distribution function for within-education-group productivity shocks.

Single female agents

$$\psi_{f,j}^S(a',h',\mathbf{s}_f^S) = \int_{A\times H} \psi_{f,j-1}^S(a,h,\mathbf{s}_f^S)\chi\{a_f^S(a,h,\mathbf{s}_f^S,\ j-1)=a',\ \mathfrak{h}^S(a,h,\mathbf{s}_f^S,j-1)=h'\}dhda, \tag{4}$$

for $j>1$, and

$$\psi_{f,1}^S(a,h,\mathbf{s}_f^S) = \begin{cases} \phi(x)\lambda_{b,g}^S(x)\Xi(\varepsilon_x) \text{ if } a=0,\ h=\eta(x) \\ 0,\ \text{otherwise} \end{cases}.$$

Single male agents

$$\psi_{m,j}^S(a',\mathbf{s}_m^S) = \int_A \psi_{m,j-1}^S(a,\mathbf{s}_m^S)\chi\{a_m^S(a,\mathbf{s}_m^S,\ j-1)=a'\}da, \tag{5}$$

for $j>1$, and

$$\psi_{m,1}^S(a,z) = \begin{cases} \omega(z)\Xi(\varepsilon_z) \text{ if } a=0 \\ 0,\ \text{otherwise} \end{cases}.$$

Given distribution functions $\psi_j^M(a,h,\mathbf{s}^M)$, $\psi_{f,j}^S(a,h,\mathbf{s}_f^S)$, and $\psi_{m,j}^S(a,\mathbf{s}_m^S)$, aggregate capital ($K$) and aggregate labor ($L$) are given by

$$\begin{aligned} K &= \sum_j \mu_j[\sum_{\mathbf{s}^M}\int_{A\times H} a\psi_j^M(a,h,\mathbf{s}^M)dhda + \sum_{\mathbf{s}_m^S}\int_A a\psi_{m,j}^S(a,\mathbf{s}_m^S)da \\ &+ \sum_{\mathbf{s}_f^S}\int_{A\times H} a\psi_{f,j}^S(a,h,\mathbf{s}_f^S)dhda], \end{aligned} \tag{6}$$

and

$$
\begin{aligned}
L &= \sum_j \mu_j [\sum_{\mathbf{s}^M} \int_{A\times H} (h\varepsilon_x l_f^M(a,h,\mathbf{s}^M,j) \\
&\quad +\varpi_m(z,j)\varepsilon_z l_m^M(a,h,\mathbf{s}^M,j))\psi_j^M(a,h,\mathbf{s}^M) dhda \\
&+ \sum_{\mathbf{s}_m^S} \int_A \varpi_m(z,j)\varepsilon_z l_m^S(a,\mathbf{s}_m^S,j)\psi_{m,j}^S(a,\mathbf{s}_m^S)da \qquad (7) \\
&\quad +\sum_{\mathbf{s}_f^S} \int_{A\times H} h\varepsilon_x l_f^S(a,h,\mathbf{s}_f^S,j)\psi_{f,j}^S(a,\mathbf{s}_f^S)dhda],
\end{aligned}
$$

where μ_j is the fraction of the population of age j at any point in time.

Furthermore, labor used in the production of goods, L_g, equals

$$
\begin{aligned}
L_g &= L - [\sum_{b=1,2} \sum_{j=b,b+2} \sum_{\{\mathbf{s}^M|b\}} \mu_j \int_{A\times H} \chi\{l_f^M\}k(x,z)d(j+1-b,x,z,g) \\
&\quad \psi_j^M(a,h,\mathbf{s}^M)dhda \\
&+ \sum_{b=1,2} \sum_{j=b,b+2} \sum_{\{\mathbf{s}_f^S|b\}} \mu_j \int_{A\times H} \chi\{l_f^S\}k(x)d(j+1-b,x,g)\psi_{f,j}^S(a,h,\mathbf{s}_f^S)dhda],
\end{aligned}
$$

where the term in brackets is the quantity of labor used in childcare services.

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

$$
\begin{aligned}
G + C + TR &= \sum_j \mu_j [\sum_{\mathbf{s}^M} \int_{A\times H} T^M(I,k(x,z))\psi_j^M(a,h,\mathbf{s}^M)\ dh\ da \qquad (8) \\
&+ \sum_{\mathbf{s}_m^S} \int_A T^S(I,0)\psi_{m,j}^S(a,\mathbf{s}_m^S)\ da \\
&+ \sum_{\mathbf{s}_m^S} \int_{A\times H} T^S(I,k(x))\psi_{f,j}^S(a,h,\mathbf{s}_f^S)\ dh\ da] + \tau_k rK,
\end{aligned}
$$

where I represents a household's total income as defined in the description of the individual and household problems in Section 3.2 of the paper. The total government expenditure on child care subsidies is given by

$$\begin{aligned} C &= \theta \sum_{b=1,2} \sum_{j=b,b+2} \sum_{\{\mathbf{s}^M|b\}} \mu_j \int_{A\times H} \chi(I,\widehat{I},l_f^M) k(x,z) w d(j+1-b,x,z,g) \psi_j^M(a,h,\mathbf{s}^M)\ dh\ da \\ &+ \theta \sum_{b=1,2} \sum_{j=b,b+2} \sum_{\{\mathbf{s}_f^S|b\}} \mu_j \int_{A\times H} \chi(I,\widehat{I},l_f^S) w k(x) d(j+1-b,x,g) \psi_{f,j}^S(a,h,\mathbf{s}_f^S)\ dh\ da, \end{aligned}$$

where the indicator function $\chi(I,\widehat{I},l)$ indicates whether a household qualifies for a subsidy. It equals 1 if $I \leq \widehat{I}$ and $l > 0$, and 0 otherwise.

In turn, aggregate transfers are given by

$$\begin{aligned} TR &= \sum_j \mu_j [\sum_{\mathbf{s}^M} \int_{A\times H} TR^M(I,D,k(x,z)) \psi_j^M(a,h,\mathbf{s}^M)\ dh\ da \\ &+ \sum_{\mathbf{s}_m^S} \int_A TR_m^S(I,0,0) \psi_{m,j}^S(a,\mathbf{s}_m^S)\ da \\ &+ \sum_{\mathbf{s}_f^S} \int_{A\times H} TR_f^S(I,D,k(x)) \psi_{f,j}^S(a,h,\mathbf{s}_f^S)\ dh\ da], \end{aligned}$$

where D stands for childcare expenditures, as defined in Section 3.2 of the paper.

Finally, the social security budget must balance

$$\begin{aligned} & \sum_{j\geq J_R} \mu_j [\sum_{\mathbf{s}^M} \int_{A\times H} p^M(x,z) \psi_j^M(a,h,\mathbf{s}^M) dhda + \sum_{\mathbf{s}_f^S} \int_{A\times H} p_f^S(x) \psi_{f,j}^S(a,h,\mathbf{s}_f^S) dhda \\ & + \sum_{\mathbf{s}_m^S} \int_A p_m^S(z) \psi_{m,j}^S(a,\mathbf{s}_m^S)\ da] \qquad (9) \\ = & \ \tau_p w L. \end{aligned}$$

Equilibrium Definition For a given government consumption level G, social security benefits $p^M(x,z)$, $p_f^S(x)$ and $p_m^S(z)$, tax functions $T^S(.)$, $T^M(.)$, a payroll tax rate τ_p, a capital tax rate τ_k, transfer function $TR_f^S(.)$, $TR_m^S(.)$, $TR^M(.)$, and an exogenous demographic structure represented by $\Omega(z)$, $\Phi(x)$, $M(x,z)$, and μ_j, a *stationary equilibrium* consists of prices r and w, aggregate capital (K), aggregate labor (L), labor used in the production of goods (L_g), household decision rules $a_m^S(a,\mathbf{s}_m^S,j)$, $l_m^S(a,\mathbf{s}_m^S,j)$ for single males, $a_f^S(a,h,\mathbf{s}_f^S,j)$ and $l_f^S(a,h,\mathbf{s}_f^S,j)$ for single females, and $a^M(a,h,\mathbf{s}^M,j)$, $l_f^M(a,h,\mathbf{s}^M,j)$ and $l_m^M(a,h,\mathbf{s}^M,j)$ for married households, and distribution functions $\psi_j^M(a,h,\mathbf{s}^M)$, $\psi_{f,j}^S(a,h,\mathbf{s}_f^S)$, and $\psi_{m,j}^S(a,\mathbf{s}_m^S)$, such that

1. Given tax and transfer rules, and factor prices, the decision rules of households are optimal.

2. Factor prices are competitively determined; i.e. $w = F_2(K, L_g)$, and $r = F_1(K, L_g) - \delta_k$.
3. Factor markets clear; i.e. equations (6) and (7) hold.
4. The functions ψ_j^M, $\psi_{f,j}^S$, and $\psi_{m,j}^S$ are consistent with individual decisions, i.e. they are defined by equations (3), (4), and (5).
5. The government and social security budgets are balanced; i.e. equations (8) and (9) hold.

2 Parameter Values

In this section of the Online Appendix, we provide details on how we assign parameter values to the endowment, preference, and technology parameters of the benchmark economy. To this end, we use aggregate as well as cross-sectional data from multiple sources. As a first step in this process, we start by defining the length of a period to be 5 years.

Heterogeneity Individuals start their life at age 25 as workers and work for forty years, corresponding to ages 25 to 64. The first model period ($j = 1$) corresponds to ages 25-29, while the first model period of retirement ($j = J_R$) corresponds to ages 65-69. After working 8 periods, individuals retire at age 65 and live until age 80 ($J = 11$). The population grows at the annual rate of 1.1%, the average values for the U.S. economy between 1960-2000.

There are 5 education types of males. Each type corresponds to an educational attainment level: *less than high school* (HS<), *high school* (HS), *some college* (SC), *college* (COL) and *post-college* (COL+) education. We use data from the 2008 CPS March Supplement to calculate age-efficiency profiles for each male type.[1] Within an education group, efficiency levels correspond to mean weekly wage rates, which we construct using annual wage and salary income and weeks worked. We normalize wages by the mean weekly wages for all males and females between ages 25 and 64.[2] Figure A1 shows the second degree polynomials that we fit to the raw wage data. In our quantitative exercises, we calibrate the male efficiency units, $\varpi_m(z, j)$, using these fitted values.

There are also 5 education types for females. Table A1 reports the initial (ages 25-29) efficiency levels for females together with the initial male efficiency levels and the corresponding gender wage gap. We use the initial efficiency levels for females to calibrate their initial

[1] We use 2008 data to capture *pre-crisis* age-efficiency profiles.

[2] We include in the sample the civilian adult population who worked as full time workers last year, and exclude those who are self-employed or unpaid workers or make less than half of the minimum wage. Our sample restrictions are standard in the literature and follow Katz and Murphy (1992).

human capital levels, $h_1 = \varpi_f(x, 1)$. After ages 25-29, the human capital level of females evolves endogenously according to

$$h' = \mathcal{H}(x, h, l, j) = \exp\left[\ln h + \alpha_j^x \chi(l) - \delta_x(1 - \chi(l))\right]. \tag{10}$$

We calibrate the values for δ_x and α_j^x as follows. First, we select α_j^x so that if a female of a particular type works in every period, her wage profile has exactly the same shape as a male of the same type. This procedure takes the initial gender differences as given, and assumes that the wage growth rate for a female who works full time will be the same as for a male worker; hence, it sets α_j^x values equal to the growth rates of male wages at each age. Table A2 shows the calibrated values for α_j^x. We then select two values of δ_x; one for skilled women (those with a college degree) and one for unskilled women (those without a college degree) so that we match the level of gender gap for skilled and unskilled women by age 30-34 as closely as possible. Figure 4 in the paper shows the gender gap in the data and in the model.

We assume that the variables capturing residual heterogeneity within educational types, ε_x and ε_z, take two values: $\varepsilon_z \in E_z = \{\varepsilon, -\varepsilon\}$ and $\varepsilon_x \in E_x = \{\varepsilon, -\varepsilon\}$. Furthermore, we set $\Xi_z(\varepsilon) = \Xi_x(-\varepsilon) = \Xi_z(\varepsilon) = \Xi_x(-\varepsilon) = 0.5$. This leaves us with one parameter (ε) to calibrate. We set this parameter so that, in conjunction with heterogeneity in education types, the model reproduces the variance of log-wages for males in our first age group. Using estimates in Heathcote, Storesletten and Violante (2004), we calculate a value of about 0.227 for this statistic. Matching this value requires $\varepsilon = 0.395$ (39.5%).

Demographics We determine the distribution of individuals by productivity types for each gender, i.e. $\Omega(z)$ and $\Phi(x)$, using data from the 2008 American Community Survey (ACS). For this purpose, we consider all household heads or spouses who are between ages 30 and 39 and for each gender calculate the fraction of population in each education cell. For the same age group, we also construct $M(x, z)$, the distribution of married working couples, as shown in Table A3. Given the fractions of individuals in each education group, $\Phi(x)$ and $\Omega(z)$, and the fractions of married households, $M(x, z)$, in the data, we calculate the implied fractions of single households, $\omega(z)$ and $\phi(x)$, from accounting identities (5) and (6) in the article. The resulting values are reported in Table A4. About 74% of households in the benchmark economy consist of married households, while the rest (about 26%) are single. Since we assume that the distribution of individuals by marital status is independent of age, we use the 30-39 age group for our calibration purposes. This age group captures the marital status of recent cohorts during their prime-working years, while being at the same time representative of older age groups.

Children In the model each single female and each married couple belong to one of three groups: *without* children, *early* child bearer and *late* child bearer. The early child bearers have children at ages 1, 2 and 3, corresponding to ages 25-29, 30-34 and 35-39, while late child bearers have their children at ages 2, 3, and 4, corresponding to ages 30-34, 35-39, 40-44. This particular structure captures the fact that births occur within a short time interval, mainly between ages 25 and 29 for households with low education and between ages 30 and 34 for households with high education in 2008 CPS June supplement.[3]

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

We follow a similar procedure for married couples, combining data from the CPS June Supplement and the ACS. For childlessness, we use the larger sample from the ACS.[4] The Census does not provide data on total number of live births but the total number of children in the household is available. Therefore, as a measure of childlessness we use the fraction of married couples between ages 35-39 who have no children at home.[5] Then, using the CPS June supplement we look at all couples above age 25 in which the female had a total of two live births and was below age 30 at her last birth. This gives us the fraction of couples who are early child bearers, with the remaining married couples labeled as the late ones. Table A6 shows the resulting distributions.

Table A7 shows how lifetime fertility, conditional on having a child, differs by the education for single and married households.[6] The differences in fertility are non trivial. For instance, Table A7 shows that single females with more than college education have about

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

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

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

[6]The table shows children ever born for single and married females of different types. We use the 2008 CPS June Supplement that provides detailed fertility statistics. As a measure of completed fertility, the children ever born by ages 40-44 are reported.

1.6 children on average, while their counterparts with less than high school education have 2.7 children. Equivalent fertility differences are present for married couples, albeit they tend to be smaller in magnitude.

Childcare Costs We use the U.S. Bureau of Census data from the Survey of Income and Program Participation (SIPP) to calibrate childcare costs we use.[7] The total yearly cost for employed mothers, who have children between 0 and 5 and who make childcare payments, was about \$6,414.5 in 2005. This is about 10% of average household income in 2005. The Census estimate of total childcare costs for children between 5 and 14 is about \$4,851, which amounts to about 7.7% of average household income in 2005.

We assume that childcare costs depend on whether a household has access to informal care, as households with access to informal childcare are likely to spend less on childcare. We also assume that the childcare costs depend on the education level of household members, as more educated households spend more on childcare than less educated households in the data, possibly reflecting differences in childcare quality. Table A8 shows the fraction of households who use informal care by marital status and the education level of the mother. Table A9 shows how childcare expenditures differ by education of females in single-female and married-couple households, conditional availability of informal childcare. Given data limitations, we condition married couples' childcare expenditure only on wives' education.[8] Since the use of informal childcare is very limited for older (above age 5) children we do not condition childcare expenditure on the availability of informal childcare for these children. The table shows non-trivial heterogeneity in expenditures. We note that for children under age 5, a single female with more than college education spends almost twice as much as a single female with less than high school education. Similar figures hold for couples in which both members have more than college education.

Recall that $d(s,x,g)$ and $d(s,x,z,g)$ are the efficiency units of labor required for childcare for a single female of type-(x,g), and for a married couple of type-(x,z,g), respectively. Then, the total cost of childcare for a single female and married couple household with age-s children is given by $wk(x)d(s,x,g)$ and $wk(x,z)d(s,x,z,g)$, respectively. We assume that the childcare costs for married couples only depend on her own education. We then calibrate the childcare costs as follows: We treat the cost for a married female with less than high

[7] See Table 6 in http://www.census.gov/population/www/socdemo/child/tables-2006.html

[8] Table A9 reports average weekly childcare expenditures for households between ages 25-44. The data comes from the 2004 SIPP Panel, Wave 4, 4th reference month (January 2005 to April 2005). All the income and demographics were extracted from the core files, while the data related to childcare expenditure comes from the Childcare Topical Module. We restrict the sample to households in which mothers are employed in all months.

school education who has access to informal care and has young (0-5), as a free parameter and set all other childcare costs for households with young children according to left panel of Table A9. We choose this free parameter so that on average households spend about 10% of average household income on young children. Hence, all relative spending levels come from Table A9, and one parameter is adjusted to generate the right level of spending in the aggregate. We then do the same for older children. Recall that households do not use informal care for older children. Therefore, we treat the cost for a married female with less than high school education as a free parameter, and set all other childcare costs for older children according to right panel of Table A9. We choose this parameter so that on average households spend about 7.7% of average household income on old children.

In the benchmark economy, this choice of parameter values results in 1.2% of the total labor input being used to produce childcare services. This is broadly in line with the share of employment in the childcare sector in the U.S., which was about 1.1% in 2012.[9]

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

Childcare Credits All households with positive income can qualify for the Child and Dependent Care Tax Credit (CDCTC), or, as we refer in the paper, for *childcare credits*. We model these credits as closely as possible to the tax code. Potential childcare credits are

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

calculated in two steps, using the total childcare expenditures of the household, a cap, and rates that depend on household income. First, for each household, a childcare expenditure that can be claimed against credits is calculated. This expenditure is simply the minimum of the earnings of each parent in the household, a cap and actual childcare expenditures. The cap is set $3,000 and $6,000 for households with one child and with more than one child in 2004.[10] Second, each household can claim a certain fraction of this qualified expenditure as a tax credit. This fraction starts at 35%, and declines by household income by 1% for each $2,000 above $15,000 until it reaches 20%, and then remains constant at this level.

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

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

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

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

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

In 2004, d_{CDCTC} was $3,000, i.e. maximum qualified expenditure for households with more than 1 child was capped at $6,000. In multiples of mean household income in the U.S. ($60,464 in that year), d_{CDCTC} was equal to 0.0496, i.e. about 5% of mean household income in the US.

A household, however, only receives a fraction $\theta_{CDCTC}(I)$ of qualified expenses. The rate, θ_{CDCTC}, is a declining function of household income. It is set at 35% for households whose income is below $15,000 ($\widehat{I}_{CDCTC}$), and after this point the rate declines by 1% for each extra $2,000 that the household earns down to a minimum of 20%. Hence, the potential $CDCTC$ that a household can receive is then given by

$$CDCTC_{potential}(I) = \text{Expense} \times \theta_{CDCTC}(I), \tag{11}$$

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

with

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

where $\widehat{I}_{CDCTC}$ is equal to 0.248 is in multiples of mean household income in the U.S. in 2004. Figures A2 and A3 show $\theta_{CDCTC}(I)$ and $CDCTC_{potential}(I)$.[11] In Section 6 of the paper, when we expand the childcare credit program, the entire schedule in equation (11) is multiplied by a constant.

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

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

$$CTC_{potential}(I) = \max\{[k \times 0.0165 - \max(I - \widehat{I}_{CTC},\, 0) \times 0.05], 0\}, \tag{12}$$

with

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

where again the maximum amount of credit per child, 0.0165, and income limits, 1.819 and 1.240, are in multiples of mean household income in the U.S. in 2004. Figure A4 shows $CTC_{potential}(I)$ for a household with 2 children. Both the CTC and the CDCTC are *non-refundable*, as a result, how much of the potential credit a household actually gets depends on its total tax liabilities and total tax credits (CTC plus CDCTC).

[11] The simulations for Figure A4 are done under the assumption that at each income level, the husband and the wife earns 60% and 40% of the household income, respectively, and the households spend 10% of their income on childcare.

Let $Credit_{potential}(I) = CTC_{potential}(I) + CDCTC_{potential}(I)$ and $Taxes(I)$ be the total potential tax credits and the tax liabilities of the household. Then,

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

and

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

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

Given CTC_{actual} and CTC_{credit}, the ACTC is calculated as

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

Figure A5 illustrates the sum of $CDCTC_{actual}(I)$, $CTC_{actual}(I)$ and $ACTC$ that a household receives.

In Section 6 of the paper, when we expand the child credit program, we multiply d_{CTC} by a constant. For the expansion of child credits under the Tax Cuts and Jobs Act of 2017, we increase d_{CTC} from $1,000 to $2,000 per child, increase the income thresholds $\widehat{I}_{CTC}$ for married and single female households to $400,000 and $200,000, respectively, and make the program fully refundable.[12]

[12] In terms of mean household income in 2018, the thresholds are now multiples 6.6 and 3.3 of mean

Earned Income Tax Credits (EITC) The Earned Income Tax Credit is a fully refundable tax credit that subsidizes low income working families. The EITC amounts to a fixed fraction of a family's earnings until earnings reach a certain threshold. Then, it stays at a maximum level, and when the earnings reach a second threshold, the credit starts to decline, so that beyond a certain earnings level the household does not receive any credit. The amount of maximum credits, income thresholds, as well as the rate at which the credits declines depend on the tax filing status of the household (married vs. single) as well as on the number of children. To qualify for the EITC, the capital income of a household must also be below a certain threshold, which was $2,650 in 2004.

In 2004, for a married couple with 0 (2 or 3) children, the EITC started at $2 ($10) and increased by 7.6 (39.9) cents for each extra $ in earnings up to a maximum credit of $3,900 ($4,300). Then the credit stays at this level until the household earnings are $7,375 ($15,025). After this level of earnings, the credit starts declining at a rate of 7.6 (21) cents for each extra $ in earnings until it becomes zero for earrings above $12,490 ($35,458). The formulas for a single household with 0 (2 or 3) children are very similar.

We calculate the level of $EITC$ as a function of earnings with the following formula,

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

where CAP (the maximum credit level), $bend_1$ and $bend_2$ (the threshold levels), and $slope_1$ and $slope_2$ (the rate at which credit increase and decline), earnings and EITC (credit amount) are all in fraction of mean household income in 2014:

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

Figure A6 shows the EITC as a function of household income and the tax filing status. As with taxes, we use the nearest integer for the number of children in Table A7 to determine the relevant EITC schedule for a household.

household income for married and single individuals, respectively. While the Tax Cuts and Jobs Act of 2017 does not make the child credits fully refundable, it significantly expands the refundability of it. Only households with less than $2,500 annual income do not qualify to receive the credits that exceed their tax payments.

Income Taxes To construct income tax functions for married and single individuals, we follow Guner et al (2014) and estimate *effective tax rates* as a function of reported income, marital status and the number of children. The underlying data is tax-return, micro-data from Internal Revenue Service for the year 2000 (Statistics of Income Public Use Tax File). For married households, the estimated tax functions correspond to the legal category *married filing jointly.* For singles without children, tax functions correspond to the legal category of *single* households; for singles with children, tax functions correspond to the legal category *head of household.*[13] To estimate the tax functions for a household with a certain number of children, married or not, the sample is further restricted by the number of dependent children for tax purposes.

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

As in Guner et al (2014) we posit

$$t(I) = \eta_1 + \eta_2 \log(I),$$

and the total tax liabilities amount to $t(I) \times I \times mean\ household\ income$.

Estimates for η_1 and η_2 are contained in Table A10 for different tax functions we use in our quantitative analysis. Given the number of children that different types of households have in Table A7, we estimate tax functions for households with zero, two and three children. We then round the number of children from Table A7 to the nearest integer and assign the appropriate tax function to each household.

Figure A7 displays estimated average and marginal tax rates for different multiples of household income for married and single households with two children. Our estimates imply that a married household at around mean income faces an average tax rate of about 9.1% and marginal tax rate of 14.7%. As a comparison, a single household around mean income faces average and marginal tax rates of 8.0% and 11.5%, respectively. At twice the mean

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

income level, the average and marginal rates for a married household amount to 20.3% and 25.3%, respectively, while a single household at the mean income level has an average tax rate of 15% and a marginal tax rate of 18.5%.

Social Security and Capital Taxation We calculate $\tau_p = 0.086$, as the average value of the social security contributions as a fraction of aggregate labor income for 1990-2000 period.[14] Using the 2008 ACS, we calculate total Social Security benefits for all single and married households.[15] Tables A11 and A12 show Social Security benefits, normalized by the level corresponding to single males of the lowest type, $p_m^S(z_1)$. We treat $p_m^S(z_1)$ as a free parameter, and determine all other benefit levels according to Tables A11 and A12. Then, given τ_p, choose $p_m^S(z_1)$ to balance the budget for the social security system. Hence, while the relative values social security benefits come from the data, the absolute level of one, $p_m^S(z_1)$, is adjusted to balance the budget of the system.The implied value of $p_m^S(x_1)$ for the benchmark economy is about 18.1% of the average household income in the economy.

We use τ_k to proxy the U.S. corporate income tax. We estimate this tax rate as the one that reproduces the observed level of tax collections out of corporate income taxes after the major reforms of 1986. Such tax collections averaged about 1.91% of GDP for 1995-2008 period. Using the technology parameters we calibrate in conjunction with our notion of output (business GDP), we obtain $\tau_k = 0.097$.

Means-Tested Transfers We use the 2004 wave of the Survey of Income and Program Participation (SIPP) to approximate a welfare schedule as a function of labor earnings for different household types. The sample of household heads aged 25-54 spans 876,277 observations across 24,392 households. Per household there are between 1 and 48 monthly observations with an average of nearly 36 monthly observations per household. The SIPP is a panel surveying households every three months retrospectively for each of the past three months. We compute the average amount of monthly welfare payments and monthly labor earnings, both corrected for inflation, for each household. The welfare payments include the following main means-tested programs: Supplemental Social Security Income (SSI), Temporary Assistance for Needy Families (TANF formerly AFDC), Supplemental Nutrition Assistance Program (SNAP formerly food stamps), Supplemental Nutrition Program for Women, In-

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

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

fants, and Children (WIC), and Housing Assistance.[16] For a description of these programs, see Scholz, Moffitt and Cowan (2009).

We then estimate an "effective transfer function" (conditional on marital status and the number of children). Again let let I stand for multiples of mean household income in the data. We assume that these functions take the following form

$$TR(I) = \begin{cases} \omega_0 \text{ if } I = 0 \\ \max\{0, \alpha_0 - \alpha_1 I\} \text{ if } I > 0 \end{cases},$$

where ω_0 is the transfers for a household with zero income, α_1 is the benefits reduction rate, $TR(I)$ is the welfare payments as multiples of mean household income in the data.

In order to determine ω_0, we simply calculate the average amount of welfare payments for households with zero non-transfer income. Then we estimate an OLS regression of welfare payments on household non-transfer income to determine α_0 and α_1. In Table A13 shows the estimated values of ω_0, α_1 and α_2, and Figures A8 and A9 show the welfare payments as a function of household income for married and single female households, respectively. In the simulations, we use the estimates for single females for both single female and single male households.

Preferences and Technology There are three utility functions parameters to be determined: the intertemporal elasticity of labor supply (γ), the parameter governing the disutility of market work (φ), and fixed time cost of young children (η). We set γ to 0.4. This value is contained in the range of recent estimates by Domeij and Floden (2006, Table 5). Given γ, we select the parameter φ to reproduce average market hours per worker observed in the data, about 40.1% of available time in 2008.[17] We set η to match the labor force participation of married females with young, 0 to 5 years old, children. From the 2008 ACS, we calculate the labor force participation of females between ages 25 to 39 who have two children and whose oldest child is less than 5 as 62.2%. We select the fixed cost such that the labor force participation of married females with children less than 5 years (i.e. early child bearers between ages 25 and 29 and late child bearers between ages 30 and 34), has the same value. Finally, we choose the discount factor β, so that the steady-state capital to output ratio

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

[17] The numbers are for people between ages 25 and 54 and are based on data from the Census. We find mean yearly hours worked by all males and females by multiplying usual hours worked in a week and number of weeks worked. We assume that each person has an available time of 5,000 hours per year. Our target for hours corresponds to 2005 hours in the year 2003.

matches the value in the data consistent with our choice of the technology parameters (2.93 in annual terms).

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

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

where $\Gamma(.)$ is the Gamma function, which we approximate on a discrete grid.

This procedure allows us to exploit the information contained in the differences in the labor force participation of married females as their own wage rate differ with education (for a given husband type). In this way we control the slope of the distribution of utility costs, which is potentially key in assessing the effects of changing incentives for labor force participation.

Using the Census data, we calculate that the employment-population ratio of married females between ages 25 and 54, for each of the educational categories defined earlier.[18] Table A14 shows the resulting distribution of the labor force participation of married females by the productivities of husbands and wives for married households. The aggregate labor force participation for this group is 72.2%, and it increases from 61.8% for the lowest education group to 81.9% for the highest. Our strategy is then to select the two parameters governing the gamma distribution, for every husband type, so as to reproduce each of the rows (five entries) in Table A14 as closely as possible. This process requires estimating 10 parameters (i.e. a pair (θ, k) for each husband educational category).

Finally, we specify the production function as Cobb-Douglas, and calibrate the capital share and the depreciation rate using a notion of capital that includes fixed private capital, land, inventories and consumer durables. For the period 1960-2000, the resulting capital to output ratio averages 2.93 at the annual level. The capital share equals 0.343 and the (annual) depreciation rate amounts to 0.055.[19]

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

[19] We estimate the capital share and the capital to output ratio following the standard methodology; see Cooley and Prescott (1995). The data for capital and land are from Bureau of Economic Analysis (Fixed Asset Account Tables) and Bureau of Labor Statistics (Multifactor Productivity Program Data).

3 Gender-Wage Gaps

As we have noted in the paper, we report in Figure 4 the gender gap in hourly wages from the model for all married females (independent of whether they participate in the labor market). In order to produce a comparable measure from the data, we impute wages for females who do not participate in the labor market using a standard Heckman selection model. In order to do that, we estimate a standard Mincer regression with a Heckman (1979) selection correction, which provides us with wage estimates for women who do not participate in the labour market. When we report data on wages, we report an average of observed wages (for women who work) and imputed wages (for women who do not work). For the population equation for wages, we assume a standard Mincer equation, i.e. log wages of women depend on years of education, age, and age squared. For the selection equation, we assume that the probability of participation in the labour market for a female depends on her marital status, number of children younger than age 5, and the variables in the population equation. Our selection equation is similar to one used by Mulligan and Rubinstein (2008).

We estimate the parameters using maximum likelihood and use the corrected parameters of the Mincer equation to impute wages for women with missing wages. We use data from the 2008 CPS March Supplement. We restrict the sample to women between ages 25 and 65 and estimate separate population and selection equations for skilled and unskilled women. Unskilled women are those with less than high school education, high school education and some college. Skilled females are those with college education and more than college education.

4 Effects on Poverty

The expansions of child-related transfers also lower the poverty rate among households. For instance, in the benchmark economy, about 1.2% of married-couple households have incomes below one third of mean household income. The fraction of households below this threshold declines to 0.6%, 0.9% and 0.5% under the expansions of childcare subsidies, child credits and childcare credits, respectively. Similarly, while the fraction of single-mother households below one third of mean household income is 18.4% in the benchmark economy, this fraction declines to 18.3%, 17.6% and 18.3% under the expansions of childcare subsidies, child credits and childcare credits, respectively.[20] Hence, the expansion of these programs

[20] In order to calculate the poverty rates for each experiment, we use the level of poverty threshold from the benchmark economy. The one-third mean household income approximately correspond to the poverty threshold in the US for a four-person household with two children, respectively. This

reduce the poverty rate substantially among married households. The reduction for single households is important but of a lower magnitude, as the bulk of these households benefited substantially from transfer programs in the first place. Furthermore, the entry of poorer married females into the labor force has a large impact on total household income of these households, whereas all single females work in the benchmark economy and there is no effect on the extensive margin.

5 Additional Childcare Subsidy Experiments

We present in this section additional results for the expansion of childcare subsidies. We first consider three subsidy rates; 50%, 75% (the benchmark value) and 100% and make them universal. The results are presented in Table A15A. Fully eliminating eligibility constraints has substantial consequences on aggregate variables. Under the benchmark subsidy rate (75%), which we focus in the paper, making the subsidies universal leads to a the long-run increase in participation amounts of about 10.2%. The effects driven by changes in the subsidy rate are also substantial. When subsidies are universal, increasing the subsidy rate from 50% to 100% implies an increase in participation rates of about 7.2% and 12.6%, respectively, relative to the benchmark case. The changes in participation as subsidies increase are large; increasing the subsidy rate from 50% to 100% leads to a change that is about half of the increase that is associated with making the benchmark subsidy of 75% universal.

We also show the results for the case when we relax the eligibility constraints ($\widehat{I}$) but do not make it universal. The results are presented in Table A15B. Under the benchmark subsidy rate (75%), increasing the threshold $\widehat{I}$ from the benchmark value (21% of mean household income) to 50% and 100% of mean household income increases the participation rate of married females by 2.4% and 6.6%, respectively. The effects on aggregate work hours are small at a threshold of about one-half mean household income, but become positive when the threshold equals mean household income. Overall, a central message of these exercises is that changes in eligibility under the benchmark subsidy rate are substantial; more than half of the changes in the participation rates of married females under universal subsidies are realized with at an eligibility rate of mean household income.

threshold was about $22,000 in 2008 (see https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html)

6 Cross-Country Evidence on Participation Rates and Hours Worked

Our model predicts that upon expansion (universalization) of childcare subsidies, the participation rate of married females increases and hours worked (conditional on working) decline. Cross-country evidence is consistent with these predictions of the model economy. Figure A10 summarizes this evidence, showing the relation between public spending on childcare and the two measures of labor supply of married females aforementioned. We measure public spending on childcare as the total public spending on childcare as a percentage of GDP (calculated as the sum of public spending on childcare plus pre-primary education).[21] The data for married female labor force participation and hours are taken from Bick and Fuchs-Schundeln (2016), who provided us with the data used in Figure 3 in their paper. Participation is positively related to spending (correlation: 0.7) and hours worked are negatively related (correlation: -0.3).

7 Making Existing Credits Fully Refundable

In this section, we present the results of making child tax credits and childcare tax credits fully refundable. Full refundability of credits implies that, relatively to the benchmark case, poorer households (those whose tax liabilities are below the levels of credits in the benchmark economy) have now access to a partial refund of childcare expenses via the childcare credit while others receive credits via the child credit. Thus, there are two forces in operation. As Table A15 shows, on the one hand, the full refundability of childcare credits leads to expansions in participation and labor supply, whereas the income effects of child credits have the opposite effects. The effects, however, are small – in particular the one associated with making the childcare credit fully refundable. The results in Table A16 also demonstrate that when we make both programs fully refundable, the negative income effects stemming from the child credit dominate, leading to relatively small reductions in participation rates. Since the changes in participation and hours are small – in particular at the top of the skill distribution – and the required tax rates are small, the concomitant effects on output are also small.

[21] Table PF3.1 (Public spending on childcare and early education) available in OECD Family Database, http://www.oecd.org/els/family/database.htm. We use the sum of spending on childcare plus pre-primary education in order to maximize the number of countries in the sample.

8 Robustness

In this section of the Online Appendix, we provide further details on the effects of different model features on our main results that were presented in Section 6 of the paper.

The Role of Endogenous Skills Table A17 shows the results of our main experiments – expansions of child care subsidies, child credits and childcare credits, – when we shut down the endogenous skill channel. In each experiment, we assume that married female of a given type has exogenously the *same* skill profile that she had in the benchmark economy. Hence, her skills do not change if she chooses to change her participation decision in response to the policy change.

As Table A17 demonstrates, without the endogenous changes in skills, the labor supply by married females increases much less than it does in the baseline experiments of universal childcare subsidies and the childcare credit expansion. Similarly, the labor supply of married females decreases more under the expansion of child credits.

The Role of the Reallocation of Hours Worked Within Couples As we have mentioned in the paper, the expansion of childcare subsidies or the childcare credits generates a reallocation of hours worked in married couples, from males to females. This reallocation is arguably important: males are on average more skilled than females and in our baseline experiments, and as we document in Table 4 per-worker hours of males drop by about 1.5% under universal subsidies at a 75% rate, and by 1.7% under the revenue-equivalent expansion of the childcare credits program.

In order to quantify the importance of these reallocations, we compute stationary equilibria when we expand childcare subsidies, child credits and childcare credits while keeping the labor supply decisions of married males at their benchmark values. Table A18 shows the results. The total hours worked by married females increase less with more generous childcare subsidies than in our baseline experiments, although the increase is very comparable with our benchmark results. With universal subsidies, the increase in total hours is of about 8.0%, versus an increase of about 8.6% in the baseline experiment. The expansion of childcare credits also gives quite similar results; 8.4% versus 8.6%.

When the labor supply of males is fixed, and that males are on average more skilled than females, total output increases more with the expansion of subsidies or childcare credits. With universal subsidies, the increase in output amounts to about 1.8% – it is 0.5% in the baseline experiments. Output increases by 1.8% with the expansion of childcare credits, while it increases by 0.7% in our benchmark experiments. On the other hand, by the same logic, the negative effects of child credits on output are now more muted. The expansion of child credits now reduces aggregate output by only 0.2%, while the reduction was 1.7% in the benchmark economy when we allow males to adjust their labor supply.

We conclude that the reallocation of hours within married couples in response to the expansion of child-related is not a mechanism of first-order importance underlying our findings on the labor force participation of married females, and their labor supply in general. Nonetheless, given the importance of male skills in determining the size of the aggregate labor input, the ability of households to substitute work hours from men to women in response to the expansion of child-related transfers is quantitatively important for the output effects.

Expanding Child-Related Transfers in a Closed Economy The benchmark experiments in Section 6 of the paper are done under the assumption of a small-open economy, where the rate of return on capital, and thus the wage rate, are unchanged across steady states. In this section we study the importance of this assumption by replicating our experiments under a closed economy assumption, where the factor prices adjust to changes in factor supplied. The results are documented in Table A19. As the table shows, the differences with the benchmark experiments are very small, and not important at all. The key reason for these findings is that policies that lead to changes in the size of the labor input – accompanied by small changes in distortionary taxes to finance them – lead to essentially no changes in capital to output ratios and therefore, factor prices. Since factor prices are constant by assumption in the small open-economy case, this (benchmark) case is an excellent approximation to the aggregate effects of transfers to households with children.

Imperfect Substitutability of Skills In our benchmark model, all efficiency units are perfect substitutes in production. We now investigate the extent to which our results depend on this assumption. For this purposes, we extend the model to account for imperfect substitution between labor types in the production of consumption and investment goods. We consider a version of the model with two 'types' of labor; *skilled* labor and *unskilled* labor. Production of childcare services requires only unskilled labor.

We empirically identify the skilled group with college and more than college labor. The unskilled group is the rest: less than college, high school and less than high school. Consumption and investment goods are produced according to

$$Y = F(K, S, U) = K^{\alpha} L_g^{1-\alpha}$$

with

$$L_g \equiv (\nu S^\rho + (1-\nu)U^\rho)^{\frac{1}{\rho}}, \quad \rho \in (-\infty, 1)$$

The elasticity of substitution between labor of different types is constant and given by

$$\sigma = \frac{1}{1-\rho}$$

Notice that when $\rho \to 0$, L becomes a Cobb-Douglas aggregator. If $\rho \to 1$, then efficiency units are perfect substitutes, which is the case we address in the paper. The assumption on the production technology implies that there are two rental prices for labor, w^S and w^U. As childcare services are produced with unskilled labor, the price one unit of childcare services is the wage rate of unskilled labor.

Note that the model has to be calibrated again. To select ρ, we use standard estimates of the elasticity of substitution that suggest a value of 1.5 – see Katz and Murphy (1992) and Heckman, Lochner and Taber (1998). This dictates $\rho = 1/3$. To calibrate the share parameter ν, we force the model to reproduce the *skill premium* in the data, defined as per-worker earnings of workers in the skilled category to per-worker earnings of workers in the unskilled category. For this statistic, we target a value of 1.8. The calibrated value of ν is 0.4816.[22]

Table A18 shows the main results from the experiments under imperfect substitutability of skills. As the table shows, the changes are the same in direction, and similar in terms of magnitudes with respect to the benchmark case. For instance, under the expansion of childcare subsidies, the participation rate of married females goes up by 10.2% in the benchmark case. When skills are imperfect substitutes, the corresponding increase is 10.0%.

Table A20 also shows the effects on the implied skill premium. As the table shows, the effects are of second order, reflecting the countervailing changes taking place in terms of the relative sizes of skilled and unskilled labor. At most, in the case of childcare credits expansion, the skill premium increases by 0.9%. Overall, we conclude from these findings that our benchmark results are robust to an extension of our model with imperfectly substitutability of labor types in production.

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

9 Findings on Participation Rates by Childbearing Status and Education

In this section, we provide further results for changes in participation rates of married females. Table A21 shows results according to education, as well as for education and childbearing status. Even conditional on education, the effects on participation are larger for early childbearers. Early childbearers have a longer working life after their childbearing years and hence more to benefit from increasing their participation.

10 Welfare -New Born Married Households

Table A22 shows disaggregated effects for newborn married households. Universal subsidies lead to modest gains for poorer households of the same educational type (e.g. $<$ HS and $<$ HS). As the female type increases, welfare gains increase as well. As the skills of both spouses increase, gains first increase, and then decline and become eventually negative. A married household in which both spouses have some college education gains about 1.91%, whereas those households in which both spouses have more than college education lose by about 0.12%. Hence, the benefits of universal childcare subsidies at the top are more than compensated by higher taxes needed to finance the program. In contrast, Table A22 shows that the welfare gains are concentrated at the bottom of the skill distribution for the child credit and the childcare credit expansions, and are rather large. A household in which both members have less than high school education gains about 10.5% and 5.4% under the child credit and the childcare expansions, respectively. Gains decline sharply as the education of both members increase, and become significantly negative at the top of the skill distribution. This reflects the nature of these programs, which by design, reduce their generosity as household income increases.

11 Redistribution and Welfare

In this section of the Online Appendix, we describe an alternative way to calculate welfare effects associated to policy changes. This alternative way, which we refer as the *weighted welfare* calculations in the paper, aims at capturing efficiency consequences of policy changes by removing distributive effects of policy, and it applies only to newborn individuals. The methodology follows Domeij and Klein (2003).

To simplify our exposition, consider a life-cycle economy, similar to the one described in the paper. Let $V(a, \mathbf{s}, j; \mathbf{P})$ be the value of lifetime utility at age j of an agent with assets a and exogenous state $\mathbf{s}$, under policy $\mathbf{P}$. The corresponding value of lifetime utility of a newborn agent is then $V(0, \mathbf{s}, 1; \mathbf{P})$. We focus on the calculation of the welfare effects on newborns associated to a policy change from $\mathbf{P}$ to $\mathbf{P}'$.

The alternative notion of welfare that we entertain controls for distributive effects via the shadow value of a dollar (or asset) transferred to a newborn. We denote this shadow value by $\Delta(\mathbf{s}; \mathbf{P})$. This is formally defined as

$$\Delta(\mathbf{s}; \mathbf{P}) \equiv \frac{V(\epsilon, \mathbf{s}, 1; \mathbf{P}) - V(0, \mathbf{s}, 1; \mathbf{P})}{\epsilon}$$

for a small $\epsilon > 0$, all $\mathbf{s}$.

We then weigh discounted utility by the *reciprocal* of this shadow value. Hence, if resources are transferred to a poor agent, for whom the shadow value of an additional dollar is high, his change in welfare has a small weight in the overall notion of welfare. As a result, the weighted welfare of newborns under policy $\mathbf{P}$ is given by

$$W(\mathbf{P}) = \int \frac{V(0, \mathbf{s}, 1; \mathbf{P})}{\Delta(\mathbf{s}; \mathbf{P})} \, dF(\mathbf{s}),$$

where $F(\mathbf{s})$ is an initial distribution of exogenous states, while the weighted welfare of newborns under policy $\mathbf{P}'$ is given by

$$W(\mathbf{P}') = \int \frac{V(0, \mathbf{s}, 1; \mathbf{P}')}{\Delta(\mathbf{s}; \mathbf{P})} \, dF(\mathbf{s}).$$

We then look for the usual consumption compensation that makes an agent indifferent between being born under policy $\mathbf{P}$ versus policy $\mathbf{P}'$.

12 Subsidies and Transfers by Household Income

What is the extent of redistribution embedded in the expansion of child-related transfers? Why does the expansion of childcare credits dominate the rest in terms of the welfare of newborns? In Table A23, we provide a quantification of the size of childcare subsidies and transfers at different deciles of the income distribution in each major expansion. For the case of childcare subsidies, subsidies are at 75% rate at all levels and transfers are zero. For the case of the child credit expansion, childcare subsidies are zero, but transfers are large and decline with household income. The transfers are reported as a fraction of the mean household income in each decile. Hence, under the expansion of child credits, households in the lowest income decile receive on average 6.5% of the mean income in the decile.

For the mixed case of the childcare credit expansion, subsidies are 100% for low income levels and subsequently decline to values below, but close, to the universal subsidy rate (75%). Transfers in this case, or credits in excess of childcare expenditures, emerge for low income levels and then decline and vanish as income increases. These properties are key for why the expansion of childcare credits delivers the largest welfare gains, as it combines different pieces analyzed in section 6 of the paper. The upshot is that it yields benefits for all households with children whose members participate in the labor market. But the extent of redistribution is more substantial than under universal subsidies. These benefits are concentrated at the bottom of the income distribution, and non-trivially exceed childcare expenses for low income levels, as Table 6 demonstrates.

References

[1] Bick, Alexander and Nicola Fuchs-Schundeln. "Taxation and Labor Supply of Married Couples across Countries: A Macroeconomic Analysis." Working Paper, 2016.

[2] Domeij, David and M. Floden, "The Labor-Supply Elasticity and Borrowing Constraints: Why Estimates are Biased", *Review of Economic Dynamics*, vol. 9, no. 2 (April 2006), 242-262.

[3] Domeij, D. and P. Klein, "Should day care be subsidized?," *Review of Economic Studies,* vol. 80, no 2 (April 2013), pages 568-595.

[4] Guner, Nezih, Kaygusuz, Remzi and Gustavo Ventura, "Income Taxation of U.S. Households: Basic Facts," *Review of Economic Dynamics*, vol. 17, no. 4 (October 2014), 559-581.

[5] Heathcote, J., K. Storesletten, and G. L. Violante, "The Cross-Sectional Implications of Rising Wage Inequality in the United States," CEPR Discussion Paper 4296, 2004.

[6] Heckman, James J. "Sample Selection Bias as a Specification Error," *Econometrica* vol. 47, no. 1 (January 1979), 153-161.

[7] Heckman, James, Lance Lochner and Christopher Taber. "Explaining Rising Wage Inequality: Explorations With A Dynamic General Equilibrium Model Of Labor Earnings With Heterogeneous Agents," *Review of Economic Dynamics*, 1998, vol. 1, no. 1 (January 1998), 1-58.

[8] Katz, Lawrence and Kevin Murphy, "Changes in Relative Wages, 1963-1987: Supply and Demand Factors," *The Quarterly Journal of Economics*, vol. 107, no. 1 (February 1992), 35-78.

[9] Mulligan, Casey B. and Yona Rubinstein. "Selection, Investment, and Women's Relative Wages over Time" *Quarterly Journal of Economics* vol. 123, no. 3 (August 2008), 1061-1110.

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

Table A1: Initial Productivity Levels, by Type and Gender

	males (z)	females (x)	x/z
< HS	0.511	0.416	0.813
HS	0.668	0.542	0.811
SC	0.728	0.639	0.878
COL	1.039	0.809	0.779
COL+	1.287	1.065	0.828

Note: Entries are the productivity levels of males and females, ages 25-29, using 2008 data from the CPS March Supplement. These levels are constructed as weekly wages for each type –see text for details.

Table A2: Labor Market Productivity Process for Females (α_J^x)

	Types				
Age	<HS	HS	SC	COL	COL+
25-29	0.038	0.114	0.194	0.213	0.254
30-34	0.041	0.086	0.125	0.140	0.157
35-39	0.042	0.063	0.077	0.091	0.095
40-44	0.044	0.044	0.038	0.053	0.048
45-49	0.045	0.027	0.003	0.020	0.007
50-54	0.046	0.012	-0.031	-0.010	-0.033
55-60	0.047	-0.003	-0.069	-0.042	-0.078

Note: Entries are the parameters α_J^x for the process governing labor efficiency units of females over the life cycle – see equation(7) in the text. These parameters are the growth rates of male wages.

Table A3: Distribution of Married Working Households by Type

Males	Females <HS	HS	SC	COL	COL+
< HS	5.77	2.35	2.65	.047	0.12
HS	0.19	7.21	7.80	2.31	0.70
SC	1.49	5.34	16.85	6.82	2.38
COL	0.29	1.27	5.41	11.18	4.83
COL+	0.06	0.36	1.54	5.01	5.87

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

Table A4: Fraction of Agents by Type, Gender and Marital Status

	Males			Females		
	All	Married	Singles	All	Married	Singles
< HS	11.72	8.41	3.31	9.77	7.03	2.74
HS	20.30	14.75	5.54	16.98	12.21	4.77
SC	33.37	24.29	9.08	35.48	25.31	10.17
COL	22.51	17.10	5.41	24.17	19.06	5.11
COL+	12.12	9.49	2.63	13.6	10.27	3.33

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

Table A5: Childbearing Status, Single Females

	Childless	Early	Late
< HS	27.72	62.04	10.24
HS	26.68	59.95	13.37
SC	32.39	53.38	14.23
COL	53.75	30.50	15.75
COL+	56.17	23.06	20.77

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

Table A6: Childbearing Status, Married Couples

	Childless						Early				
	Females						Females				
Male	<HS	HS	SC	COL	COL+	male	<HS	HS	SC	COL	COL+
< HS	6.76	8.23	8.60	13.37	15.51	< HS	74.92	67.55	62.64	46.31	18.61
HS	9.04	10.60	8.76	14.76	12.66	HS	70.03	63.33	60.10	43.39	40.98
SC	6.82	10.52	9.53	12.66	13.08	SC	72.49	58.36	60.93	41.10	32.37
COL	3.52	9.36	10.35	11.57	11.24	COL	43.39	56.99	43.17	32.55	21.36
COL+	5.90	10.57	9.55	9.45	13.28	COL+	46.42	52.85	36.36	30.57	15.52

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

Table A7: Fertility Differences

Singles			Married				
			Females				
		Male	<HS	HS	SC	COL	COL+
< HS	2.72	< HS	2.74	2.52	2.27	1.97	2.08
HS	2.19	HS	2.73	2.27	2.15	2.10	1.97
SC	2.00	SC	2.68	2.27	2.23	2.07	1.89
COL	1.84	COL	3.01	2.34	2.27	1.97	1.87
COL+	1.65	COL+	2.22	2.26	2.43	2.18	1.90

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

Table A8: Fraction of Households Using Informal Care

	Young Children			Older Children	
	Single	Married		Single	Married
< HS	0.216	0.464	< HS	0.107	0.116
HS	0.133	0.309	HS	0.067	0.035
SC	0.271	0.301	SC	0.088	0.059
COL	0.232	0.183	COL	0.100	0.049
COL+	0.076	0.161	COL+	0.019	0.032

Note: Entries show the fraction of households with young and old children, by the marital status of the household, with access to informal childcare. These are authors' calculations from Bureau of Census data and the Survey of Income and Program Participation (SIPP). See text for details.

Table A9: Child Care Cost Differences by Education

	Young Children					Older Children	
	Informal		Formal			Single	Married
	Single	Married	Single	Married			
< HS	0.847	1	0.799	1.642	< HS	1.135	1
HS	0.924	1.011	1.226	1.398	HS	1.192	1.229
SC	1.019	0.935	1.736	1.682	SC	1.542	1.306
COL	1.502	1.272	2.094	2.157	COL	1.915	1.598
COL+	1.496	1.727	2.349	2.653	COL+	2.151	2.170

Note: Entries show child care costs for young (0-4 years old) and older (5-14 years old) children, relative to a single female household with less than high school education, for different households. The authors' calculations from SIPP. See text for details.

Table A10: Tax Functions

Estimates	Married			Single		
	(no child)	(2 child.)	(3 child.)	(no child)	(2 child.)	(3 child.)
η_1	0.096	0.090	0.081	0.120	0.079	0.069
η_2	0.053	0.056	0.056	0.035	0.035	0.032

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

Table A11: Social Security Benefits, Singles

	Males	Females
< HS	1	0.858
HS	1.126	0.999
SC	1.184	1.050
COL	1.274	1.063
COL+	1.282	1.122

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

Table A12: Social Security Benefits, Married Couples

	Females				
Males	<HS	HS	SC	COL	COL+
< HS	1.708	1.873	1.904	1.890	1.911
HS	1.870	1.989	2.042	2.065	2.095
SC	1.887	2.018	2.040	2.101	2.249
COL	1.912	2.140	2.196	2.224	2.321
COL+	2.091	2.149	2.234	2.300	2.365

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

Table A13: Welfare System

Estimates	Married			Single		
	(no child)	(2 child.)	(3 child.)	(no child)	(2 child.)	(3 child.)
ω_0	0.063	0.090	0.143	0.090	0.116	0.152
α_1	0.023	0.043	0.065	0.044	0.101	0.125
α_2	-0.017	-0.033	-0.053	-0.042	-0.091	-0.118

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

Table A14: Labor Force Participation of Married Females, 25-54

	Females				
Males	<HS	HS	SC	COL	COL+
< HS	44.0	64.8	71.3	76.9	79.2
HS	49.4	70.8	77.2	85.1	90.6
SC	51.7	69.9	75.8	83.5	90.4
COL	47.1	64.0	68.6	73.0	82.9
COL+	42.8	55.4	60.6	62.7	76.7
Total	46.4	68.8	73.9	74.9	81.9

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

Table A15A: Expansion of Childcare Subsidies (%, Relative to Benchmark)

	Universal Subsidies (50%)	Universal Subsidies (75%)	Universal Subsidies (100%)
Participation Married Females	7.2	10.2	12.6
Total Hours	1.4	1.8	2.0
Total Hours (Married Females)	6.3	8.6	10.2
Hours per worker (females)	-0.5	-1.1	-1.8
Hours per worker (males)	-1.0	-1.5	-1.7
Output	0.5	0.5	0.6
Tax Rate	0.8	1.2	1.6
Effects on Participation:			
By Education			
< HS	15.4	25.4	33.7
HS	9.3	13.3	16.9
SC	6.6	9.1	11.2
COL	7.1	9.4	10.7
COL+	4.0	5.2	5.9
By Child Bearing Status			
Early	10.5	14.9	18.5
Late	5.9	8.2	9.7

Note: Entries in the top panel show effects (percentage changes) across steady states on selected variables driven by the universalization of subsidies at different rates. The values for "Tax Rate" correspond the values that are necessary to achieve revenue neutrality. The bottom panel shows the effects on the participation rates of married females of different schooling levels. See text for details.

Table A15B: Additional Childcare Subsidy Experiments (%, Relative to Benchmark)

	$\widehat{I}$= 1/2 mean income			$\widehat{I}$=mean income		
	50%	75%	100%	50%	75%	100%
Participation Married Females	2.0	3.1	4.2	5.4	8.1	9.9
Total Hours	0.3	0.2	0.2	1.0	1.3	1.3
Total Hours (Married Females)	1.7	2.4	3.1	4.6	6.6	7.7
Hours per Worker (females)	0.0	-0.8	-1.3	-0.3	-1.1	-1.8
Hours per Worker (males)	-0.5	-1.0	-1.2	-1.0	-1.2	-1.7
Output	0.3	-0.6	-0.9	-0.3	-0.1	-0.8
Tax Rate (%)	0.3	0.5	0.7	0.6	0.8	1.3
Effects on Participation:						
By Education						
< HS	8.9	15.4	21.1	14.9	24.7	32.8
HS	4.2	6.1	7.8	8.8	12.4	15.4
SC	1.8	2.6	3.5	5.4	8.2	9.8
COL	0.7	1.2	1.8	3.8	5.3	6.1
COL+	0.0	-0.2	-0.1	1.0	1.6	2.2
By Child Bearing Status						
Early	3.8	5.7	7.6	8.9	13.2	16.4
Late	0.7	1.4	1.9	3.2	4.9	5.9

Note: Entries in the top panel show effects (percentage changes) across steady states on selected variables driven by different childcare subsidy rates at different levels of eligibility. The values for "Tax Rate" correspond the values that are necessary to achieve revenue neutrality. The bottom panel shows the effects on the participation rates of married females of different schooling levels. See text for details.

Table A16: Making Tax Credits Fully Refundable (%, Relative to Benchmark)

	Child Credit	Childcare Credit	Both
Participation Married Females	-1.2	0.4	-1.1
Total Hours	-0.6	0.0	-0.6
Total Hours (Married Females)	-1.4	0.3	-1.3
Hours per worker (females)	-0.5	0.0	-0.5
Hours per worker (males)	-0.2	-0.2	-0.2
Output	-0.6	-0.3	-0.7
Tax Rate (%)	0.3	0.15	0.3
Effects on Participation:			
By Education			
< HS	-3.3	3.9	-3.0
HS	-2.7	1.1	-2.1
SC	–1.3	0.0	-1.3
COL	-0.3	0.0	-0.3
COL+	–0.1	0.0	-0.1
By Child Bearing Status			
Early	-2.2	0.8	-1.9
Late	-0.5	0.1	-0.5

Note: Entries in the top panel show effects (percentage changes) across steady states on selected variables driven making child credits and childcare credits fully refundable. The values for "Tax Rate" correspond to the values that are necessary to achieve revenue neutrality. The bottom panel shows the effects on the participation rates of married females of different schooling levels. See text for details.

Table A17: Policy Experiments:
Role of Endogenous Skill Accumulation (%, Relative to Benchmark)

	Universal Subsidies (75%)	Child Credit Expansion	Childcare Credit Expansion
Participation Married Females	6.1	-2.2	6.9
Total Hours	0.6	-1.6	0.2
Total Hours (MF)	3.8	-2.7	3.8
Hours per worker (f)	-2.1	-1.3	-3.2
Output	-2.8	-3.4	-2.9
Tax Rate (%)	1.2	1.2	1.2
Effects on Participation:			
By Education			
< HS	18.8	-7.3	24.5
HS	9.2	-3.5	11.3
SC	5.7	-2.3	6.3
COL	4.3	-1.1	4.1
COL+	2.0	-0.6	1.3
By Child Bearing Status			
Early	9.3	-3.2	10.9
Late	4.5	-1.7	4.7

Note: Entries show effects across steady states on selected variables driven by the expansion of child-related transfers, when female skills are fixed at their benchmark values. The values for "Tax Rate" correspond the values that are necessary to achieve revenue neutrality. See text for details.

Table A18: Policy Experiments Under
Fixed Labor Supply of Males (%, Relative to Benchmark)

	Universal Subsidies (75%)	Child Credit Expansion	Childcare Credit Expansion
Participation Married Females	9.8	-0.9	11.0
Total Hours	2.1	-0.9	2.0
Total Hours (MF)	8.0	-1.4	8.4
Hours per worker (f)	-1.1	-0.8	-2.4
Output	1.8	-0.2	1.8
Tax Rate (%)	0.9	0.9	0.9
Effects on Participation:			
By Education			
< HS	24.2	-3.2	32.0
HS	13.1	-3.0	16.3
SC	8.8	-0.5	10.0
COL	8.8	0.1	8.4
COL+	4.8	-0.2	3.9
By Child Bearing Status			
Early	14.4	-1.3	16.5
Late	7.8	-0.6	8.1

Note: Entries show effects across steady states on selected variables driven by the expansion of child-related transfers, when the labor supply of married males is fixed at their benchmark values. The values for "Tax Rate" correspond to the values that are necessary to achieve revenue neutrality. See text for details.

Table A19: Policy Experiments in a
Closed Economy (%, Relative to Benchmark)

	Universal Subsidies (75%)	Child Credit Expansion	Childcare Credit Expansion
Participation Married Females	10.3	-2.7	10.6
Total Hours	1.8	-1.6	1.3
Total Hours (MF)	8.6	-3.5	8.4
Hours per worker (f)	-1.1	-1.3	-2.1
Output	0.7	-1.0	0.3
Tax Rate (%)	1.2	1.2	1.2
Effects on Participation:			
By Education			
< HS	25.4	-7.0	31.2
HS	13.4	-4.6	15.9
SC	9.1	-2.7	9.5
COL	9.5	-1.5	8.0
COL+	5.1	-0.8	3.8
By Child Bearing Status			
Early	15.0	-4.3	16.0
Late	8.2	-1.7	7.8

Note: Entries show effects across steady states on selected variables driven by the expansion of child-related transfers in a closed economy. The values for "Tax Rate" correspond to the values that are necessary to achieve revenue neutrality. See text for details.

Table A20: Policy Experiments Under
Imperfect Skill Substitutability (%, Relative to Benchmark)

	Universal Subsidies (75%)	Child Credit Expansion	Childcare Credit Expansion
Participation Married Females	10.0	-2.1	9.9
Total Hours	1.6	-1.4	1.2
Total Hours (MF)	8.3	-2.9	7.8
Hours per worker (f)	-1.3	-1.6	-2.1
Output	0.9	-1.5	0.4
Skill Premium	-0.4	-0.2	0.9
Tax Rate (%)	1.1	1.1	1.1
Effects on Participation:			
By Education			
< HS	26.7	-5.8	30.3
HS	13.3	-3.2	14.9
SC	8.9	-2.6	8.8
COL	8.5	-1.1	7.0
COL+	5.2	-0.5	4.0
By Child Bearing Status			
Early	14.7	-3.5	15.1
Late	7.8	-1.3	7.1

Note: Entries show effects across steady states on selected variables driven by the expansion of child-related transfers when skills are imperfect substitutes in production. The variable 'skill premium' corresponds to the per-worker earnings of skilled workers relative to unskilled workers. The values for "Tax Rate" correspond to the values that are necessary to achieve revenue neutrality. See text for details.

Table A21: Effects on Participation by Education and Childbearing Status (%, Relative to Benchmark)

	Universal Subsidies (75%)	Child Credit Expansion	Childcare Credit Expansion
By Education			
< HS	25.4	-6.4	32.0
HS	13.3	-4.4	16.9
SC	9.1	-2.5	10.4
COL	9.4	-1.2	7.0
COL+	5.1	-0.7	2.8
By Education and Child Bearing Status			
Early Childbearing			
< HS	29.6	-7.7	36.6
HS	16.6	-5.9	19.4
SC	12.0	-3.6	12.7
COL	14.6	-2.1	12.7
COL+	8.8	-1.2	6.6
ALL	18.5	-4.4	17.0
Late Childbearing			
< HS	24.7	-5.4	28.7
HS	12.2	-3.3	14.2
SC	7.3	-1.5	7.6
COL	8.4	-1.1	7.0
COL+	5.0	-0.7	3.5
ALL	9.7	-1.4	6.9

Note: Entries show effects (percentage changes) across steady states on participation rates of married females by the universalization of childcare subsidies, and the expansions of child credits and childcare credits. Effects on participation rates are shown by education (top panel), and by child bearing and education levels combined (bottom panel). See text for details.

Table A22: Welfare Effects (Newborn Married Households, %)

	Childcare Subsidy (75%)						Childcare Credit				
	Females						Females				
Males	<HS	HS	SC	COL	COL+	Males	<HS	HS	SC	COL	COL+
<HS	1.82	2.48	3.92	3.37	5.25	<HS	5.42	8.33	8.32	5.92	5.35
HS	0.98	1.59	2.30	2.61	4.34	HS	3.90	5.23	5.24	4.23	5.11
SC	0.72	0.99	1.91	1.86	3.17	SC	3.21	3.92	4.19	3.17	3.33
COL	-0.62	-0.23	-0.05	0.10	1.07	COL	0.73	1.31	0.97	0.61	0.44
COL+	-1.85	-1.40	-1.02	-0.71	-0.12	COL+	-1.40	-0.77	-0.61	-0.78	-0.72

	Child Credit						New Child Credit				
	Females						Females				
Males	<HS	HS	SC	COL	COL+	Males	<HS	HS	SC	COL	COL+
< HS	10.49	7.45	5.60	3.08	2.40	< HS	12.65	9.16	6.93	4.15	2.67
HS	5.69	2.92	2.28	1.45	0.36	HS	7.09	3.91	3.14	1.96	0.87
SC	4.06	1.86	1.72	0.55	0.11	SC	5.25	2.69	2.54	1.03	0.26
COL	1.90	0.47	0.12	-0.55	-0.80	COL	2.78	0.95	0.52	-0.36	-0.60
COL+	-0.20	-0.30	-0.26	-0.65	-1.19	COL+	0.26	0.12	0.18	-0.22	-0.91

Note: Entries show the welfare effects (consumption compensation) driven by the expansion of child-related transfers for young married households (newborns). Calculations take into account transitions between steady states.

Table A23: Childcare Subsidies and Transfers in Policy Exercises (%)

Income Decile	Childcare Subsidy		Child Credit		Childcare Credit	
	Subsidy	Transfer	Subsidy	Transfer	Subsidy	Transfer
1st	75	0	0	6.5	100	2.7
2nd	75	0	0	6.3	99.3	1.8
3rd	75	0	0	6.3	97.4	0.5
4th	75	0	0	6.5	83.3	0
5th	75	0	0	6.4	75.2	0
6th	75	0	0	6.4	74.4	0
7th	75	0	0	6.3	74.8	0
8th	75	0	0	6.1	73.7	0
9th	75	0	0	5.9	73.5	0
10th	75	0	0	2.4	73.9	0

Note: Entries show for each policy exercise (i) the explicit and implicit childcare subsidy rates at different deciles of the distribution of income; (ii) the implicit transfers received at different deciles of the distribution of income as a percentage of the household income of the decile. See text for details.

Figure A1: Labor Productivity Levels by Education, Males

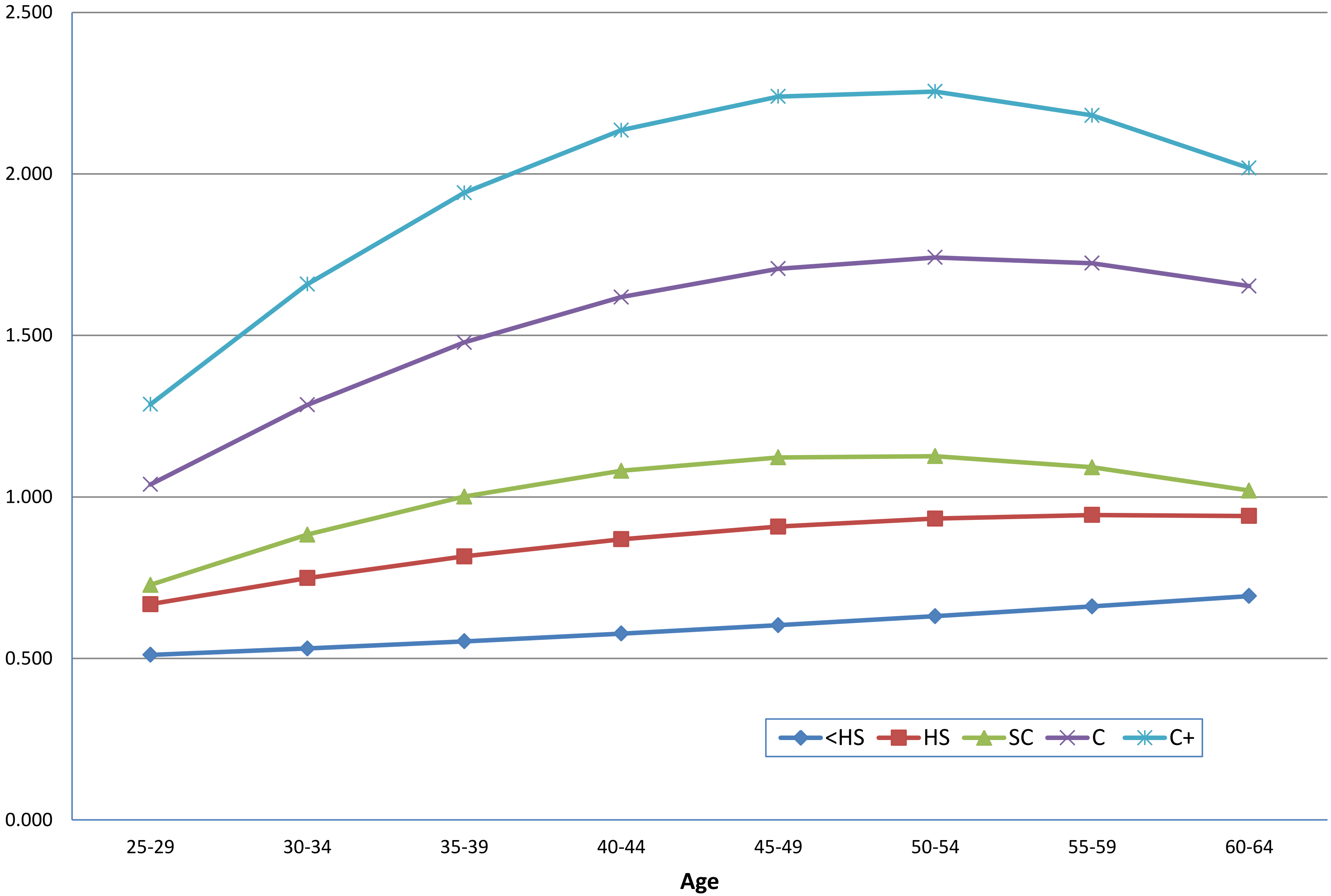


Figure A2: Fraction of Child Care Expenses Credited with the CDCTC

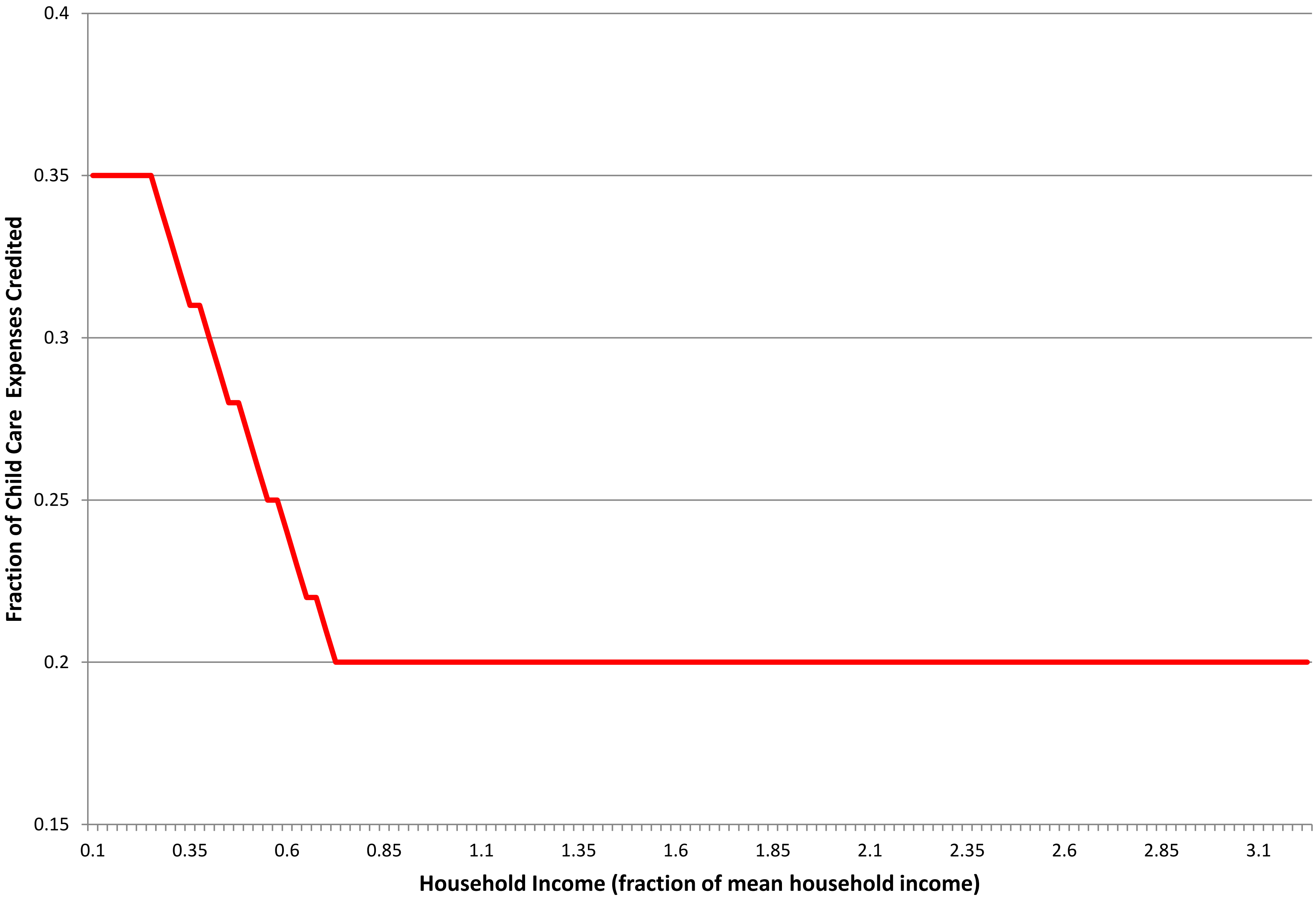
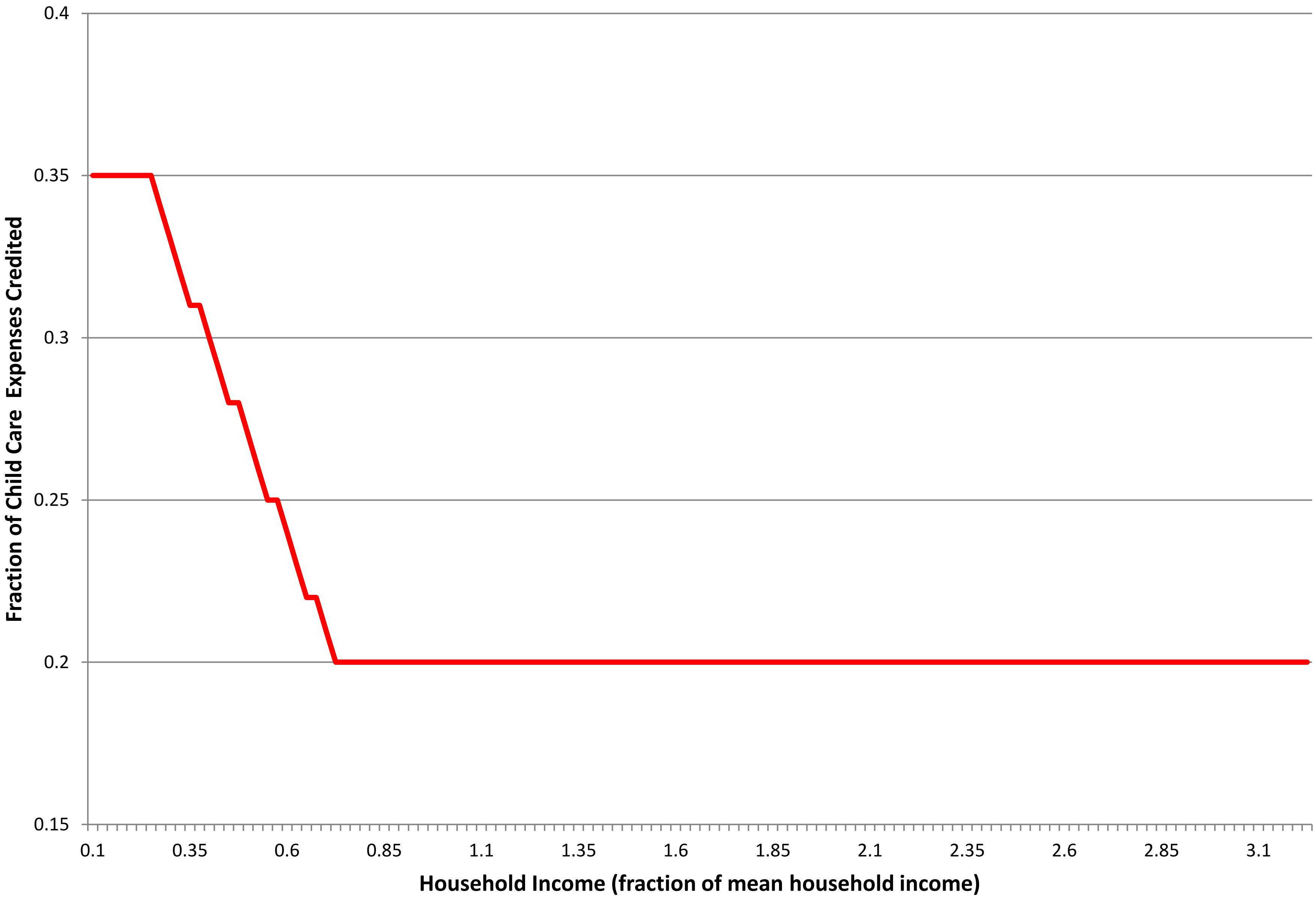


Figure A2: Fraction of Child Care Expenses Credited with the CDCTC



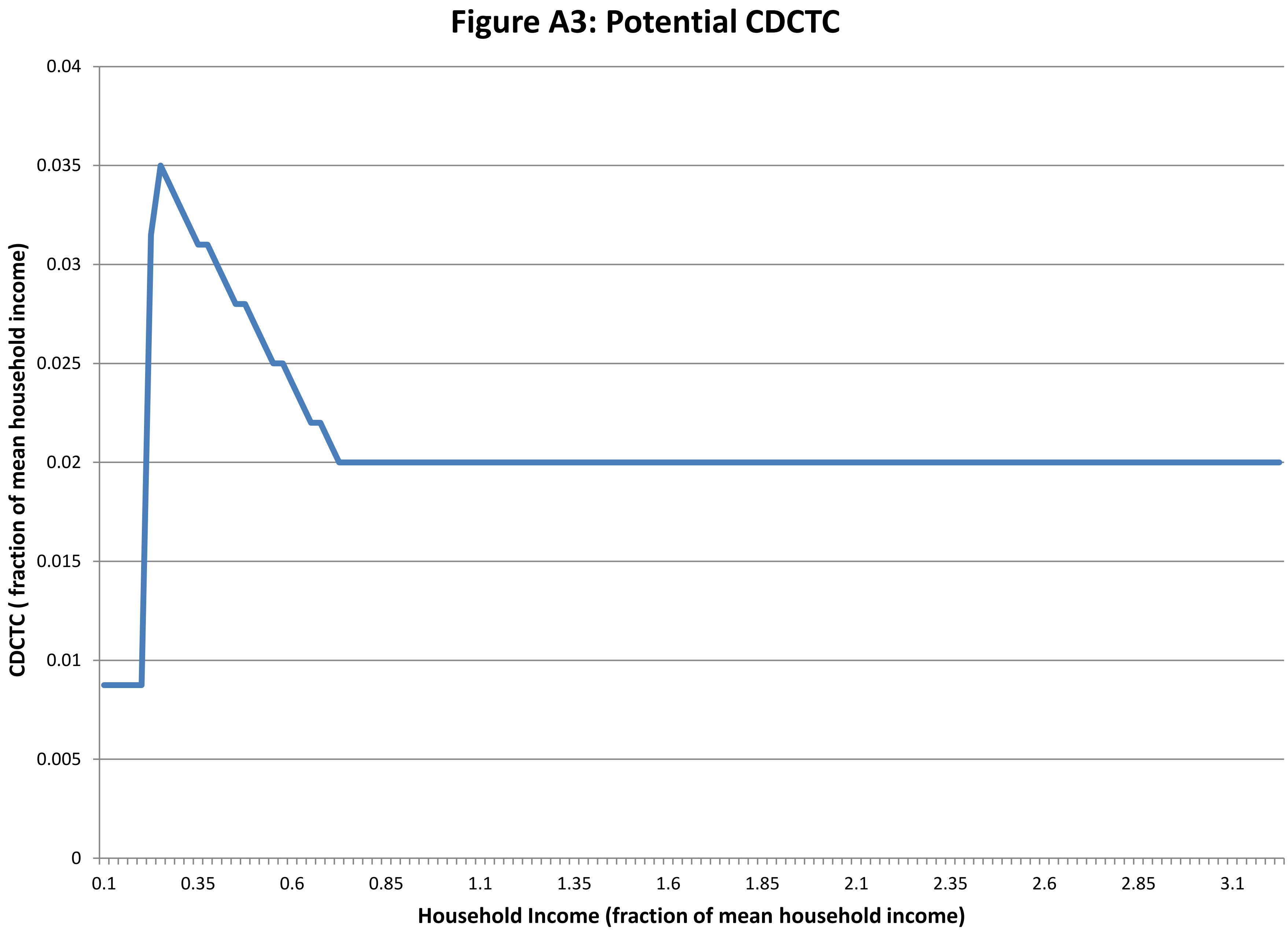
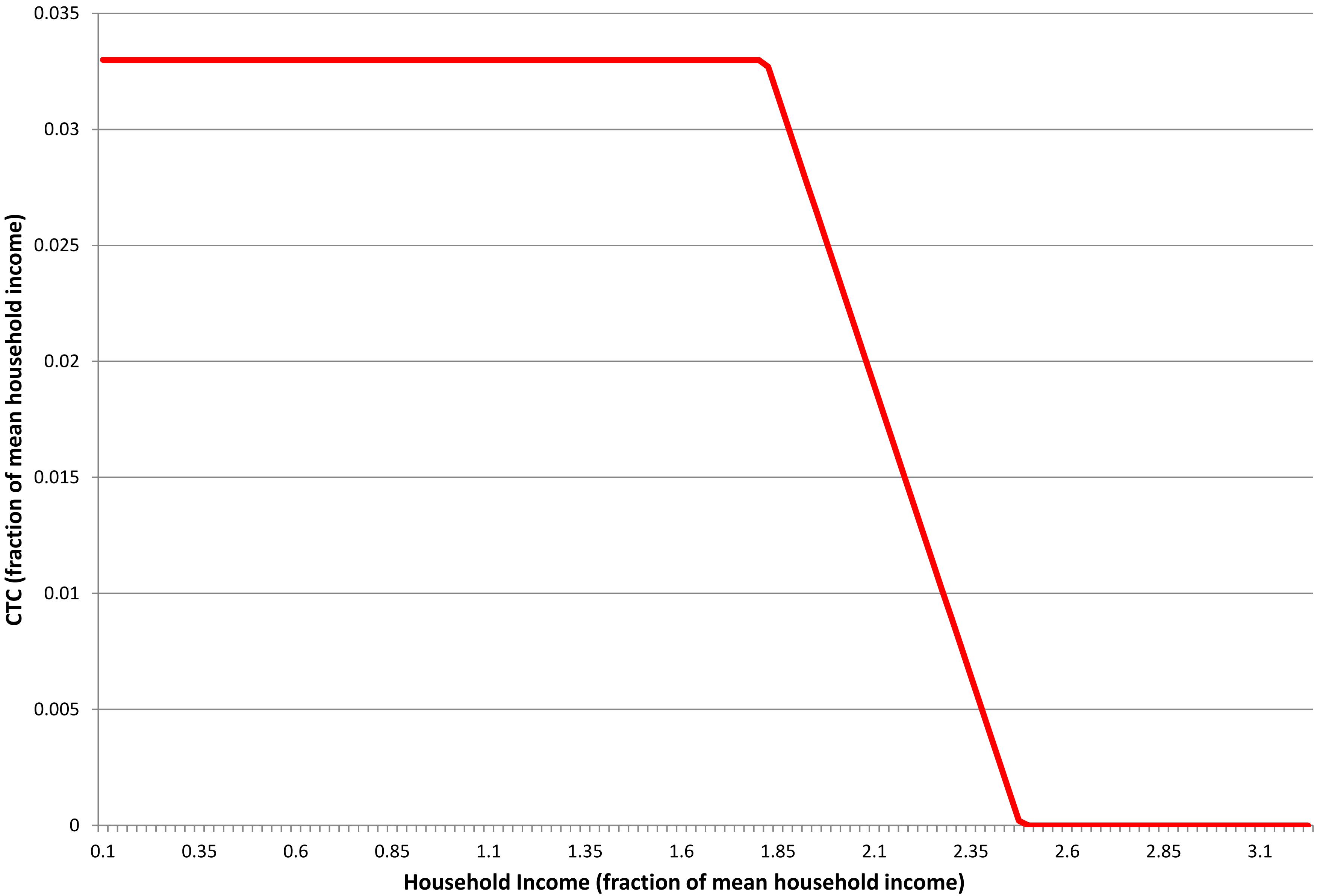


Figure A3: Potential CDCTC
CDCTC (fraction of mean household income)
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0.1
0.35
0.6
0.85
1.1
1.35
1.6
1.85
2.1
2.35
2.6
2.85
3.1
Household Income (fraction of mean household income)

Figure A4: Potential Child Tax Credit (a household with 2 children)



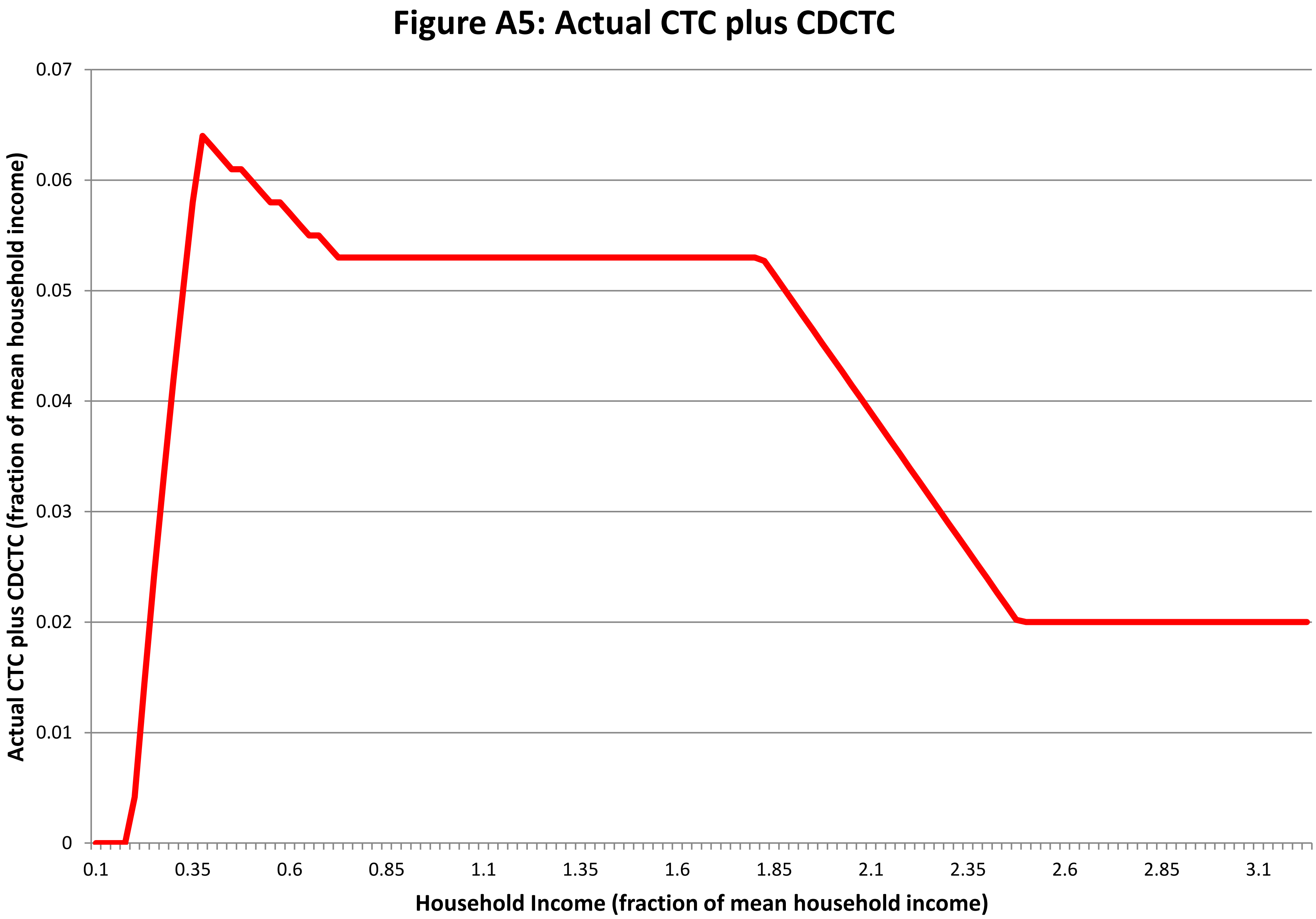


Figure A5: Actual CTC plus CDCTC
Actual CTC plus CDCTC (fraction of mean household income)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0.1
0.35
0.6
0.85
1.1
1.35
1.6
1.85
2.1
2.35
2.6
2.85
3.1
Household Income (fraction of mean household income)

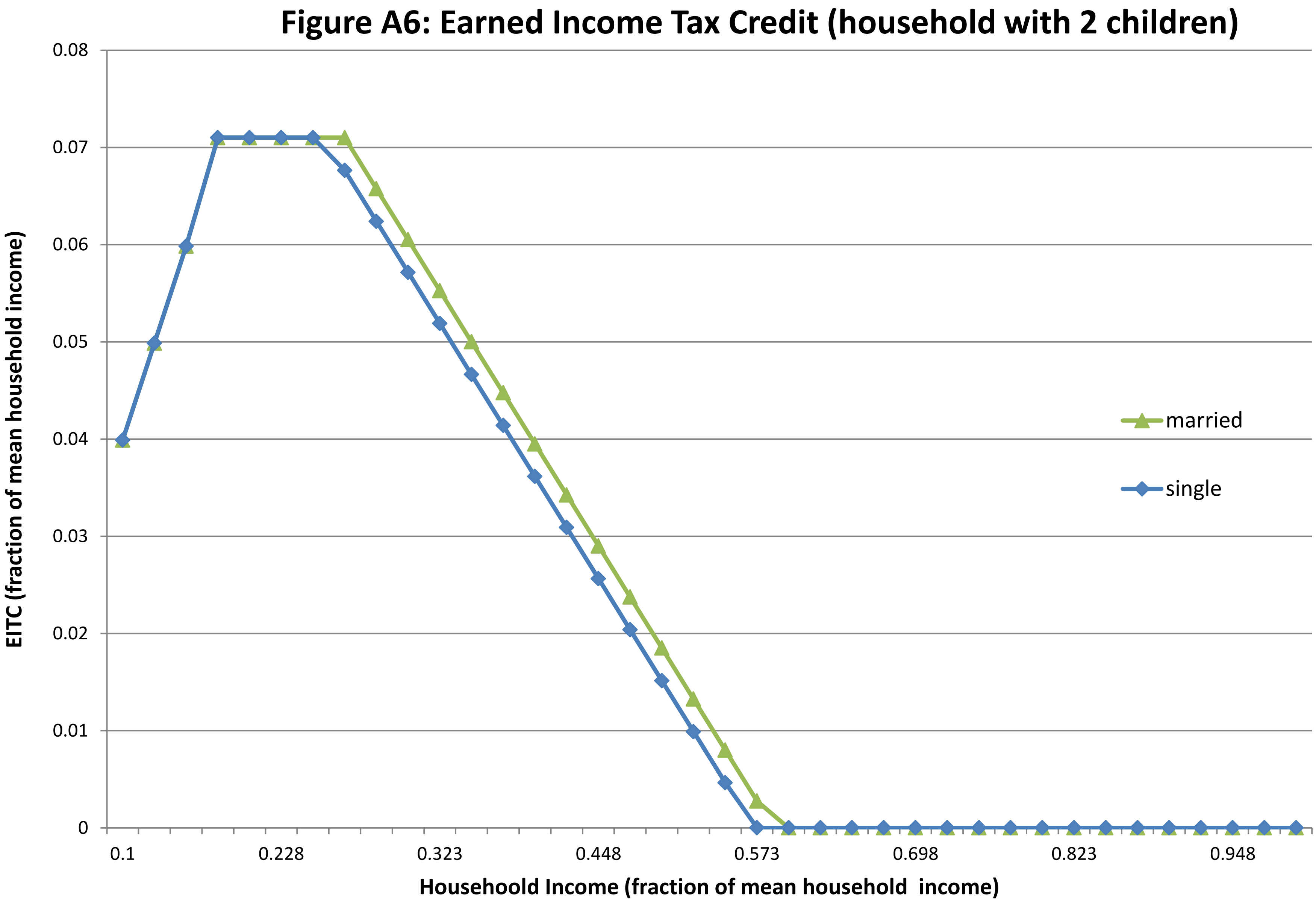


Figure A6: Earned Income Tax Credit (household with 2 children)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
EITC (fraction of mean household income)
0.1
0.228
0.323
0.448
0.573
0.698
0.823
0.948
Househoold Income (fraction of mean household income)
married
single

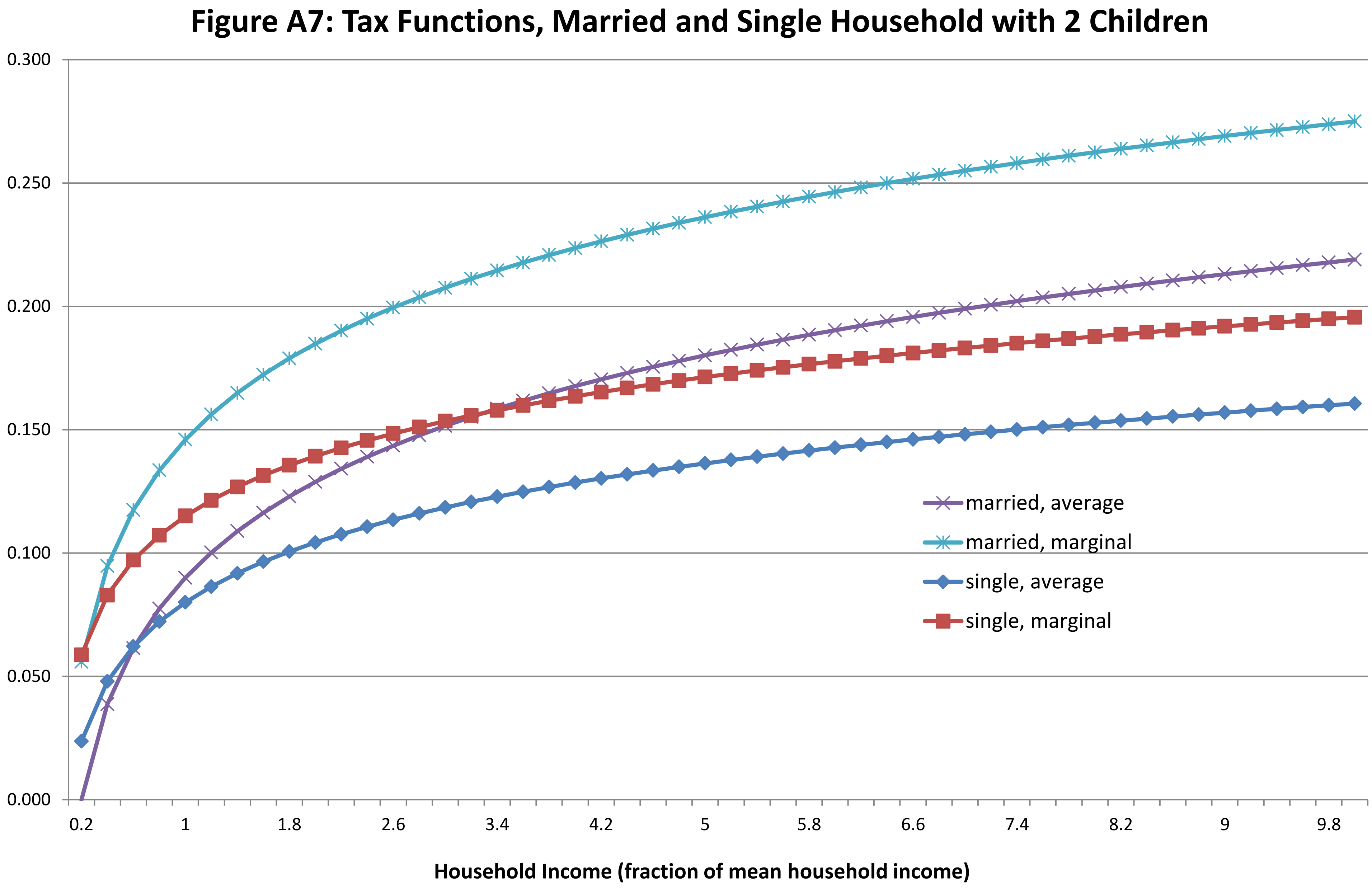


Figure A7: Tax Functions, Married and Single Household with 2 Children
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.2
1
1.8
2.6
3.4
4.2
5
5.8
6.6
7.4
8.2
9
9.8
Household Income (fraction of mean household income)
married, average
married, marginal
single, average
single, marginal

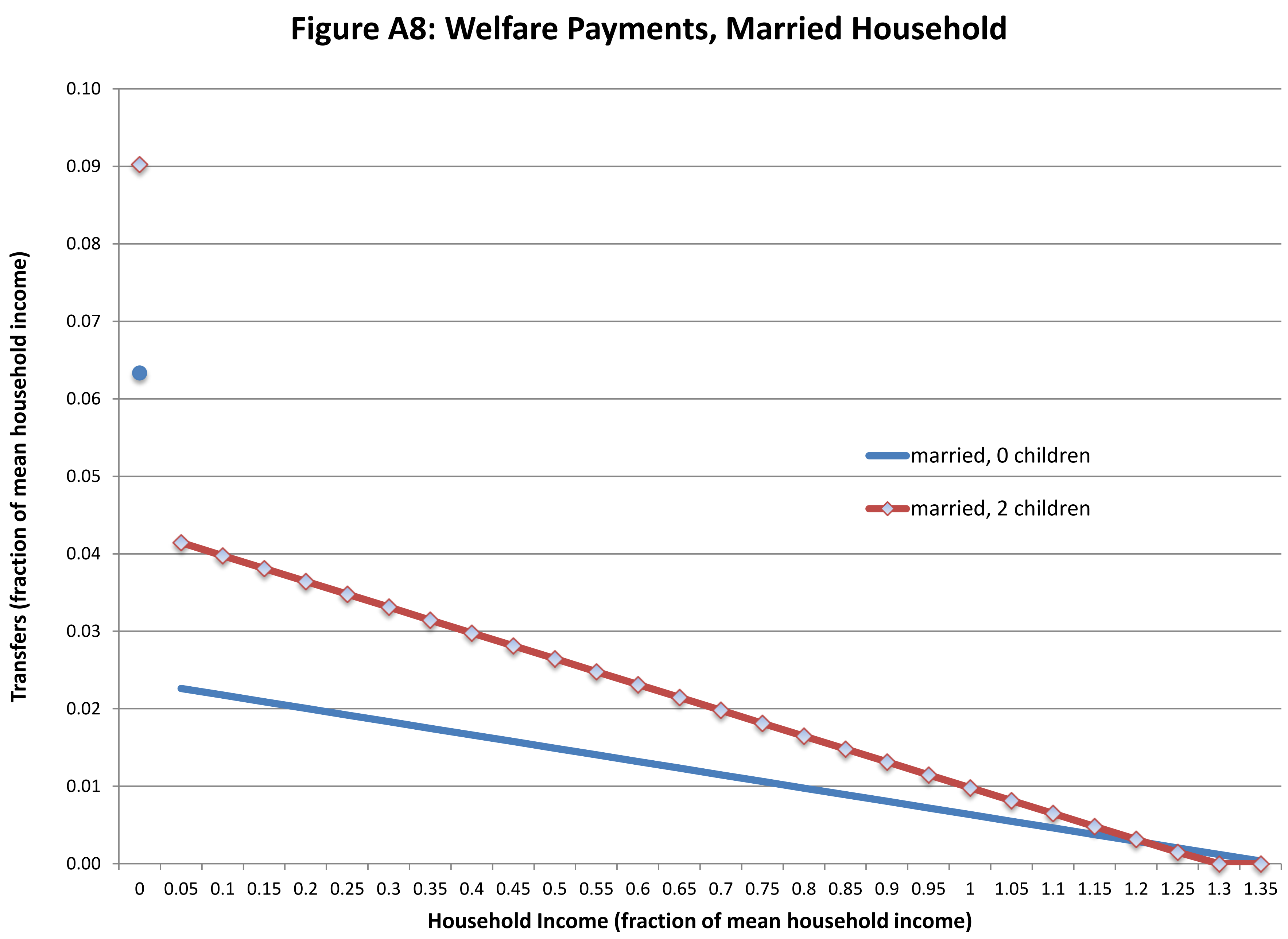


Figure A8: Welfare Payments, Married Household
Transfers (fraction of mean household income)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
married, 0 children
married, 2 children
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9 0.95 1 1.05 1.1 1.15 1.2 1.25 1.3 1.35
Household Income (fraction of mean household income)

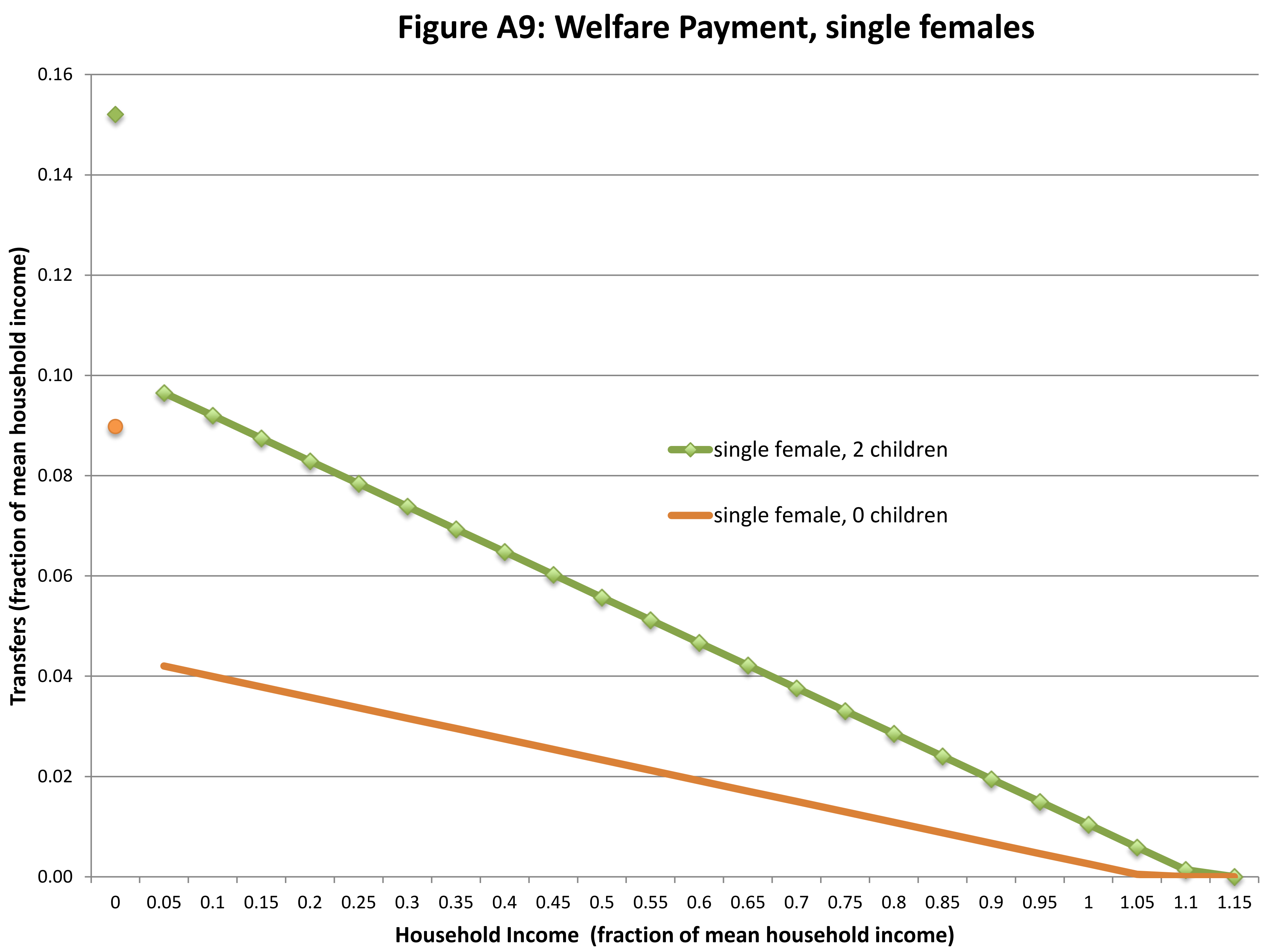


Figure A9: Welfare Payment, single females
Transfers (fraction of mean household income)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
single female, 2 children
single female, 0 children
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
Household Income (fraction of mean household income)

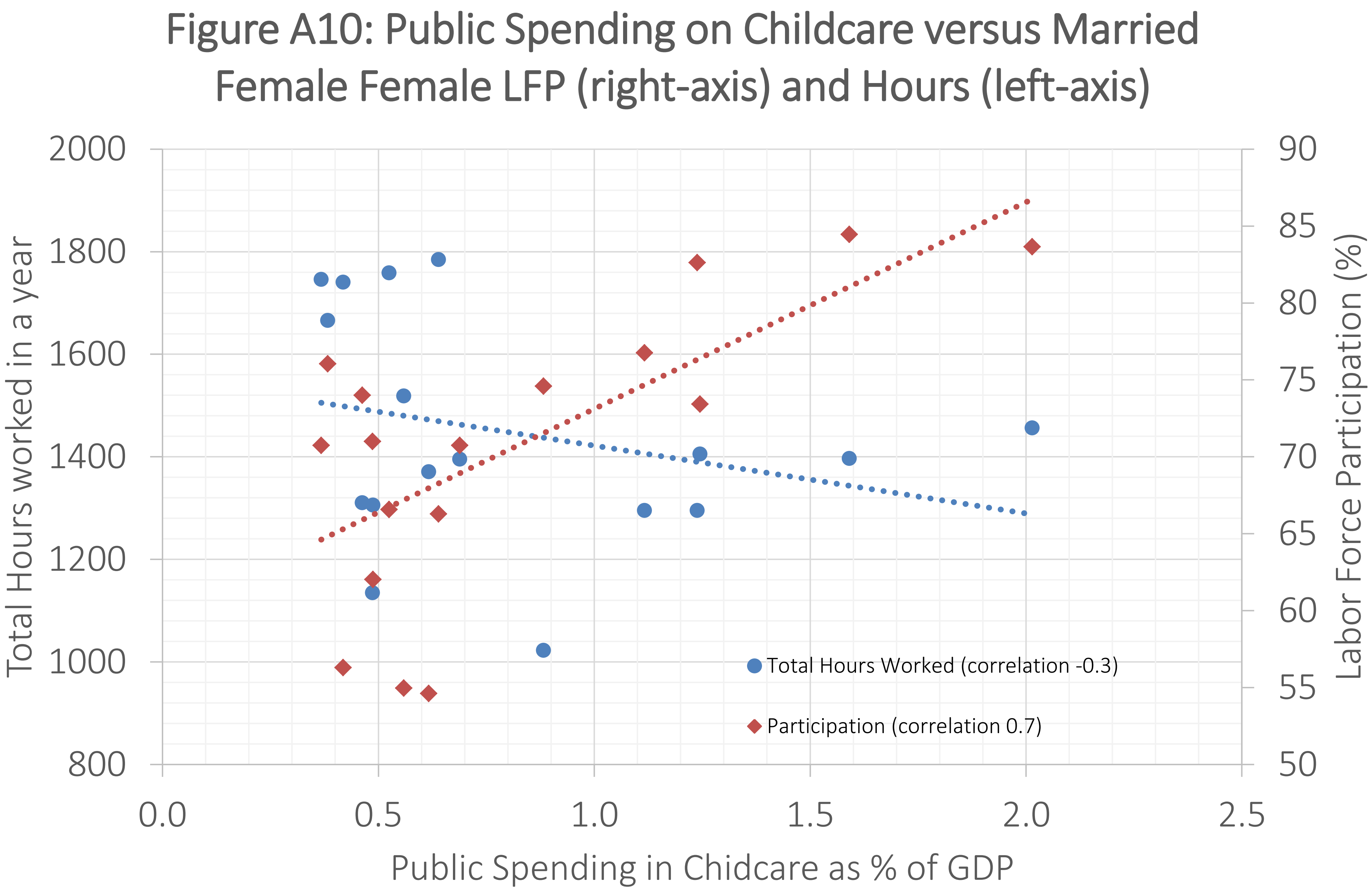


Figure A10: Public Spending on Childcare versus Married Female Female LFP (right-axis) and Hours (left-axis)
2000
1800
1600
1400
1200
1000
800
90
85
80
75
70
65
60
55
50
0.0
0.5
1.0
1.5
2.0
2.5
Total Hours worked in a year
Labor Force Participation (%)
Public Spending in Chidcare as % of GDP
Total Hours Worked (correlation -0.3)
Participation (correlation 0.7)

Figure A11: Married Female Labor Force Participation by the Presence of Children, Unskilled

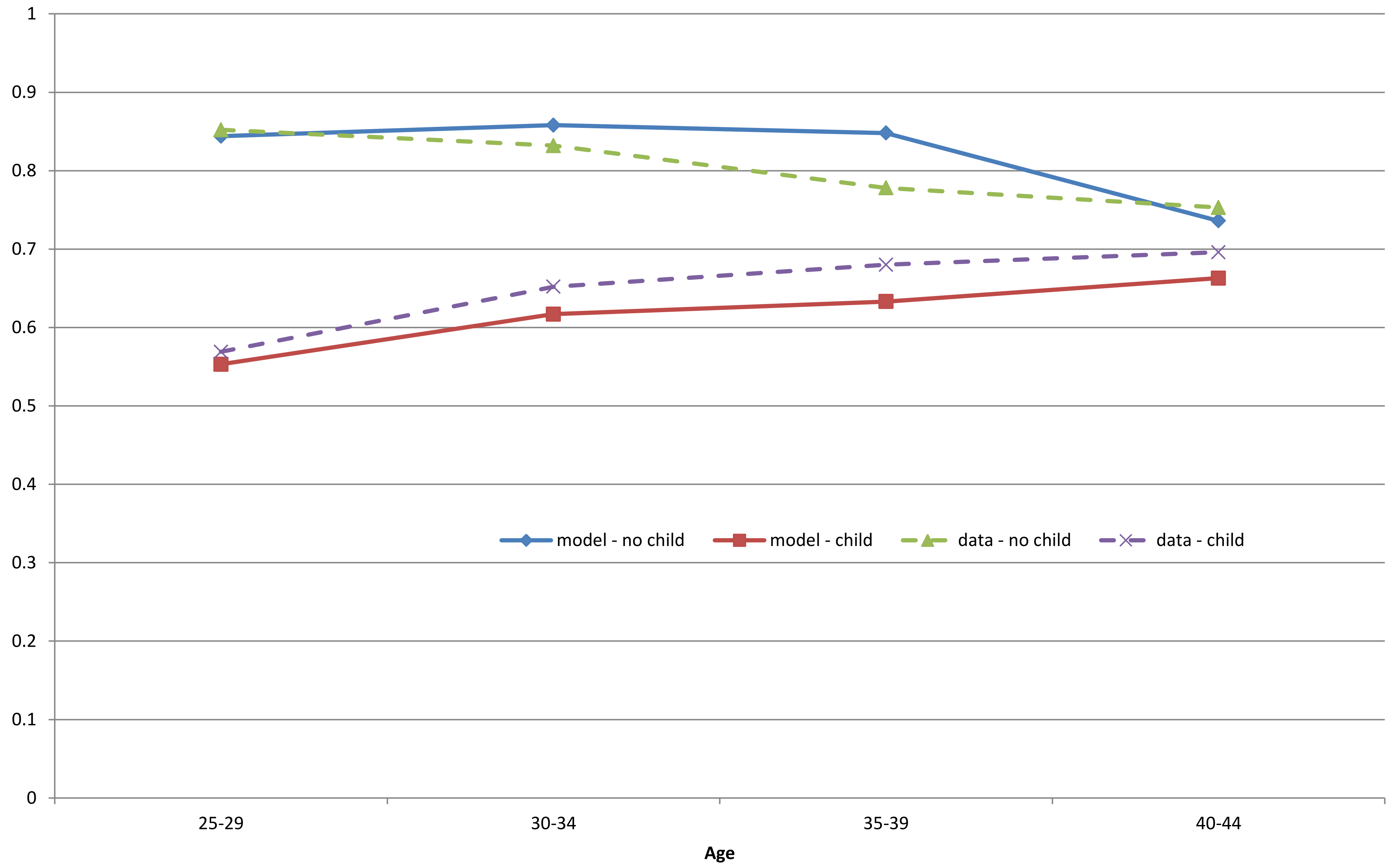


Figure A12: Married Female Labor Force Participation by the Presence of Children, Skilled