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Taxing Families: The Impact of Child-related Transfers on Maternal Labor Supply

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The Impact of Child-Related Transfers and Maternal Labor Supply

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Abstract

The employment rate of married women with and without pre-school children varies substantially across countries. To what extent do child-related transfers account for this variation? I develop a life cycle model in which married couples jointly decide their labor supply, female human capital evolves endogenously, and some couples have access to grandparental childcare. I show that child-related transfers can explain most of the variation in the employment rates of married women, even after taking the labor income tax treatment and cross-country variation in childcare fees into account.

JEL Codes: E62, H24, H31, J12, J22

Keywords: Maternal Labor Supply, Nonlinear Transfers, Taxation, Two-earner Households

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The employment rate of married mothers with young children is on average 15% lower than the employment rate of married women without children (OECD, 2012).[1] I refer to this difference as the *maternal employment gap*. The size of this gap varies significantly across countries. For example, the employment rate of married women with pre-school-aged children was 23.2% lower in the United States (US) between 2004 and 2007 relative to married women without children[2]. In Denmark, on the other hand, there is no considerable difference in the employment rate for these two groups of married women. How can we reconcile the varying size of the maternal employment gap across countries?

Countries differ substantially in the way their tax and transfer systems are designed and Denmark and the US offer an interesting comparison. First, their tax and transfer systems differ along three dimensions that are of first-order importance for the labor supply decision of families with children. Second, the US taxes the labor income of spouses jointly, while Danish labor income is taxed at the individual level. Third, childcare fees for a place in full-time daycare are about 25% lower in Denmark. Last, the generosity and design of child-related transfers, defined as all government transfers to families with children, varies substantially; where Denmark spends 3.1% of its GDP on child-related transfers, the US spends 1.5% of its GDP on these policies. A large fraction of Danish subsidies is distributed in a lump-sum fashion. All programs that support families with children in the US are means-tested, with the support gradually tapering off as family income increases.

The key difference in reconciling the maternal employment gap across countries as seen in the data, I argue, is the design of child-related transfers. For example, child-related transfers in the US economy explain why the employment rate of married mothers with young children is 23.2% lower compared to married women without children. In the Danish economy, the opposite result is true; married mothers with young children work as much as married women without children. This result is driven by the fact that a large fraction of Danish child-related transfers is distributed in a lump-sum fashion, yet all US transfers for families with children are means-tested. While lump-sum transfers do not affect the decision of the second earner at the margin, means-tested transfers introduce important nonlinearities in the effective tax rates that families face. If the family income falls into the phase-in range of such a transfer program, the size of the transfer is increasing with family income and provides strong incentives for the second income earner to enter the labor force. The opposite is true in the phase-out range: Transfers are a decreasing function of family income. Hence, if the additional income of the second earner pushes the couples' income into the phase-out range of a large scale transfer program, the household might be better off specializing. In doing so, they forgo paying the costs of formal childcare and remain in the eligible range of the means-tested transfer program. As a result, the aggregate effect of child-related transfer programs is a function of the specific policy design and the distribution of family incomes in the economy.

To analyze the trade-offs stemming from taxes and transfers for families with children, I

[1]At the same time, employment rates of men with and without children in the household are comparable.

[2]Own calculations. For simplicity, I refer to married women with children of age 15 or older as married women without children throughout the paper.

propose a life cycle model in which spouses jointly decide their labor supply. The economy is populated by married couples and singles. Some households have children, who arrive early or late in the life cycle. Having children consumes additional resources as working parents need to purchase childcare services unless they have access to grandparents who can provide childcare at no cost. Male and female individuals are ex-ante heterogeneous in their education. While male age-earning profiles are taken as exogenous, female labor productivity evolves endogenously over the life cycle.

I calibrate the model to the US economy. Holding preferences fixed, I use the model economy to predict the labor supply of married women with and without children for a set of 13 European countries. The goal of this policy experiment is to evaluate to what extent the model can rationalize variation in the maternal employment gap across countries by only changing country-specific policies (taxes and transfers), the degree to which informal childcare is available (grandparents), and the cost of childcare. Hence, four features of the model economy are adjusted and informed by country-specific data targets: (1) income taxes and transfers independent of the presence of children; (2) out-of-pocket childcare costs; (3) the fraction of couples relying on grandparents as the primary caretaker; and (4) child-related transfers. Decomposing the total effect on maternal labor supply into the contribution of each component reveals that the fourth component is the most important in quantitatively matching the data.

Another advantage of the general equilibrium setup is that it allows for interesting cross-country experiments. Using the framework, I can assess the effects of introducing Danish child-related transfers in the US economy on maternal employment and account for the effect that such a policy change has on the government budget. While more generous child-related transfers, as observed in Denmark, increase maternal employment in the US economy, such a reform is not self-financing. The additional tax revenue generated from the employment increase cannot fully cover the increased government spending on child-related transfers. As a result, tax revenue relative to output slightly declines in the US economy with Danish child-related transfers.

The framework builds on the joint labor supply problem proposed by Guner et al. (2020). Their analysis focuses on the US economy with the aim of studying the effect of childcare policy reforms on family labor supply and welfare. The framework lends itself to study maternal employment decisions across countries since it incorporates important country-specific features, such as the cost of childcare or the role of informal childcare provided by grandparents, that are potentially important drivers of the maternal employment gap. To account for the rich heterogeneity in taxes and child-related transfers across countries in a parsimonious way, I rely on the method outlined in Bick and Fuchs-Schündeln (2018). They use the statutory nonlinear income tax code for married couples provided by the OECD to infer effective tax rates of single and two-earner households. I extend their method to incorporate the generosity and design of child-related transfers explicitly. The results from the model economy confirm that differences in the transfer system due to the presence of children in the household are important in explaining the maternal employment decisions. The paper also offers additional insights into how such transfer policies affect the tax revenue in the economy. Relative to Bick and Fuchs-Schündeln (2018), who focus on the employment decisions of married women in general, maternal employment gaps cannot be easily studied in a static framework. Families with children are often only eligible for child-related transfers during the time when children are young. Yet, the employment decisions taken by mothers early in life, when human capital growth is particularly strong, impact maternal earnings over the entire life cycle. Ultimately, the framework developed in this paper is the first to allow the systematic study of child-related transfers and maternal employment decisions over the life cycle and across countries and to understand the impact of such transfers on the macroeconomy.

This paper is part of a growing macroeconomic literature that departs from the standard single earner decision problem and models the joint decision making of spouses in a unitary framework.[3] A number of these studies have emphasized the importance of income taxes and the social security benefits in determining the labor supply decision of the second earner in the household.[4] This paper extends the analysis and emphasizes differences in the decision problem for families with and without children. In doing so, it is closely related to a strand of macroeconomic research that explores the effects of childcare costs and childcare subsidies on family labor supply.[5] The analysis presented here contributes to these studies by providing a tractable framework that allows the systematic study of the impact of nonlinear taxes and transfers on family labor supply for the entire income distribution and across countries.

Finally, the paper is also related to an extensive empirical literature going back to Heckman (1974) that estimates the effects of childcare costs on maternal labor supply.[6] Estimates of maternal labor supply elasticity vary greatly with most authors arguing that labor supply estimates should be carefully interpreted within the country-specific context of their study.[7] Another way of interpreting the large variation in parameter estimates has been put forth by Attanasio et al. (2018), who document a considerable heterogeneity in female labor supply elasticities at the micro level due to observables such as age and education. The structural framework presented in this paper extends this notion. It shows that maternal labor supply crucially depends on the size and the design of the child-related transfers, the demographic structure of the economy, and the distribution of family income and household composition.

The remainder of the paper is organized as follows. Section 1 summarizes important facts about the maternal employment gap across countries and presents empirical results

[3]See Greenwood et al. (2003), Hong and Ríos-Rull (2007), and Heathcote et al. (2010), among others.

[4]Important contributions to this literature are Chade and Ventura (2002), Bar and Leukhina (2009), Kaygusuz (2010), Erosa et al. (2012), Guner et al. (2012), Chakraborty et al. (2015), Duval-Hernández et al. (2018), Holter et al. (2019), Sanchez-Marcos and Bethencourt (2018) and Nishiyama (2019).

[5]Rogerson (2007), Attanasio et al. (2008) and Domeij and Klein (2013) study the effect of childcare costs and family transfers for stand-in households. Erosa et al. (2010) and Bick (2015) have extended the analysis to heterogeneous households.

[6]Hotz and Miller (1988), Schøne (2004), Baker et al. (2008) and Havnes and Mogstad (2011) and Blau and Currie (2006) for a summary.

[7]Examples include Sánchez-Mangas and Sánchez-Marcos (2008), Azmat and Gonazález (2010), Bettendorf et al. (2015), Cascio et al. (2015), Geyer et al. (2015), Givord and Marbot (2015), Nollenberger and Rodríguez-Planas (2015) and Raute (2019).

that combine harmonized microdata across countries with simulated tax data. Section 2 develops a model of couples' and singles labor supply choices conditional on having children and Section 3 provides a detailed description of the model calibration. Section 4 contains the results for the US benchmark economy with policy experiments in Section 5 to assess the contribution of child-related transfers to the maternal employment gap across countries. Finally, Section 6 concludes the paper.

1. Stylized Facts

1.1 Maternal Employment Gaps

The maternal employment gap is defined as the difference in the average employment rate between two groups of married women. The first group includes married women with a child less than six years of age, while the second group is composed of married women without children or children older than the age of 14. For simplicity, I refer to the latter group as married women without children of pre-school age. Figure 1 summarizes the variation in the maternal employment gap using data from the Current Population Survey (CPS) for the US and the European Labor Force Survey (ELFS) for a set of 13 countries. The sample is limited to married women who are either the household head or spouse, between the ages of 25 and 49, and born in the country the survey is conducted in. The fact that the employment rates of married women vary substantially across countries has been documented by previous studies, such as Bick and Fuchs-Schündeln (2018). Yet, the presence of pre-school children in the family amplifies this variation in employment rates. As a result, the size of the maternal employment gap differs substantially across countries. This suggests that there are factors that uniquely impact the employment decision of married couples with pre-school children relative to couples without pre-school children.[8]

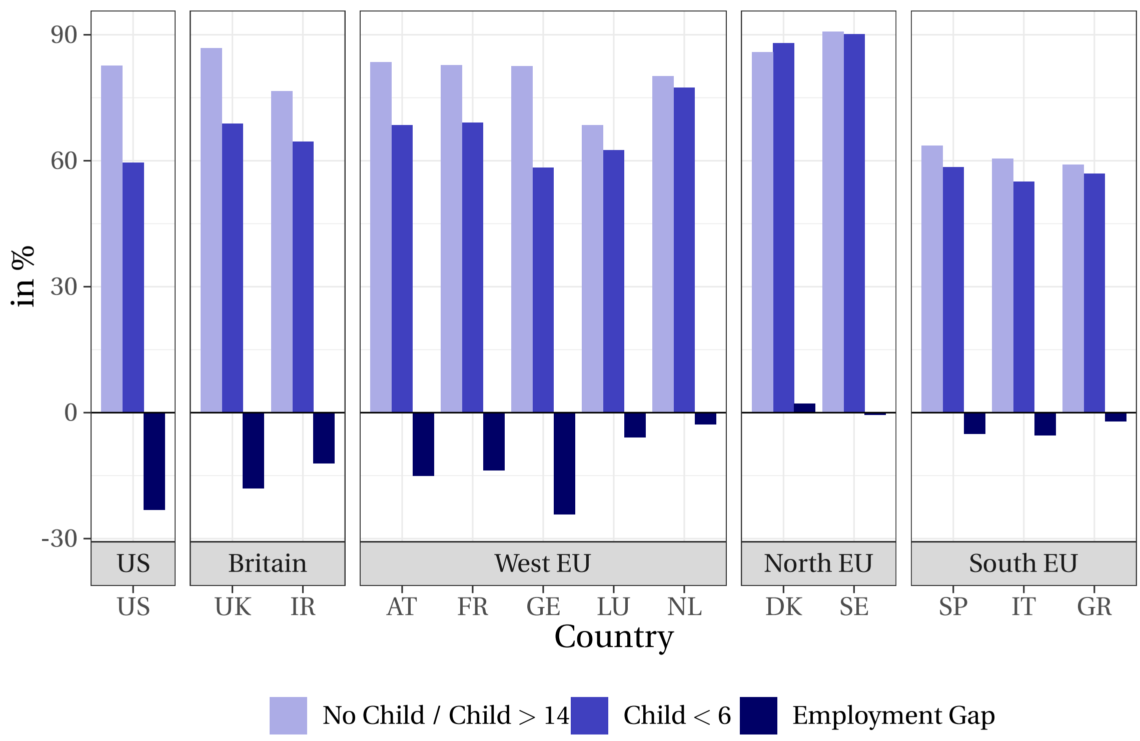
Is the variation in maternal employment gaps simply driven by differences in the age and education composition between these two groups? The maternal employment gap conditional on education in Figure 2 shows, not surprisingly, that maternal employment gaps are smaller for more highly educated women in most countries. However, the difference between the smallest and the largest maternal employment gap within an education group is just as pronounced as in Figure 1.[9] Put differently, even after accounting for differences in the educational composition of married women within countries, maternal employment gaps still emerge.

The differences in maternal employment gaps across countries might also be a direct result of differences in the age compositions between married women with and without pre-school children. The employment rates for both groups of married women conditional on

[8] Appendix Table A.1 summarizes the employment rates and maternal employment gaps across countries. While the empirical section focuses on employment rates, Table A.1 shows that the pattern across countries is unchanged if labor force participation rates are used instead of employment gaps. Table A.2 computes usual hours worked for married women with and without pre-school children.

[9] A.3 and A.4 report the underlying employment rates for married women with and without pre-school children, conditional on education.

Figure 1: Employment Rates of Married Women, 2004-2007

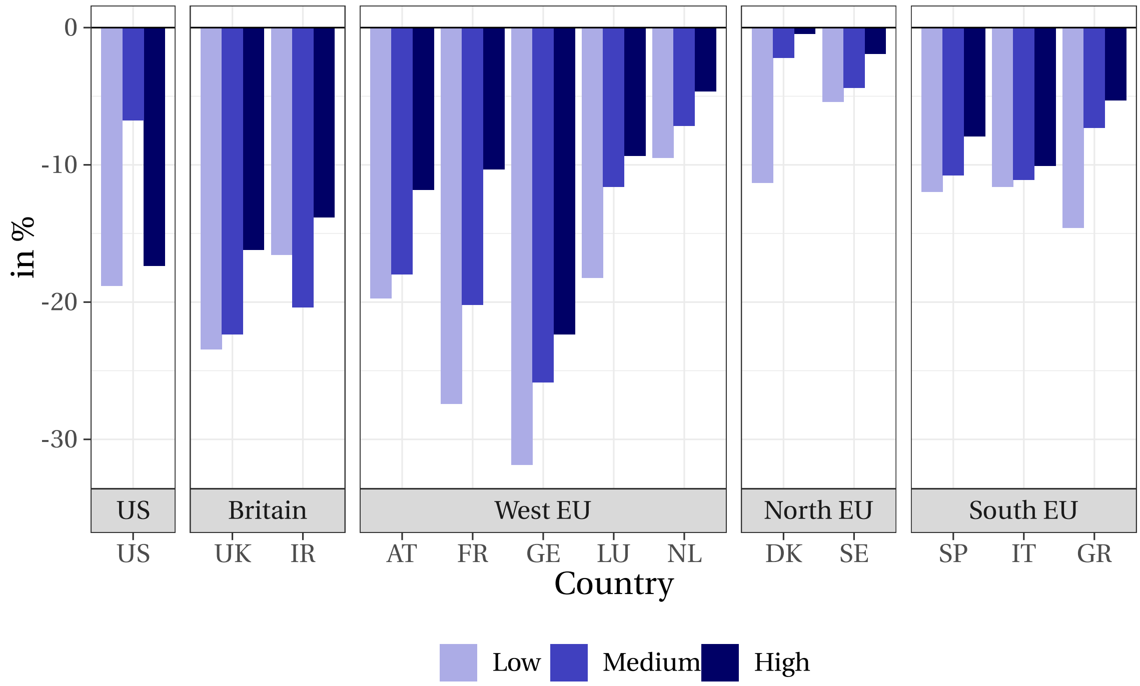


Notes: Data for the US is from the March Supplement of the CPS, while employment rates for European countries are based on the Yearly Files of the ELFS release 2020, version 3. The sample is restricted to married women between the ages of 25 and 49. Married women without pre-school children includes both married women without children and married women with children older than the age of 14. Data for Denmark and Sweden comes from the 2010-2015 ELFS Speciality Files as married women with pre-school children cannot be distinguished in earlier waves.

age in Figure 3 suggest, remarkably, that the gap is present at all ages for women between 20 and 49, except in Denmark and Sweden. In these two countries, maternal employment rates catch up to the employment rates of women without pre-school children by the time women age 30. Note that the gap also shrinks at higher ages in countries like Italy, Greece, and Spain. Here, the closing of the gap is driven by a decline in the employment rate of married women at higher ages without pre-school children, rather than married women with pre-school children catching up to those without children.

Finally, I check whether the employment gap vanishes if I limit the sample to mothers with pre-school children older than the age of two. Figure A.1 in Appendix A shows that maternal employment rates increase as the age of the youngest child increases. Again, we observe pronounced differences in the size of the maternal employment gap across countries (see Figure A.2). To sum up, the maternal employment gap varies considerably across countries and persists even when conditional on maternal education, maternal age, and the age of the youngest child.

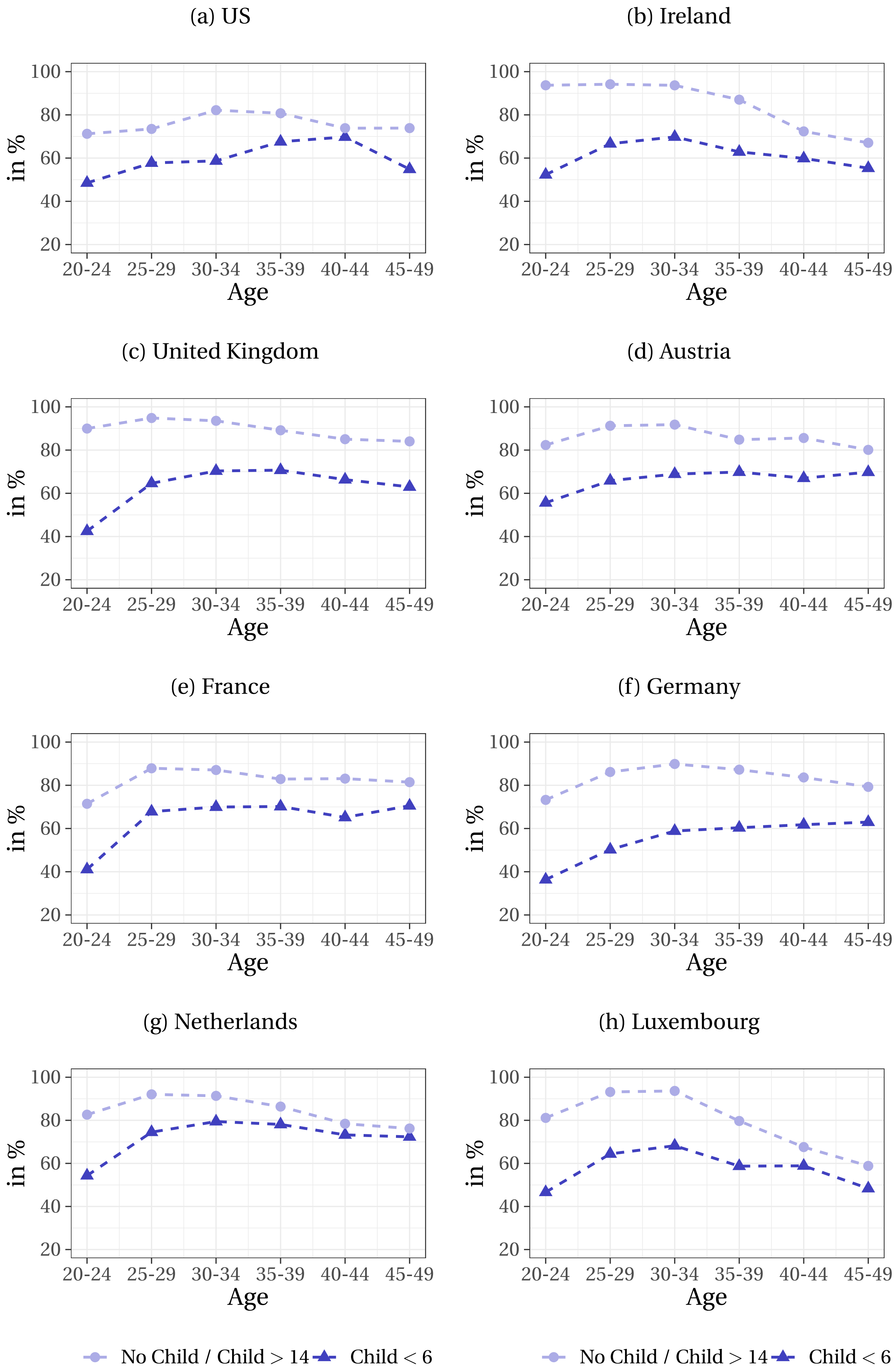
Figure 2: Maternal Employment Gaps By Education, 2004-2007



Notes: Data for the US comes from the CPS, while employment rates for European countries are based on the ELFS. The sample is restricted to married women between the ages of 25 and 49. Employment rate gaps are defined as the difference in the employment rates of married women with pre-school children and married women without pre-school children conditional on education. Data for Denmark and Sweden comes from the 2010-2015 ELFS Speciality Files as married women with pre-school children cannot be distinguished in earlier waves.

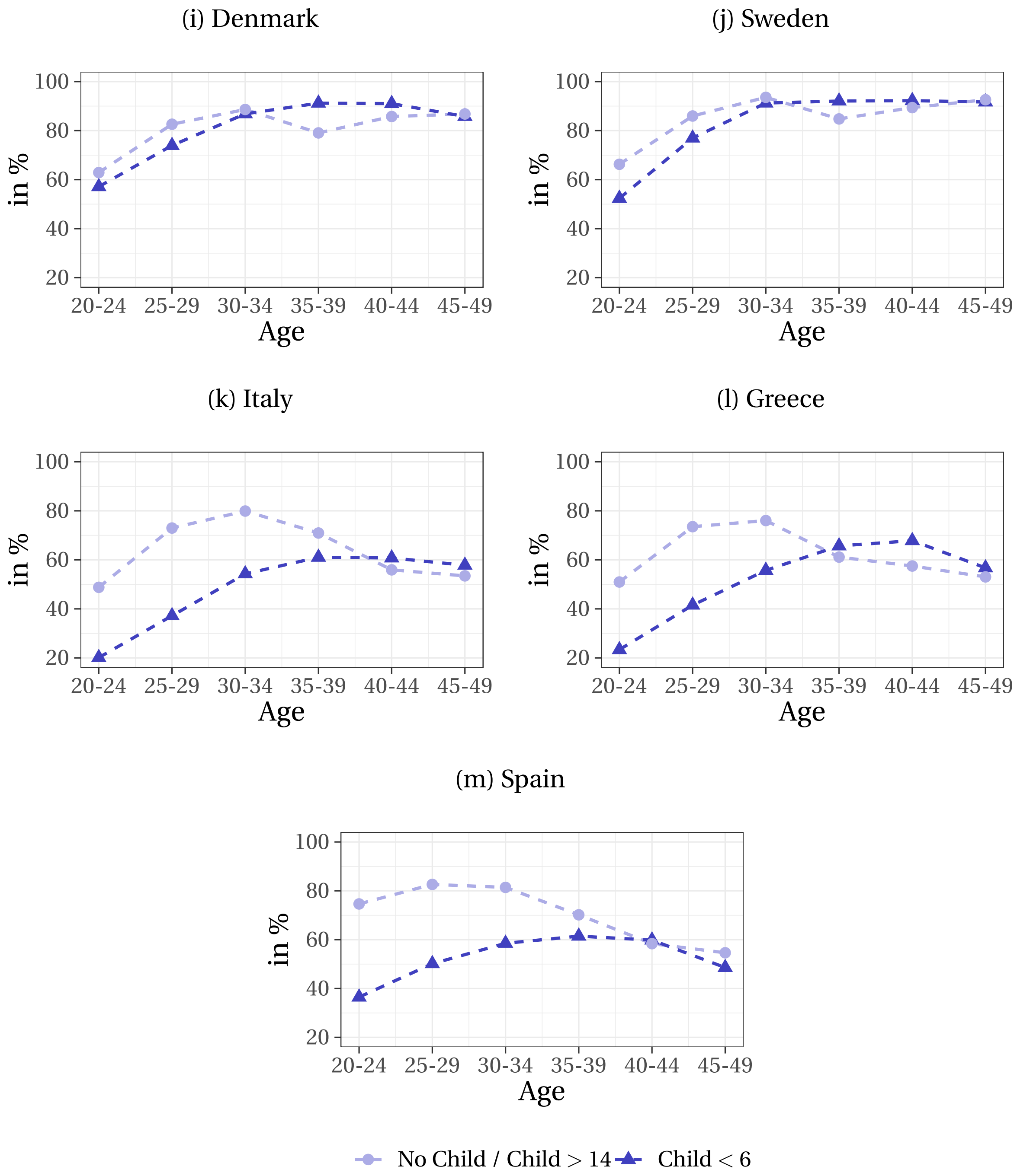
To rationalize these data facts, this paper is focused on two key determinants of the labor supply of mothers with young children: out-of pocket childcare costs and child-related transfers. The paper abstracts from modeling maternity leave decisions for two reasons. First, whether a mother is on maternity leave or employed during the first year after child birth cannot be identified in the data. Mothers on maternity leave are recorded as employed in both data sets throughout the duration of their leave. Once the maternity leave is over, mothers are recorded as unemployed if they do not return to work. Given that the gap is still present both in the first year and when the child is older, the gap cannot be purely driven by mothers who do not return to work after their maternity leave is over. Second, there is no obvious consensus in the literature about the impact of maternity leave policies on maternal employment (see, for example, Lalive and Zweimüller (2009), Schönberg and Ludsteck (2014), or Dahl et al. (2016)). Olivetti and Petrongolo (2017) review micro and macro evidence on parental leave rights and benefits and conclude that the long-run effects of maternity leave on employment and earnings are small or negligible. In contrast, evidence of the effect of policies that subsidize childcare is consistently positive. Olivetti and Petrongolo (2017) hypothesize that policies that make it easier to combine work and childcare matter more for maternal employment than the benefits parents receive while out of the labor force. As a result, in this paper I investigate the way in which childcare costs are subsidized through child-related transfers and the combined effect of this on maternal employment across countries.

Figure 3: Employment Rates of Married Women by Age (1/2)



Notes: See Notes Figure 4 on the next page.

Figure 4: Employment Rates of Married Women by Age (2/2)



Notes: Data for the US comes from the CPS Basic Monthly, while employment rates for European countries are based on the Yearly Files of the ELFS, release 2020, version 3. The sample is restricted to married women between the ages of 20 and 49. Married women without pre-school children include both married women without children and married women with children older than the age of 14. Data for Denmark and Sweden comes from the 2010-2015 ELFS Speciality Files as married women with pre-school children cannot be distinguished in earlier waves of the ELFS for these two countries.

1.2 Child-Related Transfers

I define child-related transfers as any tax credit or subsidy that alters the tax liability of married couples with pre-school children relative to married couples without children, conditional on the same pre-tax earnings. Child-related transfers interact with country-specific policies, in particular, other social transfers that are targeted at low-income families. Studying child-related transfers in isolation may, therefore, limit our understanding of how these policies affect the labor supply incentives of couples. Cascio et al. (2015) identify interactions between policy programs as a key reason for why national studies on family policy reforms find very heterogeneous effects on maternal labor supply, ranging from zero to rather large positive effects. The structural framework in this paper is aimed to fill this gap by allowing for the joint analysis of child-related transfers in the context of the country-specific tax and transfer system. Such an analysis can shed new light on how child-related transfers shape family labor supply incentives across countries and along the income distribution.

One way of summarizing the extent to which child-related transfers affect the labor supply decision of mothers at the extensive margin is the participation tax rate. Suppose the mother is the second earner of the family. The participation tax rate then summarizes her incentive to take up work (Immervoll et al. (2011), Bartels and Pestel (2016)) by comparing the tax rate of a two-earner family relative to that of a single-earner family, holding the pre-tax income of the primary earner constant. Hence, it captures how much of the additional family income is taxed away if the mother chooses to work. We can then compare the participation tax rate of families with children to that of families without children. The difference reflects how much child-related transfers alter the labor supply incentives of mothers relative to other cross-country variations in the tax treatment of labor income.

I define the participation tax rates as one minus the increase in after-tax household income from being a two-earner family relative to being a single-earner family $(y_2^{cc} - y_1)$ divided by the additional gross income generated by the second earner $(Y_2 - Y_1)$:

$$\tau^{PTR} = 1 - \frac{y_2^{cc} - y_1}{Y_2 - Y_1}.$$

Variable y indicates after-tax family income, while family income before taxes is labeled Y. The subscripts 1 and 2 distinguish single-earner from two-earner families. The after-tax family income y_2^{cc} indicates that two-earner families with children pay for childcare (cc) and, if the statutory income tax code allows, are able to deduct these expenses from their taxable income. A higher participation tax rate implies a lower incentive for mothers to work. If the participation tax rate is equal to one, all of the additional income from the working mother is taxed away.

Analyzing participation tax rates across different family types requires survey data that contain detailed information on the composition of the household, its marital status, and the pre-tax labor income for both spouses. The EU Survey of Income and Living Conditions (EU-SILC) is a harmonized household level data set for Europe that is well-suited to this task. I rely on the CPS for household data for the US. I then compute Participation tax rates by comparing two labor market states of the mother, one in which she works and one in which she does not work. While the actual labor market state can be directly observed in the data, the non-working state has to be inferred. If a mother reports positive labor income in the data, the non-working state is simply simulated by setting her pre-tax labor income to zero and computing the after-tax family income, y_1, solely based on the partner's labor income. On the other hand, if a mother reports zero labor income in the data, it is assumed that she would be able to earn the country-specific average income of a married woman in her education group. For after-tax income, y_2^{cc}, it is assumed in this case that the family has to pay for formal childcare and that these expenses are potentially tax-deductible. Four education groups are distinguished in the data based on ISCED-97 educational classifications.[10]

After-tax family incomes are simulated based on the OECD Tax Benefit Model. This simulation carefully and consistently models the full set of institutional features of the tax and transfer system across countries, taking into account the fact that income tax treatment varies based on marital status and the number and age of children in the household. In particular, child-related transfers across countries are incorporated in great detail, making it an ideal tool to study the impact of these policies on maternal labor supply.

Table 1: Participation Tax Rates and Employment Rates of Second Earners

Country	Part. Tax$_{cc}$	Part. Tax$_{nc}$	Part. Tax Gap	Emp. Rate$_{cc}$	Emp. Rate$_{nc}$	Emp. Rate Gap
US	48.9	28.3	20.6	59.9	75.7	−15.8
UK	47.2	24.1	23.1	67.8	86.9	−19.1
IR	24.4	12.6	11.9	64.5	76.7	−12.2
AT	27.4	20.5	6.8	68.0	83.5	−15.5
FR	32.2	32.4	0.2	68.4	82.5	−14.1
GE	52.4	49.9	2.5	57.6	82.4	−24.8
LU	33.2	31.1	2.1	62.4	68.7	−6.3
NL	33.5	34.5	−1.0	77.0	80.3	−3.3
DK	52.7	46.3	6.4	87.8	85.5	2.3
SE	36.8	28.8	8.0	89.6	89.9	−0.3
SP	27.2	20.7	6.5	58.2	63.8	−5.6
IT	30.9	28.5	2.4	54.3	60.4	−6.1

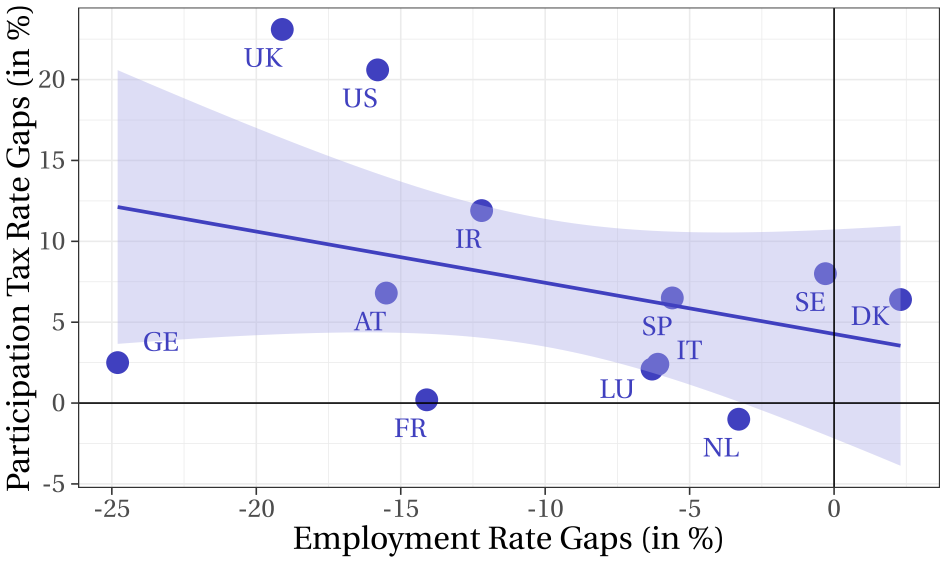
Notes: 'Part. Tax' stands for participation tax rate. The subscript cc indicates families with pre-school children who pay for childcare if both partners work. nc stands for families with no children. Gap is defined as the difference in participation tax rates or employment rates between families with and without children. Tax rates for all countries except the US are computed using EU-SILC data, release EU-SILC Cross UDB 2004-2007 – version of 2020-0. US tax rates are computed based on Basic Monthly CPS data between 2004 and 2007. Note that participation tax rates for Greece cannot be simulated since the EU-SILC does not report gross income for the sample period. Observations with a simulated participation tax rates of over 200% are dropped, which translates into a loss of 4% of observations from the sample.

Table 1 summarizes the simulated median participation tax rates by country. Participation tax rates vary across countries and are especially high in joint taxation countries, such as

[10]These groups roughly correspond to the following educational groups in the US: less than high school, high school, some college, and college graduate.

Germany or the US, and in countries with highly progressive tax systems such as Denmark. In almost all countries in the sample, participation tax rates are higher for married couples with pre-school children compared to married couples without pre-school children. There are two reasons for this finding. First, in the simulation I assume that single-earner couples with pre-school children do not have to pay childcare costs. As soon as the second earner enters the workforce, the couple has to pay childcare costs, which reduces the net benefit from being a two-earner couple, y_2^{cc}. Second, most transfer programs are means-tested and the additional gross household income can push families out of the eligibility range of such transfers, thereby effectively reducing the net benefit of being a two-earner family even further. Figure 5 compares the median gap in participation tax rates between families with pre-school children and families without children to the gap in employment rates from Figure 1. The correlation between both gaps is -0.33, which suggests that countries with higher participation tax rate gaps between married women with and without pre-school children are associated with larger employment rate gaps.

Figure 5: Gaps in Participation Tax Rates and Maternal Employment, 2004-2007



Notes: Data for the US is from the CPS, while employment rates for European countries are based on the ELFS. The sample period is 2004 to 2007. The sample is restricted to married women between the ages of 20 and 49. Married women without pre-school children include married women without children and married women with children older than six. The blue shaded area is the 90-percent confidence interval.

To provide evidence at the micro-level that higher participation tax rates reduce the probability of mothers working, I regress the participation tax rate gap ($PTax\ Gap_{i,k}$) of family i in country k on an indicator $y_{i,k}$ that takes the value of one if the mother of the family works:

$$y_{i,k} = \alpha_k + \beta_k PTax\ Gap_{i,k} + \gamma X_{i,k} + \varepsilon_{i,k}.$$

A mother is defined to be working if she reports an annual labor income of at least 6500

Table 2: Dependent Variable: Indicator Whether the Second Earner Works

	US	UK	IR	AT	FR	GE	LU	NL	DK	SE	IT	ES
PTax Gap	-0.42^{***}	-0.19^{**}	-0.26^{**}	-0.56^{***}	-1.31^{***}	-0.34^{***}	-0.82^{***}	-0.11	-2.65^{***}	-2.48^{***}	-1.43	-1.49^{***}
	(0.01)	(0.08)	(0.10)	(0.14)	(0.17)	(0.06)	(0.26)	(0.08)	(0.29)	(0.20)	(1.10)	(0.19)
Earn_1	-0.12^{***}	-0.19^{***}	-0.11^{***}	-0.04	-0.17^{***}	-0.30^{***}	-0.17	-0.20^{***}	-0.06	-0.10	0.09	0.07
	(0.01)	(0.04)	(0.04)	(0.06)	(0.05)	(0.06)	(0.11)	(0.07)	(0.05)	(0.09)	(0.07)	(0.05)
Edu_2	0.29^{***}	0.23^{***}	0.39^{***}	0.31^{***}	0.34^{***}	0.30^{***}	0.46^{***}	0.37^{***}	0.16^{***}	0.14^{***}	0.48^{***}	0.35^{***}
	(0.01)	(0.03)	(0.04)	(0.04)	(0.02)	(0.02)	(0.06)	(0.02)	(0.04)	(0.04)	(0.04)	(0.02)
Edu_1	-0.11^{***}	-0.02	0.01	-0.04	0.07^{**}	-0.00	-0.02	0.03	-0.09^{**}	0.11^{**}	0.04	0.07^{***}
	(0.01)	(0.03)	(0.04)	(0.04)	(0.03)	(0.02)	(0.06)	(0.02)	(0.04)	(0.04)	(0.04)	(0.02)
Ch<6	-0.31^{***}	-0.49^{***}	-0.24^{***}	-0.72^{***}	-0.41^{***}	-0.46^{***}	-0.47^{***}	-0.25^{***}	0.15^{**}	-0.04	-0.07	-0.03
	(0.01)	(0.06)	(0.07)	(0.06)	(0.04)	(0.04)	(0.09)	(0.04)	(0.07)	(0.07)	(0.07)	(0.06)
Ch<12	-0.23^{***}	-0.31^{***}	-0.28^{***}	-0.37^{***}	-0.37^{***}	-0.32^{***}	-0.54^{***}	-0.32^{***}	0.13^{**}	0.27^{***}	-0.24^{***}	-0.11^{**}
	(0.01)	(0.05)	(0.07)	(0.05)	(0.04)	(0.04)	(0.09)	(0.03)	(0.06)	(0.08)	(0.07)	(0.05)
N	36,149	1,869	1,036	1,924	3,696	3,884	653	4,402	3,241	2,015	1,645	2,709

Standard errors in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$

Notes: Probit regression. Sample period: 2004–2007. Data for the US is from the CPS and for all European countries from the harmonized EU-SILC data, release EU-SILC Cross UDB 2004–2007 - version of 2020-0. The sample includes families with up to four children in which the mother is between 20 and 49 years old and born in the respective country. Husbands with an annual labor income below EUR 6,500 (USD 8,000) are dropped. The mother is considered to be working if she has annual earnings above EUR 6,500 (USD 8,000). 'PTax Gap' is the difference between the participation tax rate for a family with children and the hypothetical participation tax rate if the same family does not have children. 'Earn_1' captures the labor earnings of the primary earner normalized by the average earnings in a given year in a given country. 'Edu_2' is the education category of the secondary earner, while 'Edu_1' is the education category of the primary earner. 'Ch<6' captures the number of children less than the age of 6 and 'Ch<12' the number of children less than the age of 12. Additional control variables include age and age squared of the mother and a constant term.

EUR (8000 USD). Vector $X_{i,k}$ contains control variables including the earnings of the husband[11], the education level of both spouses, the number of children aged 0 to 5, the number of children aged 6 to 11, and the age and age squared of the mothers. In each country, the sample is restricted to families with up to four children. Only families with mothers between the ages of 20 and 49 and husbands with labor incomes of at least 6500 EUR (8000 USD) annually are included in the sample. I proceed in two steps to construct the main explanatory variable, *PTax Gap*$_{i,k}$. First, I simulate the participation tax rate for every family conditional on the age(s) and number of children in the household using the OECD Tax Benefit model. I apply the same methodology as described above to infer maternal labor income in the non-observed labor market state. Second, I repeat the same procedure, assuming that no children are present in the family. Hence, in this counterfactual world, the same families are ineligible for child-related transfers. The difference between these two simulated participation tax rates yields the main explanatory variable of interest.

[11]The majority of married couples in the 2004-2007 data consists of opposite-sex couples. Hence, married couples in the model consists of a male and a female and both spouses differ in terms of their age-earnings profiles and their human capital accumulation. The data analysis is, therefore, focused on opposite-sex couples for consistency.

The results are shown in Table 2. Even after controlling for the earnings of the husband (Earn_1), the education of both earners in the household (Edu_1 and Edu_2), and the numbers of children between the ages of 0 and 5 and the ages of 6 and 11 in the family (Ch<6 and Ch<12), the results clearly suggest that a higher gap in participation tax rates is associated with a lower probability of the mother working. Note that the estimated participation tax rate gap coefficients for Italy and the Netherlands are negative, yet insignificant.

Thus far, the analysis imposes that the husband's labor supply is exogenous and hence independent of the labor market status of the mother, a problem that is hard to overcome in cross-sectional data such as the EU-SILC or the CPS. However, if child-related transfers jointly affect a couple's decision of whether or not to specialize after childbirth, the labor supply decision of the husband is an endogenous object. Another issue of the cross-sectional analysis is a lack of exogenous variation in participation tax rate gaps to identify a causal link of child-related transfers on maternal labor supply. While such an analysis is not possible with the current data, several studies have exploited exogenous variations stemming from policy reforms related to a specific child-related transfer program. Cascio et al. (2015) summarize the findings based on a recent set of reforms and document the range of small to large maternal labor supply effects. They hypothesize that child-related transfers interact with other country-specific policies and argue that such interactions are key to understanding these varying empirical estimates. Similarly, Kleven (2020) challenges the estimated effects of expansions in the Earned Income Tax Credit (EITC) on the labor supply of women from previous studies. He argues that the positive labor supply effects previously attributed to EITC expansions may in fact be driven by confounding factors, such as a thriving macroeconomy and other aspects of a large welfare reform in the 1990s. These arguments point to the fact that a structural analysis of maternal labor supply incentives from a macroeconomic perspective may yield new insights into the varying effects of child-related transfers across countries.

Section 2, therefore, outlines a structural framework in which married couples with children jointly make labor supply decisions. The model carefully takes out-of-pocket childcare costs, the tax treatment of labor income, and transfer policies into account to capture the country-specific context that Cascio et al. (2015) refer to as a potential source for the varying effects of child-related transfers on maternal labor supply in the data.

2. Model

To study the employment decision of married women with small children across countries, a dynamic model of household labor supply and savings is developed. Children often only stay with their parents for a certain period of time and eventually leave the household. However, the employment decisions taken by mothers early in life matter for earnings even when children have left the household. Female human capital therefore evolves endogenously in the model, while male human capital follow exogenous earnings profiles conditional on education. If both parents work, couples pay out-of-pocket childcare costs. Only a fraction of families in the economy have access to informal childcare provided by grandparents, which means they pay no childcare costs even if both parents work. Households face labor income taxes and receive child-related transfers if they are eligible for the subsidy.

In addition to married couples, there are single male and female households in the economy. Single female households may have children, while single males are always assumed to be childless for simplicity.[12] Single households are included in the model to assess the impact of child-related transfers on the government budget. Since both married couples and single mothers may be eligible for child-related transfers, it is important to account for single households with children when trying to assess the impact of such transfer programs on the government budget. In addition, the design of child-related transfers varies substantially across countries and not all countries differentiate child-related transfers according to marital status. A model economy with both single and married households allows to capture the economy-wide effects of transfers on the government budget.

Finally, to study the impact of child-related transfers across countries, the differential income tax treatment of married couples and singles has to be taken into account. Changes to the labor income tax code, as well as capital or consumption taxes have large effects on prices in the economy. Hence, the model is developed in general equilibrium. In addition, such a framework allows to capture the effect of married women moving in and out of employment on the government budget due to changes in child-related transfers. Notice that the model also introduces an endogenous savings choice, which helps to capture employment rates over the life cycle.

2.1 Firms

Firms hire capital K and labor L_y on perfectly competitive factor markets to transform them into a single output good according to the Cobb-Douglas production technology given by

$$Y \equiv F(K, L) = AK^{\alpha} L_y^{1-\alpha}. \tag{1}$$

Capital depreciates at rate δ_k. Total labor services, L, are divided into labor available for the production of consumption goods, L_y, and labor used to provide childcare services, L_c, such that $L = L_y + L_c$. Since childcare is provided using labor services only, the rate for childcare services is simply the wage rate w. Households can purchase a risk-free asset that pays a competitive rate of return given by $r = R - \delta_k$.

2.2 Households

The economy is populated by a continuum of males m and females f and $j \in \{1, 2, ..., J\}$ denotes the ages of the individuals. The population grows at a constant rate n. Hence, the fraction of agents of the population at age j is given by $\mu_{j+1} = \frac{\mu_j}{1+n}$. Individuals begin their life at working-age in period 1, retire after period J_R, and die at the end of period J. Individuals are either born single or married and marital status is constant throughout the lifetime.

[12] Note that the fraction of single fathers in the 2004-2007 data is still very low.

If a couple is married, both individuals are assumed to be the same age.

Labor Productivity Individuals are endowed with a certain level of education at the start of their life. These exogenous education types are given by $z \in Z$ for males and $x \in X$ for females and both sets X and Z are finite. Male productivity evolves exogenously over the lifetime, conditional on the initial level of education, such that the age-specific labor productivity of a male with education level z in period j is given by $\omega_m(z, j)$. Female education types map into an initial human capital level, $h_1 = \eta(x)$ at the start of period 1. Female human capital evolves endogenously thereafter. Female productivity in the next period is described by Λ and depends on individual initial education type x, current period human capital h, current period labor supply l_f, and age j. Λ is increasing in the female education x and current period human capital h and non-decreasing in labor supply l_f:

$$h' = H(x, h, l_f, j) \qquad \forall\, h \in H. \tag{2}$$

The distributions of agents by household type, education, and spouse education for married couples are stationary. First, let $M_j(z)$ be the distribution of all males in the economy of education type z at age j. Further, let $F_j(x)$ define the distribution of all females by education type and age j. Since marital status is invariant over the life cycle, the following identities have to be satisfied:

$$M_j(z) = \sum_{x \in X} \Omega_j(z, x) + \Pi_j(z) \tag{3}$$

$$F_j(x) = \sum_{z \in Z} \Omega_j(z, x) + \Lambda_j(x). \tag{4}$$

$\Omega_j(z, x)$ is the distribution of females of education type x married to a male of education type z. The distribution of singles by education type is given by $\Pi_j(z)$ for males and $\Lambda_j(x)$ for females. Since marital status does not change over the life cycle, the distribution of married couples, $\Omega_j(z, x) = \Omega(z, x)$, and single males, $\Pi_j(z) = \Pi(z)$, must be constant across all ages j, which implies that the distribution of all males is stationary, $M_j(z) = M(z)$. In addition, for single females, $\Lambda_j(x) = \Lambda(x)\ \forall j$, which implies that $F_j(x) = F(x)$ at all ages j.

Children Household either have no children or two children attached to them. If a household is born with children, these children arrive either early (period 1) or late (period 2) in the life cycle. This gives rise to three childbearing types: households *without children*, *early child bearers*, and *late child bearers*. The childbearing type for each household is indexed by $b = \{0, 1, 2\}$, respectively. Children stay in the household for three model periods, that is, *early child bearers* raise children in periods 1, 2, and 3, while *late child bearers* nurture in periods 2, 3, and 4. The age of a child is indicated by $s = \{1, 2, 3\}$.

Cost of Childcare A fraction of households has access to informal care

$$\mathbb{I}(g) = \begin{cases} 0 & \text{if } g = 1 \\ 1 & \text{otherwise} \end{cases} \tag{5}$$

This function takes the value of zero if $g = 1$, that is, if households have access to informal care provided by grandparents, they do not incur any childcare costs. In the absence of informal care, a working mother, either single or married, has to purchase formal childcare. The cost of care, ψ_i, varies with child age i and is modeled as a fraction of the average earnings in the economy. Notice that the fraction of income spent on childcare is independent of maternal education or household income. Empirically, we observe that mothers with higher education spend a larger fraction of household income on childcare for every child. At the same time, lower educated households spend less on childcare per child, but tend to have more children. These two effects counteract each other in the model, such that the childcare expenses are modeled as a constant fraction of the average earnings.

Utility Cost from Joint Work Married couples face an additional utility cost from joint work, $q \in Q$, where Q is a finite set. Couples draw this fixed cost at the beginning of their lives, which remains constant throughout the lifetime. It captures all residual heterogeneity in couples beyond labor income, education, age, their childbearing status and whether or not they have access to informal childcare. The initial draw of q is conditional on the education type of the husband, z. Let $p(q|z)$ be the probability that the cost of joint work amounts to q, with $\sum_{q \in Q} p(q|z) = 1$.

Going back to Cogan (1981), who estimated labor supply functions of married women and found that fixed costs are an important feature, models of family labor supply often introduce a fixed cost of joint work (see, for example, Cho and Rogerson (1988) and Kaygusuz (2010)). Such a cost, however, has many possible interpretations. q could be preferences for joint leisure time, but also capture productivity differences in home production (Boerma and Karabarbounis (2019)), or be the result of disagreement within couples (Doepke and Kindermann (2019)). None of these potential sources are explicitly accounted for in this model setup. Despite this model simplification, the joint labor supply problem of married couples is not trivial in the model due to the presence of endogenous female human capital accumulation, childcare costs, and the availability of informal childcare.

Preferences Individuals derive utility from consumption c and dislike market work l_n, $n = \{m, f\}$. Utility is additively separable and the momentary utility function for a single male or single female household is

$$u_n^S(c, l_n) = \log c - \phi l_n^\chi \qquad n = \{f, m\}. \tag{6}$$

Married couples maximize the summed utility of individual household members. The weight and curvature of the disutility of labor is identical for all individuals, independent of gender and marital status:

$$u^M(c, l_m, l_f, q) = 2\log c - \phi l_m^{\chi} - \phi l_f^{\chi} - q\mathbb{I}(l_f > 0). \tag{7}$$

2.3 Government

The government taxes labor income, collects social security contributions and levies a flat tax on capital income. It uses these tax receipts to subsidize families with small children through transfers and childcare subsidies, to pay old-age benefits to retirees, and to finance government consumption.

Income Taxation and Child-related Transfers The taxable income is defined as the sum of labor income and capital income. For a working-age single male household, taxable income equals $I_m^S = w\omega(z,j)l_m + ra$, and for working-age single females, $I_f^S = wh_x l_f + ra$. Taxable income for working-age couples is given by $I^M = w\omega(z,j)l_m + wh_x l_f + ra$. All workers, in addition, pay social security contributions.

The total tax liability for the different household types is also contingent on the presence of children. The government subsidizes households through tax credits and childcare subsidies, conditional on household income and parental employment status. There are two types of tax credits in the economy. The first type is only contingent on the presence of a child in the household, $k = 1$. The second type is also contingent on total household income. This type of tax credit fully reduces the household's tax liability of total income I, is below a threshold $\bar{I}$, and phases out at a constant rate if $I > \bar{I}$. This tax credit fully phases out if $I > \hat{I}$.

The tax functions $t^S(I_m^S, k)$, $t^S(I_f^S, k)$, and $t^M(I^M, k)$ summarize the labor income tax code in the economy, tax credits related to children, childcare subsidies, and capital taxes. They can be interpreted as the *effective income tax rate* that households face. This general representation of the labor income tax code encompasses both individual and joint taxation regimes.

Old-age Benefits Old-age benefits are not taxed by the government so taxable income for retirees is simply capital income, defined as $I^R = (1 + r)a$. Old-age benefits depend on the innate education type of the individuals, which helps to capture the positive correlation between lifetime earnings and the size of old-age benefits. The levels of old-age benefits for single females, single males, and married couples are $p_f^S(x)$, $p_m^S(z)$ and $p^M(x, z)$, respectively, all conditional on initial education levels.

2.4 Household Problem in Recursive Form

This section lays out the decision problem for married and single households in recursive form. The state space for single males is given by $\{a, z, j\}$ and for single females by $\{a, x, h, b, g, j\}$. For married couples, the state space is given by $\{a, z, x, h, b, q, g, j\}$. Notice that $b = 0$ for all households without children. Single male households never have children attached to them.

Single Males The decision problem of a single male household, essentially, can be decomposed into two periods: working age, $j < J_R$, and retirement, $j \geq J_R$. Single males choose consumption and savings in both periods according to

$$V_m^S(a,z,j) = \max_{a',l_m} \left\{ u_m^S(c,l_m) + \beta V_m^S(a',z',j+1) \right\} \tag{8}$$

subject to

$$(1+\tau_c)c + a' = \begin{cases} (w\omega_m(z,j)l_m + ra)(1 - t^S(I_m^S, 0)) + a(1 + r(1-\tau_a)) & \text{if } j < J_R \\ \\ a(1+r(1-\tau_a)) + p^S(z) & \text{if } j \geq J_R \end{cases}$$

and

$$l \geq 0, \quad a' \geq 0 \qquad \text{and} \quad I_m^S = w\omega_m(z,j)l_m + ra.$$

Single Females In contrast to single males, single females can be born with children attached to their household. The presence of a child in a given period is indicated by $k = 1$. If females have children, they can be early ($b = 1$) or late child bearers ($b = 2$). If they are early child bearers, $k = 1$ during ages $j = \{1,2,3\}$, while $k = 1$ during ages $j = \{2,3,4\}$ for late child bearers. $\mathbb{I}(g)$ indicates whether or not mothers have access to informal care. If mothers do not have access to informal care from grandparents, $\mathbb{I}(g = 1) = 0$ and no childcare costs are incurred. The cost of formal care varies with the child's age $i = \{1,2,3\}$. Female human capital evolves endogenously. Hence, the state space for females is characterized not only by their innate education level x, but also by current period human capital h.

To simplify the notation, let $\mathbf{s}_f^S \equiv (x, b, g)$ be the vector of exogenous state variables for single females. If $g = 1$, females have access to informal care provided by grandparents and do not pay for formal care. They choose consumption and savings as given by

$$V_f^S(a,h,\mathbf{s}_f^S,j) = \max_{a',l_f} \left\{ u_f^S(c,l_f) + \beta V_f^S(a',h',\mathbf{s}_f^S,j+1) \right\} \tag{9}$$

subject to

$$(1+\tau_c)c + a' = \begin{cases} (wh_x l_f + ra)(1 - t^S(I_f^S, k)) + a(1+r(1-\tau_a)) & \\ -\omega\psi_i \mathbb{I}(l_f > 0)\mathbb{I}(g = 0) & \text{if } j < J_R \text{ and } k = 1 \\ \\ (wh_x l_f + ra)(1 - t^S(I_f^S, k)) + a(1+r(1-\tau_a)) & \text{if } j < J_R \text{ and } k = 0 \\ \\ a(1+r(1-\tau_a)) + p^S(x) & \text{if } j \geq J_R \end{cases}$$

and

$$l \geq 0, \quad a' \geq 0 \qquad \text{and} \quad I_f^S = wh_x l_f + ra.$$

Married Couples Both spouses maximize the sum of the individual utilities of both spouses. Consumption is a public good. Similar to female singles, married couples can be of all child-bearing types, $b = \{0, 1, 2\}$. Let s^M be the state space of exogenous state variables for married couples, $\mathrm{s}^M \equiv (z, x, q, b, g)$. Couples maximize household utility by choosing consumption, labor supply, and savings according to

$$V^M(a, h, \mathbf{s}^M, j) = \max_{a', l_f, l_m} \{u^M(c, l_m, l_f, q) + \beta V^M(a', h', \mathbf{s}^M, j+1)\} \tag{10}$$

subject to

$$(1+\tau_c)c + a' = \begin{cases} (w\omega(z,j)l_m + wh_x l_f + ra)(1 - t^M(I^M, k)) & \\ +a(1 + r(1-\tau_a)) - \omega\psi_i \mathbb{I}(l_f > 0)\mathbb{I}(g = 0) & \text{if } j < J_R \text{ and } k = 1 \\ & \\ (w\omega(z,j)l_m + wh_x l_f + ra)(1 - t^M(I^M, k)) & \\ +a(1 + r(1-\tau_a)) & \text{if } j < J_R \text{ and } k = 0 \\ & \\ a(1 + r(1-\tau_a)) + p^M(x, z) & \text{if } j \geq J_R \end{cases}$$

$$l \geq 0, \quad a' \geq 0 \qquad \text{and} \qquad I^M = w\omega(z,j)l_m + wh_x l_f + ra.$$

2.5 Stationary Equilibrium

The analysis in this paper compares stationary equilibria. The aggregate state of the economy consists of stationary distributions over household types, assets, and human capital levels. In the stationary equilibrium, all factor markets clear. In particular, aggregate capital (K), aggregate labor (L), which is the sum of labor used in the production of goods (L_y) and labor used in childcare services (L_c), is provided at competitive factor prices $R = F_1(K, L_y)$, where $r = R - \delta_k$ and $w = F_2(K, L_y)$. The government taxes labor income and pays benefits during retirement. A formal definition of the stationary equilibrium of this economy can be found in Appendix B.

3. Calibration

The model is used to understand what accounts for the variation in the maternal employment gap across countries. Thus, the calibration proceeds in two steps. First, the model is calibrated to match data moments from US data. More specifically, parameter values are assigned to endowments, preferences, technology, childcare costs, and policy parameters related to tax and transfer functions. This economy is referred to as the benchmark economy throughout the paper. To perform policy experiments across countries, the parameters related to childcare costs, capital and consumption taxes, as well as the tax functions that govern labor income taxes and child-related transfers are adjusted to country-specific values.

Endowments Individuals start their life at age 25, work for 40 years, retire at age 65, and die with certainty at age 80. One model period corresponds to five years, which implies that individuals live for 11 periods. The first model period corresponds to ages 25 to 29 $(j = 1)$ and the retirement period starts at ages 65 to 69 $(j = J_R)$. Population growth is set to 1.1% per annum, which is the average population growth rate for the US economy between 1960 and 2000.

Males and females start out as one of four education types: high school (hs), some college (sc), college graduate (col), more than college $(col+)$. Age-efficiency profiles are constructed by computing the average weekly wages using annual wages and salary income divided by the number of weeks worked. The data to compute age-efficiency profiles comes from the March Supplement of the 2000 CPS and follows Guner et al. (2012). Wages are normalized by the average wages for all males and females between the ages of 25 and 64. The sample restrictions are based on Katz and Murphy (1992). First, the sample is restricted to the civilian population who work full-time. Excluded are self-employed and unpaid workers. In addition, workers who make less than half the minimum wage are excluded. The labor productivity profiles for males and females, fitted to the US data using second degree polynomials, are taken from Guner et al. (2012). They use fitted values to calibrate the labor-efficiency units for males, $\omega(z, j)$. Initial labor-efficiency levels for females in period 1 are established following the same procedures as for males. Table C.4 in the Appendix shows the initial efficiency levels for males and females and the corresponding gender wage gap. The initial gender differences are about 10% smaller for both low and high educated females in Denmark. The evolution of female human capital after period 1 follows Attanasio et al. (2008) and is determined by

$$h' = H(x, h, l_f, j) = \exp\left[\ln h + \alpha_j^x \mathbb{I}(l_f > 0) - \delta_x(1 - \mathbb{I}(l_f > 0))\right]. \tag{11}$$

Human capital depreciation for the US benchmark economy is taken from Guner et al. (2012) who use the Panel Study of Income Dynamics (PSID) to estimate human capital depreciation conditional on female education following Mincer and Ofek (1982).

Demographics $F(x)$ and $M(x)$ are the stationary distributions of females and males by innate education type. The distributions are estimated using US data from the 2004 Census and are based on all household heads and spouses belonging to the ages 30-39. This age group is selected to capture the distributions of individuals across productivity types during their prime-age working years. In addition, the fraction of females and males for each education cell is computed using the same sample. 26% of households are single and 74% of households are married. Using the data for married households, the distribution of married households by male and female education, $\Omega(z, x)$, is constructed. Table C.6 summarizes the distributions.

Children There are three childbearing types in the model: *childless*, *early child bearer*, and *late child bearer*. Every single female and every married couple can be one of the three child-bearing types, while single males are always childless. Early child bearers have two children at ages 25 to 29, 30 to 34, and 35 to 39, which corresponds to model periods 1, 2, and 3. In contrast, late child bearers have children during model periods 2, 3, and 4, corresponding to ages 30 to 34, 35 to 39, and 40 to 44. In the US data from the 2004 June Supplement, conditional on having a child, married couples have on average two children and these births occur within a relatively short time period, between ages 25 to 29 for low educated households and 30 to 34 for high educated households. For single households the fraction of 40 to 44 year old women who were never married or divorced and never had children determines the measure of women who never have children in the model ($b = 0$). Next, the fraction of females aged 25 and older with their last birth between the ages of 25 and 29 gives the fraction of early child bearers ($b = 1$). Finally, females aged 25 and older with their last birth between the ages of 30 and 34 determine the fraction of late child bearers ($b = 2$). The distribution of females by childbearing type is given in Appendix C.8 for singles. US Census data is used to calculate the fraction of childless married couples with childless women aged 40 to 44.[13] The Census only provides information on the total number of children in the household, not the total number of births. Thus, the fraction of married couples aged 35 to 39 with no children in the household are used as a measure for childless married couples. The CPS June Supplement is used to calculate the fraction of couples above the age of 25 who have a child early (age 25-29) or late (30-34) in the life cycle. Appendix C.9 shows the distributions.

Out-of-pocket Childcare Costs In the US, out-of-pocket childcare costs paid by parents for full-time formal center-based care vary substantially. Some families may pay 100% of costs, others may have fully subsidized care, while still others may have partially subsidized care. Eligibility for childcare subsidies is based on state-determined criteria for family income and work requirements and these requirements vary widely by state. The OECD Tax Benefit Model assumes cost and eligibility criteria as observed in Michigan. In 2004, a full-time center-based daycare spot was 7,916 USD for a child less than three years of age and 6,616 USD for children in the age group 3-5 years. Using data from the Survey of Income and Program Participation (SIPP), families spend on average 10% of their income on childcare for children below the age of 6 and around 7.7% for school-age children.

For European countries, the OECD Tax Benefit model summarizes the cost of childcare conditional on the age of the child. For example, the maximum payable price for public day care is calculated as a proportion of the average expenses for all day care facilities of a given type in the municipality in Denmark. The proportion that parents pay can be at a maximum of 30%. The OECD Tax Benefit Model assumes public day care center fees before subsidies of 26,700 DKK (4,463 USD) for children 0 to 2 years of age and 19,000 DKK (3,176 USD) for children aged 3 to 5 years. This corresponds to 8.4% of the average Danish income in 2004 for children below the age of 3 and to 6% for children aged 3 to 6. Childcare costs for other European countries are calculated in a similar way following the estimates provided by the

[13]The fraction of childless married females is too small in the CPS June Supplement.

OECD.

Informal Care Data on the fraction of households that use informal care as their primary care arrangement for children comes from the SIPP for the US. In the US data, more highly educated mothers spend more on childcare than do less educated mothers, which potentially reflects the differences in childcare quality. At the same time, more highly educated mothers have fewer children. These two effects counteract each other in the model and almost cancel out perfectly.[14] I, thus, abstract from model the variation of childcare cost by maternal education and the variation in the number of children by maternal education type. In 2004, about 24% of US families used informal care (i.e., care provided by grandparents) as their primary care arrangement for children under the age of 6.

Capital and Consumption Taxes Consumption tax rates and capital tax rates are provided by McDaniel (2012), who calculates these tax rates from NIPA data. The advantage of using these tax rates over simple value added tax rates is that they capture both excise taxes and exemptions from value added taxes. The difference between consumption and capital taxes between the US and European countries is large. For example, while the consumption tax in the US is about 7.5%, the same tax is more than four times as large at 31% in Denmark.

Nonlinear Labor Income Taxes The tax functions for singles and married couples without children, $t^S(I,0)$ and $t^M(I,0)$, are approximated using the OECD Tax Benefit model, which is comparable to the NBER TaxSim module for the US. The OECD Tax Benefit model calculates labor income taxes according to the statutory labor income tax code and includes employee social security contributions and benefits, conditional on the number of children, child age, and marital status. The OECD model calculates the household net income for any combination of male and female earnings for married couples. It takes standard deductions, such as basic allowances, allowances for children, and deduction of social security contributions into account. In addition, since 2004 the tax deductibility of childcare expenses is included. The model abstracts from individual non-standard deductions, such as mortgage payment deductions and deductions for expenses on household helpers.

Using the module, I compute the effective tax rate for a single household with earnings between 0 and 6 times the average wage in the economy using an equally spaced grid of 251 grid points. For married couples, I construct a two-dimensional grid. One dimension captures the labor income of married women, while the other dimension captures the earnings of a married men. The combination of both incomes gives the effective tax rate that the couple faces. Female labor income varies between 0 and 6 times the average wage in the economy and is approximated on 251 grid points. Male earnings vary between 0 and 9 times the average wage in the economy and 151 grid points are used to capture earnings for males. This gives a total of 37,901 combinations of husband and wife labor incomes. I then use two-

[14] Guner et al. (2020) introduce both channels into the model and do not find that it significantly affects their conclusions, even in the cross-section.

dimensional interpolation to find the effective tax rate that a model household faces given the individual earnings of both spouses.

Child-Related Transfers The presence of children in the household is indicated by $k = 1$. The functions $t^S(I, 1)$ and $t^M(I, 1)$ approximate the effective tax rates for families with children. The tax grids are computed under the assumption that every household has two children of ages 2 and 4 attached to it. To compute the effective tax rates for households with young children, I take advantage of the special 2004 OECD Taxing Wages module, that implements the tax deductibility of childcare expenses in addition to benefits, such as child tax credits and single-parent benefits, across countries.

The OECD Tax Benefit model computes the relevant transfers and tax credits conditional on statutory eligibility criteria. For example, childcare expenses in the US are only tax deductible if the mother is working and programs such as the Child Care and Development Fund (CCDF) or the Child and Dependent Care Credit (CDCC) are means-tested. In Denmark, on the other hand, child benefits are universal. In addition, child-related transfers often vary with the age of the child and sometimes with the number of children. The OECD Tax Benefit model accounts for this variation across countries.

Preferences Following Kaygusuz (2010), Guner et al. (2012) and Guner et al. (2020), χ, the elasticity of labor supply, is set to 0.4. This is consistent with survey estimates (see Blundell and MaCurdy (1999), Domeij and Flodén (2006), and Keane (2011) for a discussion of these estimates). Given χ, I choose the value for the disutility of labor, $\phi = 5.71$, to match average hours worked per worker in the data, which is 44%. Average hours worked are calculated using a sample of all employed and unemployed individuals between the ages of 25 and 64 in the CPS data. I assume that individuals work 80 hours per week at most. The discount factor β is set to 0.973 annually, such that the capital-to-output ratio is 2.93, which is consistent with US data.

The utility cost from joint work for married couples is calibrated using the method developed in Kaygusuz (2010), which was later applied in Guner et al. (2012), Bick and Fuchs-Schündeln (2018), and Guner et al. (2020). At the beginning of their life cycle, married couples draw a utility cost parameter conditional on the husband's initial education type z. The utility cost parameter q_z is drawn from a flexible gamma distribution with shape parameter k_z and scale parameter θ_z and $\Gamma(\cdot)$ is the Gamma function:

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

The Gamma function is approximated on a discrete grid. Parameters z, k_z, and θ_z are selected in such a way that the employment rates of a female with education type x married to a male of education type z are matched as closely as possible to the US data. This implies that for each couple of type (z, x), there is a q_z^* that makes the a married women indifferent to working or not working. This optimal q_z^* will be higher for women with a higher education who can earn higher returns for market work. Hence, married women with a higher education will have a higher employment rate conditional on the husband's education, a pattern that is consistent with the data. Appendix C.12 summarizes the parameters governing the distributions of utility costs.

Table 3: Employment rates of married females, ages 25-54

	USA			
male /female	High school	Some college	College	College+
High school	48.7	66.5	71.2	78.8
Some college	52.6	72.8	77.4	85.1
College	54.4	70.8	75.7	84.2
College +	52.6	67.9	70.8	75.6
Total	50.4	70.7	74.2	78.3

Notes: Data comes from the March Supplement of CPS, 2004-2007. The sample is restricted to married women who are part of the civilian labor force, between the ages of 25 and 54, and individuals who are recorded as reference person or spouse.

Using CPS data between 2004 and 2007, I calculate the employment-to-population ratio based on individuals in the civilian labor force (i.e., excluding armed forces). Table 3 displays the resulting distributions. The average employment rate for married females aged 25 to 54 is 72.3%. It is not surprising that the employment rates of women increase with education, conditional on the husband's education. Yet, conditional on the women's educational level, the employment rates of females have a nonlinear relationship as the education of the husband increases. Female employment rates increase with the husband's education if he is less than college-educated and start declining again if the husband has a college degree or more. The exception is high-school educated females, where the employment rates increase up until the point where the husband is college educated. The rates only decline once the husband has more than a college degree. Calibrating the utility cost conditional on the male education group makes sure that the model matches these patterns.

Technology The capital share, α, of the Cobb-Douglas production function and the capital depreciation rate, δ_k, are calibrated using a notion of capital that includes fixed private capital, land, inventories, and consumer durables. The capital-to-output ratio for the period 1960-2000 is on average 2.93 annually. The capital share is set to 0.343 and the annual depreciation rate to 0.055.

Summary Table 4 summarizes the parameter choices for the benchmark economy. While the previous sections have detailed which parameters were chosen from exogenous estimates, the following parameters are chosen to match specific targets. First, the discount factor, β, is chosen to match the capital-to-output ratio in the model. Next, disutility of market work, γ, is chosen to match average hours worked in the model. Finally, the utility cost from joint work for married couples, $p(q|z)$, is chosen such that the employment rates for married females, conditional on their own education type and their husband's education type, are matched.

Table 4: Parameter Values of the Benchmark Economy

Description	Parameter	Value	Target/ Source
		A. Preferences	
Discount factor	β	0.973	Capital-to-output ratio
Intertemporal elasticity	γ	0.400	Literature estimates $[0.2, 0.4]$
Disutility of work	ϕ	5.710	Average hours worked
Joint utility cost	$p(q|z)$		Female employment by education
		B. Technology	
Capital share	α	0.342	Guner et al. (2012)
Depreciation rate	δ_k	0.055	Guner et al. (2012)
		C. Female Human Capital	
Depreciation fem COL+	δ_1	0.020	PSID data
Depreciation fem <COL	δ_2	0.009	PSID data
Growth female HC	α_j^x		Guner et al. (2012)
		D. Childcare Costs	
Childcare cost young	ψ_1	0.100	Childcare exp. for 0-5 yr olds
Childcare cost old	ψ_2	0.077	Childcare exp. for 6-15 yr olds
		E. Government	
Capital income tax	τ_a	0.236	McDaniel (2012)
Consumption tax	τ_c	0.075	McDaniel (2012)
Income tax schedule	$t^M(I,k)$		OECD Tax Benefit Model
	$t^S(I,k)$		OECD Tax Benefit Model
Old-Age-Benefits	$b^M(x,z)$		CPS data (see Appendix)
	$b^S(x)$		CPS data (see Appendix)
	$b^S(x)$		CPS data (see Appendix)

4. Benchmark Economy

The benchmark economy is calibrated to US data between 2004 and 2007. At the aggregate level, the model matches the moments targeted by the calibration reasonably well. The capital-to-output ratio is 2.93 in the data versus 2.91 in the model. Average hours worked in the benchmark economy are 0.42 compared to 0.44 in the data. The employment rate of all married women of ages 25 to 49 is 73.7% in the model and 74.6% in the data, a moment targeted by calibrating the joint utility cost for married couples. The model almost perfectly matches the employment rate of mothers with children age 0 to 4, which is 59.6% in the model and 59.5% in the data. It also predicts the employment rate of women with children older than 14 years of age or with no children with 84.6% as compared to 82.7% in the data. The resulting maternal employment gap for the US is 25.0% in the model compared to

23.2% in the data. Even though the model does not explicitly target the employment rates of these subgroups of married women, the model captures the extensive margin of labor supply fairly well. Along the intensive margin, the model fails to replicate much of the variation hours worked between the three groups of women. This is due to the fact that time costs of children are not present in the model. Without such time costs, the time budget of married women with and without young children is identical to the one of women without children. Conditional on working, they choose to supply roughly the same amount of hours in the model. In the US data, however, the gap in hours between mothers with children of ages 0 to 4 and women with children is roughly 13 hours per week. Note that the hours gap for married women is very pronounced in the US. Appendix Table A.2 shows that in many European countries, hours worked vary much less between married women with and without pre-school children. Since the paper is motivated by the empirical observation that higher participation tax rates for the second earner reduce employment rates in the data, it focuses on employment rates rather than hours worked. It tries to understand to what extent the design of child-related transfers alters participation tax rates and introduces an incentive for married couples to specialize.

Table 5: Results for the US Benchmark Economy

		Data	Model
	A. Aggregate Moments		
	K/Y	2.93	2.91
	Average Hours	0.44	0.42
	B. Employment Rates of Married Women, 25-49		
(i)	All Women	74.60	73.70
(ii)	Women with no Children of Ages 0-14	82.71	84.60
(iii)	Mothers with Children of Ages 0-4	59.51	59.60
	C. Employment Gaps of Married Women, 25-49		
(iv)	Employment Gap (i)-(iii)	15.09	14.10
(v)	Employment Gap (ii)-(iii)	23.20	25.00

Notes: The table summarizes moments of the benchmark economy and compares them to the data. Data is from the CPS March Supplement 2004-2007. Aggregate moments in panel A. are targeted by the calibration. Employment rates of all women, mothers with young children and women without children of age 0 to 14 in panel B. are not explicitly targeted. Employment gaps in Panel C. are not targeted by the calibration as well. Note that the employment gap in (v) is the model equivalent to the gaps reported in Figure 1.

4.1 The Role of Endogenous Female Human Capital

Endogenous female human capital plays a critical role in the model to match the employment rates of married women over the life cycle. Endogenous human capital provides a strong incentive for women to work and generates persistence in employment decisions relative to a model without endogenous human capital formation. This can be seen in two ways. First, if the model does not include human capital depreciation, employment rates of married women drop by about 10 percentage points. Drops in employment rates are concentrated among the least educated women and women with young children. This means that in the absence of human capital depreciation, more women would choose not not work during the model periods where children are part of the household, thereby avoiding both childcare costs and the utility cost from joint work. Second, if human capital depreciates but the growth rates of female human capital are kept constant over the life cycle at the values for age group 45 to 49 (see Appendix Table C.5), the employment rate of married women drops by 12 percentage points. Not surprisingly, constant wage growth over the life cycle also implies that employment rates are almost constant across age groups, which contradicts the data.

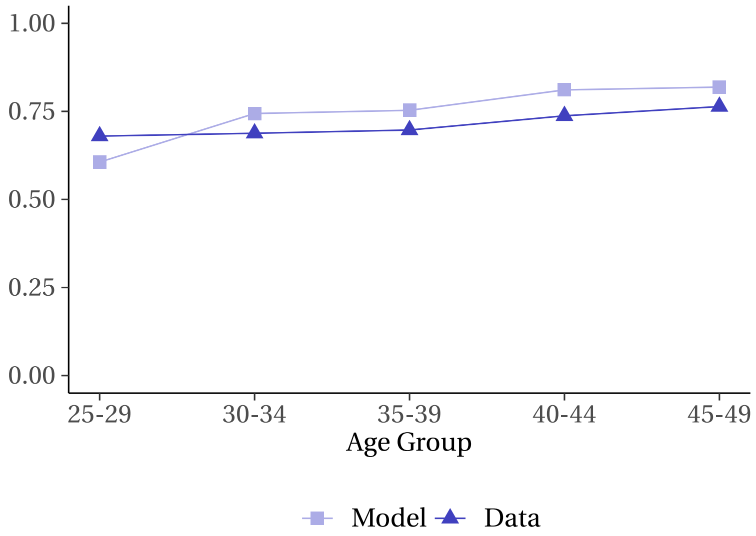
4.2 Female Employment Over the Life Cycle

Figure 6 shows the employment rates for married women of ages 25-49 by age group and compares them to the US data from the CPS March Supplement. The model understates the employment rates for the age group 25-29 to some extent, while employment rates for women of ages 30 and older are slightly higher than in the data. Overall, the model captures the employment rate of married women over the life cycle very well.

Figure 7 displays the gender wage gap of the benchmark economy. In the economy, human capital for all married women is observed, independent of whether women are working or not. Following Guner et al. (2012), I report the gender wage gap for all married women by age groups in the benchmark economy, regardless of their employment status. To construct a comparable measure in the data, wages for married women who do not work have to be imputed. This is done using a Mincer regression with selection correction (Heckman (1979)). The benchmark economy replicates the pattern of the gender wage gap in the data.

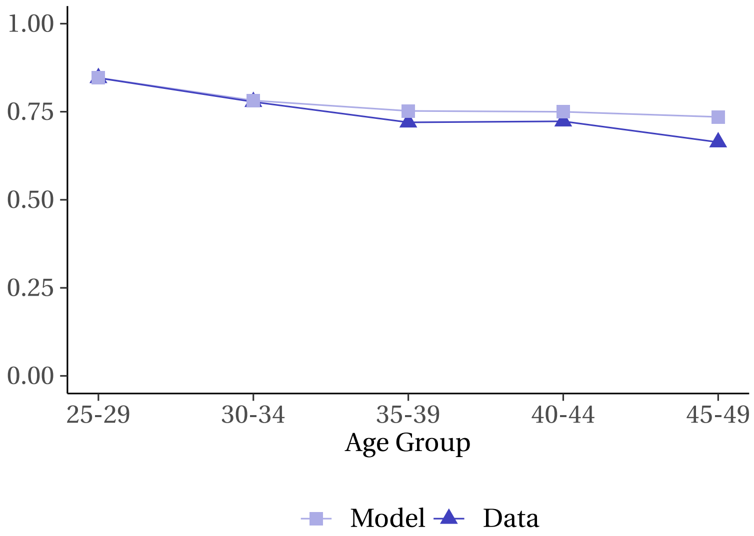
The benchmark economy also implies earnings penalties related to children for married women. I compute the differences in earnings for women who have children at the age of 25-29 in the model and compare them to the earnings of women who never have children in the model. Earnings for these mothers are on average 18% lower by the time they reach age 30-34 compared to women in the same age group who never have children. Kleven (2022) uses a pseudo-panel approach to estimate the long-run child penalty 5 to 10 years after the birth of a child using CPS data for the US. The long-run child penalty in earnings for married women is estimated to be around 34% for married women. This means the model captures about 53% of the long-run child penalty in the data.

Figure 6: Employment Rates of Married Women, 25-49



Notes: Employment rates of married women between the ages of 25-49 in the model and the data are plotted by age group. Data for the US is from the CPS March Supplement 2004-2007.

Figure 7: Gender Wage Gap of All Women, 25-49



Notes: The Figure compares the gender wage gap of all women between the ages of 25-49 in the model and the data. Data for the US is from the CPS March Supplement 2004-2007.

4.3 Child-Related Transfers Drive the Maternal Employment Gap

To identify the model component that is most important for explaining the differences in employment rates for married women with and without children, I pursue the following strategy. First, I remove the three model features that affect households, and in particular women with and without children, differently. These features are the cost of childcare, $\psi_i = 0$, access to informal care, $g = 0$, and child-related transfers, $s_k = 0$. In the quantitative model, this implies that the tax functions, $t^M(I, 0)$ and $t^S(I, 0)$, are applied to families with young children. Second, I use the same three model features successively to understand their impact on maternal employment rates. This strategy gives rise to four economies:

(1) No child-related differences: $\{\psi_i, g, s_k\} = 0$
There are no model differences between households with and without children, which implies that the budget constraint for married couples with and without children is identical. The same holds for the budget constraint of single households with and without children.

(2) Childcare-cost-economy: $\{\psi_i > 0, g = 0, s_k = 0\}$
Mothers who work have to purchase formal childcare. No working mother has access to informal care and no child-related transfers are paid.

(3) Informal-care-economy: $\{\psi_i > 0, g > 0, s_k = 0\}$
In this economy, working mothers have to pay out-of-pocket childcare costs, but a fraction of them has access to informal care.

(4) Benchmark economy: $\{\psi_i > 0, g > 0, s_k > 0\}$
This calibration is identical to the benchmark economy, in which households receive child-related transfers, a fraction of families have access to informal childcare, and working mothers without access to informal care face out-of-pocket childcare expenses.

In order for the government budget to clear in each economy, non-productive government spending has to adjust. The reason is that labor income taxes, social security contributions and child-related transfers are determined by parameters or the tax functions that assign the effective tax rate to every household conditional on marital status and whether or not the household has children. Retirement benefits paid out by the government are determined by parameters that were taken from the data. As a result, the only component of the government budget that can vary across economies is government spending.

Table 6 summarizes the results of the decomposition exercise. It reports the maternal employment gap and the change in the employment gap across model economies. Relative to the no child-related differences economy, in which households face no costs of having children, introducing out-of-pocket childcare costs for working mothers, $\psi_i > 0$, makes the employment gap bigger. The model-predicted size of the employment gap due to childcare costs is only roughly one third of gap observed in the data. Given the high level of childcare costs in the US economy, out-of-pocket childcare costs introduce a sizable increase in the

Table 6: Decomposition Exercise

	(1) - (2) $\psi_i > 0$	(2) - (3) $g > 0$	(3) - (4) $s_k > 0$	Data
Maternal Employment Gap	4.30	-1.70	14.10	15.09
Aggregate Effects				
Change in the Employment Gap (in pp)	10.90	-6.00	15.40	
% Change Employment Rate Married Women	-4.00	0.25	-7.82	
% Change Employment Rate Mothers with Children 0-4	-15.38	8.37	-27.70	
% Change Hours Per Female Worker	13.67	-8.44	-6.22	
% Change Tax revenue / Output	-13.33	15.38	-13.33	

Notes: The table summarizes the maternal employment gap and the change in the maternal employment gaps, hours per female worker, average hours per worker, the employment rate of married women and tax revenue to output across the various model economies. The maternal employment gap is defined as the difference in the employment rate of all married women ages relative to married women with children of ages 0 to 4. Married women in the age group 25 to 49 are considered.

maternal employment gap by 10.9 percentage points. The increase in the employment gap is mainly driven by a drop in employment rates of married women during the first three model periods when families have young children. Conditional on working, the average hours of women increase. However, the tax revenue relative to GDP declines as a result of out-of-pocket childcare costs. Note that the model overpredicts hours worked for married women with young children. Hence, the changes in hours per female worker and tax revenue relative to GDP should be interpreted with caution and can be thought of as an upper bound of the effect of married women with children moving in and out of employment across the model economies.

The increase in the maternal employment gap due to out-of-pocket childcare costs in (2) is largely alleviated by allowing a fraction of households in the economy to have access to informal care, $g > 0$, as in model economy (3). Informal care implies that households with access to this type of care no longer face out-of-pocket childcare costs. The employment rate of married mothers with young children increases by 8.37%. As a result, tax revenue relative to GDP increases compared to economy (2). It is crucial to note, however, that the maternal employment gap cannot be matched, even qualitatively, if only out-of-pocket childcare costs and informal care arrangements are considered. The economy predicts a negative maternal employment gap for the US, meaning that women with small children have a slightly higher employment rate compared to all married women.

Model version (4), the benchmark economy, taxes households with young children according to the statutory labor income tax code. That is, it accounts for child tax credits and the tax deductibility of childcare costs, $s_k > 0$. Introducing child-related transfers back into the model economy results in the largest change of the maternal employment gap. The employment rate of married women with young children declines by 27.7%. The aggregate change masks varying responses for married couples of different education types. Table 7 shows the decomposition by education of the changes in employment rates between economies (3) and (4). The impact of child-related transfers, s_k, is particularly strong for married women with less than college education. The impact is even stronger when the spouse is less than college educated. These households are affected the most by the means-tested US policy programs designed to subsidize low-income families with children. These programs introduce large reductions in the effective tax rates for households with children and an increase in household income due to the mother working may not be optimal since it may result in the household no longer being eligible for child-related transfers.

Table 7: Change in Employment Rates by Education Group

	Employment(Benchmark) - Employment($s_k = 0$)			
male /female	HS	SC	COL	COL+
HS	-18.0	-15.7	-3.9	0.1
SC	-5.3	-7.3	-2.3	-1.4
COL	-8.7	-1.5	0.7	0.7
COL+	-0.6	0.9	-0.3	-7.6

Notes: The table summarizes the differences in the employment rates of married women 25-49 by own education and education of the spouse when child-related transfers are introduced in back into the model economy.

Given that child-related transfers reduce maternal employment in the US economy, the question is whether we can understand which policies are driving this results. The three largest programs that subsidize families with children are (1) higher tax breaks and the extended income brackets that determine eligibility for the EITC; (2) the Child Tax Credit (CTC); and (3) childcare subsidies through the CCDF and the Child Care and Dependent Care Credit (CCDC). Table 8 breaks down the effect of removing each of these policies individually from the benchmark economy and shows the resulting employment gap between married women with and without children. Removing the additional EITC benefits is the only policy that reduces the employment gap between married women with and without children, while removing the CTC or childcare subsidies increases the employment gap to a small degree.[15] In other words, introducing the extended EITC for married couples with children increases the maternal employment gap in the benchmark economy. The reason is that the extended EITC implies that a fraction of households now falls into the eligibility range of the program, but benefits are phased out as household income increases. Hence, an additional fraction of couples in the economy is now better off if the married mother does not work in order for the family to remain eligible for EITC benefits (Meyer, 2002). Becoming ineligible for the tax

[15] Note that the EITC experiment does not correspond to a removal of the entire EITC program from the economy, but simply removes the extended tax credits for families with children relative to families without children.

credit can be interpreted as an increase in the participation tax rate for the married woman. Higher participation tax rates imply that a fraction of married households will choose to be a single-earner rather than a two-earner household. This finding is consistent with the empirical results presented in Section 1. Removing childcare subsidies, on the other hand, has the opposite effect: it reduces maternal employment in the cross-section across almost all education groups (see Table 9).

Table 8: Child-related Transfers in the US by Child-Related Transfer Program

Employment Rates	Data	Benchmark	(1) no addEITC	(2) no CTC	(3) no CC subsidies
(i) All Women	74.6	73.10	78.7	71.4	72.6
(ii) Women with children 0-4	59.5	59.0	69.9	56.0	57.8
(iii) Employment Gap (i) - (ii)	15.1	14.1	9.0	15.4	14.8
Δ			-5.1	1.3	0.7

Notes: (1) no addEITC removes the extended tax credits for families with children of the EITC program. All families face the tax credits that families without children face in a given income bracket. (2) removes the Child Tax Credit. (3) removes all childcare subsidies coming through either the CCDF or CCDC.

Table 9: Changes in Employment Rates: Individual Policies

	Emp(Benchmark) - Emp(no addEITC)				Emp(Benchmark) - Emp(no CC subsidies)			
male/female	HS	SC	COL	COL+	HS	SC	COL	COL+
HS	11.9	11.6	7.1	3.2	3.5	-5.9	-3.8	-2.7
SC	8.8	9.2	1.8	1.2	2.5	-1.7	-2.0	0.0
COL	14.7	4.3	0.6	0.2	-3.3	-5.0	-0.5	-0.7
COL+	11.1	7.2	1.8	-0.5	-2.3	-0.1	-0.2	-0.1

Notes: The table summarizes the differences in the employment rates of married women 25-49 by own education and education of the spouse relative to the benchmark economy when (i) the additional EITC benefits for married couples with children are removed, or (ii) childcare subsidies are removed.

5. Cross-country Results

To provide evidence that child-related transfers can also explain the variation in maternal employment gaps across countries, the decomposition exercise from Section 4.3 is repeated for a sample of 13 European countries. The exercise is similar in spirit to the macroeconomic cross-country studies by Prescott (2004) and, more recently, Bick and Fuchs-Schündeln (2018). The key idea is to take the US benchmark economy and only vary parameters that govern taxes, transfers, childcare costs, and access to informal childcare across countries and to ask how much of the variation in the maternal employment gap can be explained by these parameters.

In contrast to the studies mentioned above, this paper considers a joint household labor supply decision problem in a dynamic life cycle model in which female human capital evolves endogenously. The impact of child-related transfers on maternal labor supply cannot be easily assessed in a static framework since children usually arrive early during the life cycle, but the effects of employment decisions taken early in life have important implications for human capital accumulation and therefore earnings profiles over the entire working life. Note that the analysis is conducted in general equilibrium. The reason is that changes in labor income, capital and consumption taxes across countries have considerable effects on prices, savings and therefore hours worked in the model. I want to fully capture these effects and understand how much of the maternal employment gap can be explained by child-related transfers beyond the changes generated by tax and transfer policies unrelated to children.

Table 10 and Table 11 summarize the impact of country-specific policies, while keeping preference parameters, technology parameters, and the evolution of female human capital unchanged (Panel A. to C in Table 4). This also includes the utility cost of joint work, q. Only childcare costs, access to informal care, and government taxes and child-related transfers are adjusted across countries (Panel D. and E in Table 4). When interpreting the results, it is important to keep in mind that there are many reasons to think that q is not constant across countries, especially if it captures factors such as preferences for joint leisure time, home productivity, or disagreement within couples. Hence, it is not surprising that not all of the variation in maternal employment rates across countries can be explained through the variation in taxes, transfers and childcare costs. However, keeping preferences the same across model economies implies that we can study the effect of child-related transfers in a setting where policy differences will not affect maternal employment rates through preferences. Hence, the quantitative exercise captures variation in employment rates across countries that is purely driven by policy, something that cannot be observed in the data.

Results in Table 10 and Table 11 show that for many countries in the sample, the key result from the benchmark economy holds. If child-related transfers are removed from the economy as in Panel B. of both tables, maternal employment gaps are in often counterfactual to the data since the model implies that married women with children of ages 0 to 4 work at higher rates than all married women. France and the UK are the exception. In France, just accounting for labor income taxes already generates a small positive maternal employment gap. Similarly, taxes in the UK generate a positive employment gap that is almost twice as large as in the data and that does not substantially change when child-related transfers are introduced. In all other economies, the introduction of child-related transfers in Panel C. generates a positive maternal employment gap. Note that the size of the gap is often larger than what is observed in the data, except for Austria and Germany in Table 10, implying that factors that are exogenous in the model, such as variation in the utility cost of joint work, q,

Table 10: Cross-Country Evidence 1/2

	Western Europe					Britain	
	AT	FR	GE	LX	NL	IR	UK
A. Data: Employment Rates of Married Women, 25-49							
(i) All Women	78.1	77.4	73.7	62.6	78.4	66.9	79.3
(ii) Mothers with Children of Ages 0-4	68.4	69.1	58.4	62.6	77.4	64.6	68.8
Employment Gap (i)-(ii)	9.6	8.3	15.4	0.0	1.0	2.3	10.5
B. Model Without Child-related Transfers ($s_k^i = 0$): Employment Rates							
Employment Gap (i)-(ii)	−8.8	1.6	−4.3	−5.7	−7.3	−1.2	18.7
C. Model With Child-related Transfers ($s_k^i > 0$): Employment Rates							
Employment Gap (i)-(ii)	10.6	18.9	8.0	8.2	7.4	42.1	19.2

Notes: Panel A. of the table summarizes the maternal employment rates and the maternal employment gap in the data. Panel B. shows the model implied maternal employment gap in the benchmark economy, when consumption, capital and labor income taxes, as well as access to informal care, are adjusted to country-specific values and there are no child-related transfers. Panel C. reports the model implied maternal employment gap if, in addition, country-specific child-related transfers are introduced.

Table 11: Cross-Country Evidence 2/2

	Northern Europe		Southern Europe			
	DK	SW	GR	IT	PT	SP
A. Data: Employment Rates of Married Women, 25-49						
(i) All Women	81.3	91.8	58.7	56.8	73.5	59.5
(ii) Mothers with Children of Ages 0-4	88.1	90.2	57.0	55.1	75.3	58.5
Employment Gap (i)-(ii)	0.2	1.6	1.7	1.7	−1.8	1.0
B. Model Without Child-related Transfers ($s_k^i = 0$): Employment Rates						
Employment Gap (i)-(ii)	11.8	−3.7	−6.5	1.3	−2.7	1.7
C. Model With Child-related Transfers ($s_k^i > 0$): Employment Rates						
Employment Gap (i)-(ii)	1.1	4.5	−5.0	−0.3	−0.7	0.9

Notes: Panel A. of the table summarizes the maternal employment rates and the maternal employment gap in the data. Panel B. shows the model implied maternal employment gap in the benchmark economy, when consumption, capital and labor income taxes, as well as access to informal care, are adjusted to country-specific values and there are no child-related transfers. Panel C. reports the model implied maternal employment gap if, in addition, country-specific child-related transfers are introduced.

are important in explaining maternal employment gaps across countries.

One country that stands out in the analysis is Denmark in Table 11. Introducing Danish tax policies in the US benchmark economy generates an employment gap that is more than 10 percentage points larger than what is observed in the data. Yet, Panel C. shows that Danish child-related transfers reduce the maternal employment gap to 1.1 percentage points, which is much closer to the gap observed in the data. Interestingly, moving from the Danish economy without child-related transfers in Panel B. to the one in Panel C. leaves aggregate output almost unchanged. Tax revenue relative to GDP is also unaltered. However, savings relative to GDP increase and average hours per worker decline as a result of the change in child-related transfers.

Finally, the model cannot explain the maternal employment gap in Southern European countries, such as Greece, Italy, or Portugal. Note that child-related transfers generally have little effect on the employment gap when comparing Panel B. and C. for Southern European economies in Table 11. This is not surprising, given that child-related transfers in these countries do not introduce significant differences in the participation tax rates for families with and without children. Nollenberger and Rodríguez-Planas (2015) point out that Southern European countries show a low level of social assistance for families with children relative to other European economies. In addition, these economies are characterized by institutional characteristics, such as the absence of part-time schemes, a large fraction of service sector jobs with a split work schedule, and other labor market rigidities that make it harder for mothers to enter the labor market (Adsera, 2004). One should also keep in mind that factors such as social norms or variation in childbearing ages are held constant in this experiment. They may be important drivers for the size of the maternal employment gap that are omitted from the analysis.

5.1 Danish Child-related Transfers in the US Benchmark Economy

Given the finding that child-related transfers in Denmark reduce the maternal employment gap, it worth exploring whether these family transfers also have the potential to reduce the maternal employment gap in the US benchmark economy. Consider the following policy experiment: Tax rates for families without children are held constant as in the US benchmark economy. To capture the generosity and design of child-related transfers, the difference in the effective tax rates for families with and without children, that is, $t^S(I,k) - t^s(I,0)$ and $t^M(I,k) - t^M(I,0)$ are imposed in the US benchmark economy. In doing so, the experiment captures the amount of child-related transfers that Danish families with children receive conditional on household income. Non-productive government spending adjusts as a result of the changes in transfers as all other components of the government budget are fixed and informed by exogenous parameters.

Table 12 summarizes the effect of an introduction of Danish child-related transfers into the US economy. The design of Danish transfers closes the employment gap by two thirds from 14.1 percentage points to 4.9 percentage points. This suggests that most the specialization of US households with children is mainly driven by the design of child-related transfers.

Notice, however, that the reduction of the employment gap is a costly policy in the sense that it significantly reduces government tax revenue. The reduction in the employment gap in this experiment is mainly driven by low income households that do not generate enough additional labor income tax revenue to finance the more generous transfers.

Table 12: US economy with Danish child-related transfers

Employment Rates of Married Women, 25-49			
	(i) Data	(ii) Benchmark	(iii) Danish Child-Related Transfers
(i) All Women	74.60	73.70	77.30
(ii) Mothers with Children of Ages 0-4	59.51	59.60	72.40
Employment Gap (i)-(ii)	15.09	14.10	4.90

Notes: The table summarizes the effect of introducing Danish-child related transfers in the US benchmark economy, while keeping capital, consumption and labor income taxes fixed at the benchmark values. Column (iii) reports the results from this policy experiment.

6. Conclusion

The effect of child-related transfers on maternal employment has long been debated in the literature. Recent empirical evidence suggests that not all reforms across European countries in the past 15 years had the intended effect of increasing maternal employment. This paper analyzes the effect of child-related transfers in a dynamic general equilibrium model and shows that the design of child-related transfers matters for the effect on maternal employment. While some policies increase maternal employment, such as childcare subsidies, tax credits may have the opposite effect on maternal employment, particularly if they increase the participation tax rate of the second earner in the household. Results from the benchmark economy confirm that child-related transfers decrease maternal employment the US. Cross-country evidence further suggests that similar patterns are observed across many European countries. Child-related transfers reduce the employment rate of married women with children in most countries relative to an economy in which child-related transfers are absent.

One should keep two caveats in mind when interpreting these results. First, the welfare of parents and children is ignored in the analysis. Hence, the increase in maternal employment in the absence of child-related transfers does not imply that this is welfare-improving for families with children. Rather, the key takeaway is that there are countries in which the design of child-related transfers increases the employment rate of married mothers (for example in Denmark), whereas such transfers introduce incentives for couples with children to specialize in other countries (like the US). In addition, the paper completely ignores the effect of changes in maternal employment on children and their human capital formation. A large literature documents that parental time investments are particularly important when children are young. Hence, increases in maternal employment may result in less time spent with children, which ultimately affects human capital accumulation and productivity in the economy. Policies that increase maternal employment thus may have consequences for the aggregate economy that go well beyond the mechanisms studied in this paper. These questions are left for future research.

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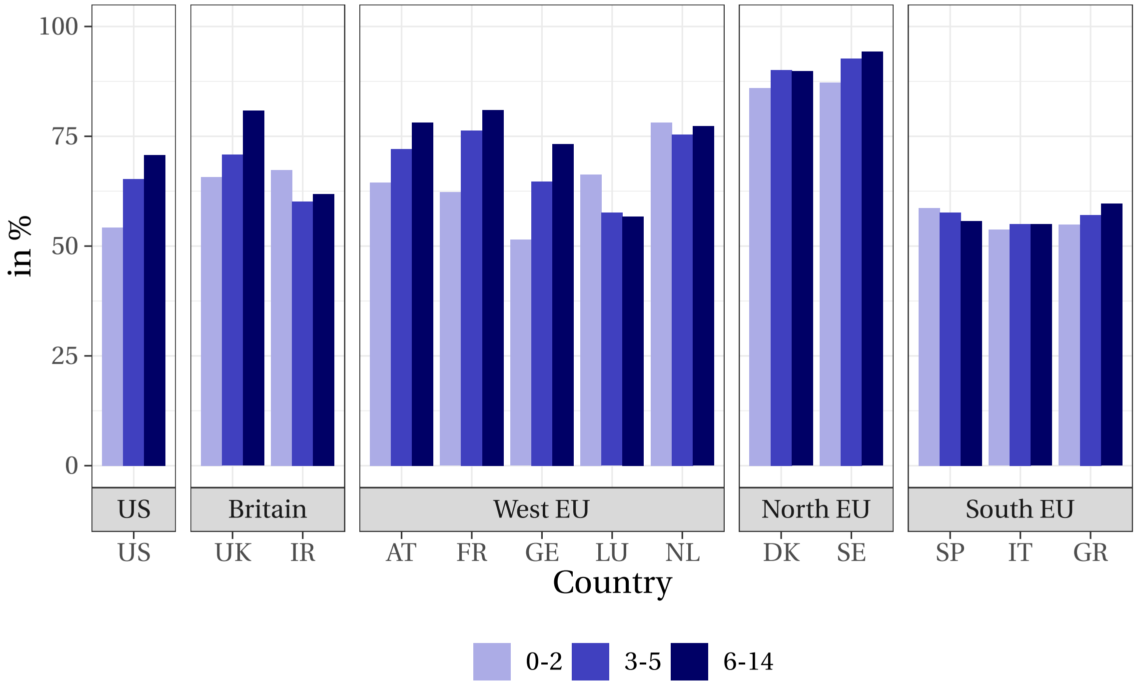
Appendix (not for publication)

A Stylized Facts

Figure A.1: Employment Rates of Married Women By Age of Youngest Child, 2004-2007



Notes: Data for the US comes from the CPS, while employment rates for European countries are based on the ELFS. The sample is restricted to married women between the ages of 25 and 49 and with the youngest child of the household less than the age of 15. Data for Denmark and Sweden comes from the 2010-2015 ELFS Speciality Files as married women with pre-school children cannot be distinguished in earlier waves.

Table A.1: Labor Force Participation and Employment Rates of Married Women, 25-49

	Labor Force Participation Rates				Labor Force Participation Gaps		
country	(i)	(ii)	(iii)	(iv)	(i)-(ii)	(i)-(iii)	(i)-(iv)
IR	66.3	78.4	70.5	68.7	−12.1	−4.2	−2.4
UK	70.5	88.3	85.7	81.0	−17.8	−15.2	−10.4
DK	91.9	90.1	91.9	91.9	1.8	0.0	0.0
SE	92.8	93.3	95.1	94.2	−0.5	−2.3	−1.4
GR	65.0	65.7	66.6	66.2	−0.7	−1.6	−1.1
IT	59.3	64.0	61.6	60.8	−4.8	−2.3	−1.6
SP	65.4	69.8	67.0	66.5	−4.4	−1.6	−1.1
US	61.0	84.8	81.7	76.5	−23.8	−20.7	−15.5
AT	71.2	85.9	83.8	80.7	−14.6	−12.6	−9.5
FR	74.7	87.0	86.2	82.2	−12.2	−11.4	−7.5
GE	62.8	88.6	84.6	79.1	−25.8	−21.8	−16.3
LU	63.6	69.9	64.6	64.3	−6.3	−1.0	−0.7
NL	79.9	82.8	81.7	81.1	−2.9	−1.7	−1.1
	Employment Rates				Employment Gaps		
country	(i)	(ii)	(iii)	(iv)	(i)-(ii)	(i)-(iii)	(i)-(iv)
IR	64.6	76.6	68.5	66.9	−12.1	−3.9	−2.3
UK	68.8	86.9	84.1	79.3	−18.0	−15.3	−10.5
DK	88.1	85.9	88.4	88.2	2.2	−0.3	−0.2
SE	90.2	90.7	92.9	91.8	−0.6	−2.8	−1.6
GR	57.0	59.0	59.3	58.7	−2.0	−2.3	−1.7
IT	55.1	60.5	57.7	56.8	−5.4	−2.6	−1.7
SP	58.5	63.6	59.9	59.5	−5.1	−1.4	−1.0
US	59.5	82.7	79.7	74.6	−23.2	−20.2	−15.1
AT	68.4	83.5	81.2	78.1	−15.1	−12.8	−9.6
FR	69.1	82.8	81.8	77.4	−13.7	−12.7	−8.3
GE	58.4	82.6	78.9	73.7	−24.2	−20.5	−15.4
LU	62.6	68.5	62.6	62.6	−5.9	0.0	0.0
NL	77.4	80.2	78.9	78.4	−2.8	−1.5	−1.0

Notes: The table shows the labor force participation and employment rates of married women between the ages of 25 and 49 for four groups: (i) women with children of ages 0 to 4, (ii) women with children of ages 5-14, (iii) women with no children or children older than 14, (iv) all married women. Data for the US is from the CPS March Supplement 2004-2007. Statistics for European countries are based on the Yearly Files of the ELFS, release 2020, version 3. Data for Denmark and Sweden comes from the 2010-2015 ELFS Specialty Files as married women with pre-school children cannot be distinguished in earlier waves of the ELFS for these two countries.

Table A.2: Usual Hours Worked per Week of Married Women, 25-49

	Usual Hours Worked per Week				Hours Gaps		
country	(i)	(ii)	(iii)	(iv)	(i)-(ii)	(i)-(iii)	(i)-(iv)
IR	29.6	33.5	30.4	30.1	−4.0	−0.8	−0.5
UK	25.6	35.1	31.7	30.0	−9.5	−6.1	−4.4
DK	35.2	35.0	35.0	35.0	0.2	0.2	0.1
SE	35.9	36.9	36.5	36.3	−1.0	−0.6	−0.4
GR	38.1	40.6	39.9	39.4	−2.5	−1.8	−1.3
IT	31.6	34.9	33.5	32.9	−3.3	−1.9	−1.3
SP	34.1	36.5	35.6	35.1	−2.4	−1.5	−1.0
US	17.7	30.4	27.9	25.4	−12.8	−10.2	−7.8
AT	27.3	34.9	32.2	31.2	−7.6	−4.9	−3.9
FR	33.7	35.2	34.4	34.2	−1.5	−0.7	−0.5
GE	24.1	32.0	28.3	27.5	−7.9	−4.2	−3.4
LU	28.0	32.7	29.7	29.2	−4.7	−1.7	−1.2
NL	20.8	26.3	23.0	22.3	−5.5	−2.2	−1.5
PT	38.5	38.3	38.2	38.3	0.3	0.3	0.2

Notes: The table shows the usual hours worked of married women between the ages of 25 and 49 for four groups: (i) women with children of ages 0 to 4, (ii) women with children of ages 5-14, (iii) women with no children or children older than 14, (iv) all married women. Data for the US is from the CPS March Supplement 2004-2007. Statistics for European countries are based on the Yearly Files of the ELFS, release 2020, version 3. Data for Denmark and Sweden comes from the 2010-2015 ELFS Specialty Files as married women with pre-school children cannot be distinguished in earlier waves of the ELFS for these two countries.

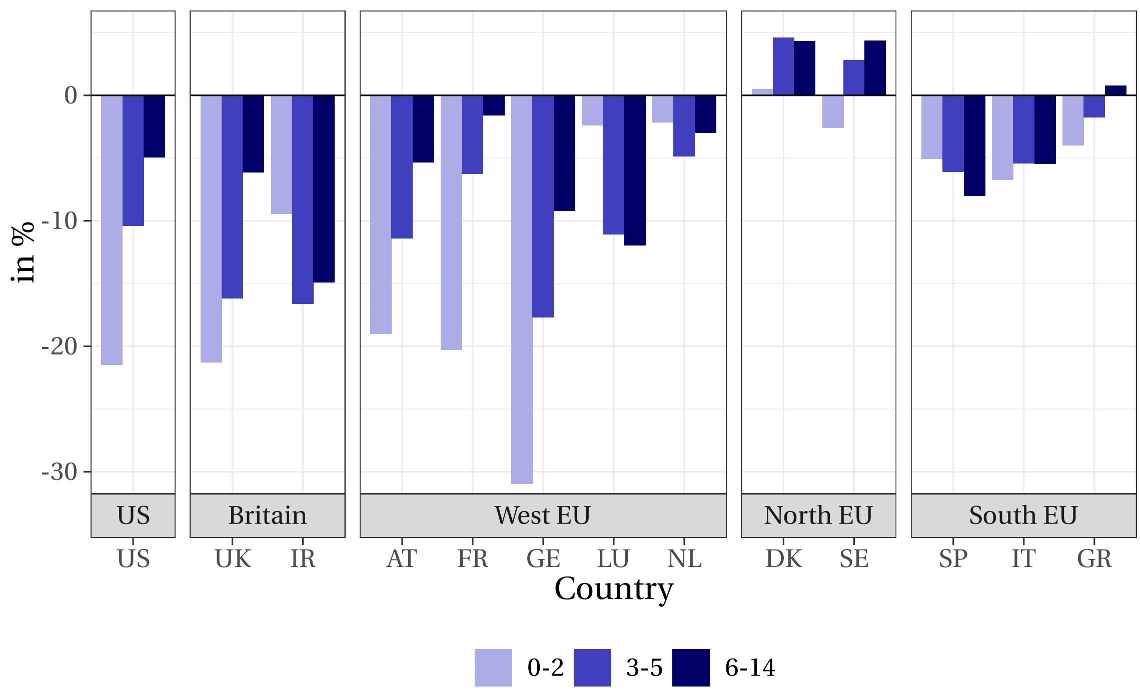
B Stationary Equilibrium

In the stationary equilibrium of this economy, all factor markets clear. The aggregate state of the economy consists of the stationary distributions of households across different household types, over assets and human capital levels. $\chi^S_{m,j}(a, \mathrm{s}^S_m)$ is the distribution of single males across assets and exogenous states in period j. Similarly, $\chi^S_{f,j}(a, h, \mathrm{s}^S_f)$ is the distribution of single females and $\chi^M_j(a, h, \mathrm{s}^M)$ for married couples, both across assets, female human capital levels and exogenous states. The state space is defined as $\mathrm{s}^M \equiv (z, x, q, b, g)$. While assets, a, and female human capital levels, h, are continuous, that is $a \in A = [0, \bar{a}]$ and $h \in H = [0, \bar{h}]$. In contrast, education types z and x, and childbearing types b, access to informal care g and utility cost q are finite.

The distribution of married couples of type (x, z) satisfies at all ages

$$\Omega(z, x) = \sum_q \sum_b \sum_g \int_{A\times H} \chi^M_j(a, h, \mathrm{s}^M)\, dh\, da$$

Figure A.2: Maternal Employment Gaps of Married Women By Child Age, 2004-2007



Notes: Data for the US comes from the CPS, while employment rates for European countries are based on the ELFS. The sample is restricted to married women between the ages of 25 and 49. Married women without pre-school children include both married women without children and married women with children older than the age of 14. Data for Denmark and Sweden comes from the 2010-2015 ELFS Speciality Files as married women with pre-school children cannot be distinguished in earlier waves.

The faction of single males and females is given by

$$\Lambda(x) = \sum_b \sum_g \int_{A\times H} \chi^S_{f,j}(a,h,\mathbf{s}^S_f)\, dh\, da$$

$$\Pi(z) = \int_A \chi^S_{m,j}(a,h,\mathbf{s}^S_m)\, da$$

The distribution of married couples and single females across childbearing types $b = \{0,1,2\}$ and the fraction of households that have access to informal care $g \in \{0,1\}$ have to obey the following: $\sum_b \sum_g \phi^M_{b,g}(x,z) = 1$ and $\sum_b \sum_g \phi^S_{b,g}(x) = 1$.

The decision rules for savings and labor supply are given by $a^S_m(a,\mathbf{s}^S_m,j)$ and $l^S_m(a,\mathbf{s}^S_m,j)$ for single males and $a^S_f(a,h,\mathbf{s}^S_f,j)$ and $l^S_f(a,h,\mathbf{s}^S_f,j)$ for single females. Married couples choose savings, husband labor supply and wife labor supply according to $a^M(a,h,\mathbf{s}^M,j)$, $l^M_m(a,h,\mathbf{s}^M,j)$ and $l^M_f(a,h,\mathbf{s}^M,j)$. The level of human capital is defined by $\mathbf{h}^S$ and $\mathbf{h}^M$ for single and married females:

$$\mathbf{h}^S(a,h,\mathbf{s}^S_f,j) = H(a,h,l^S_f(a,h,\mathbf{s}^S_f,j-1),j-1)$$

$$\mathbf{h}^M(a,h,\mathbf{s}^M,j) = H(a,h,l^M_f(a,h,\mathbf{s}^M,j-1),j-1)$$

Figure A.3: Employment Rates of Married Women with Children < 6, 2004-2007

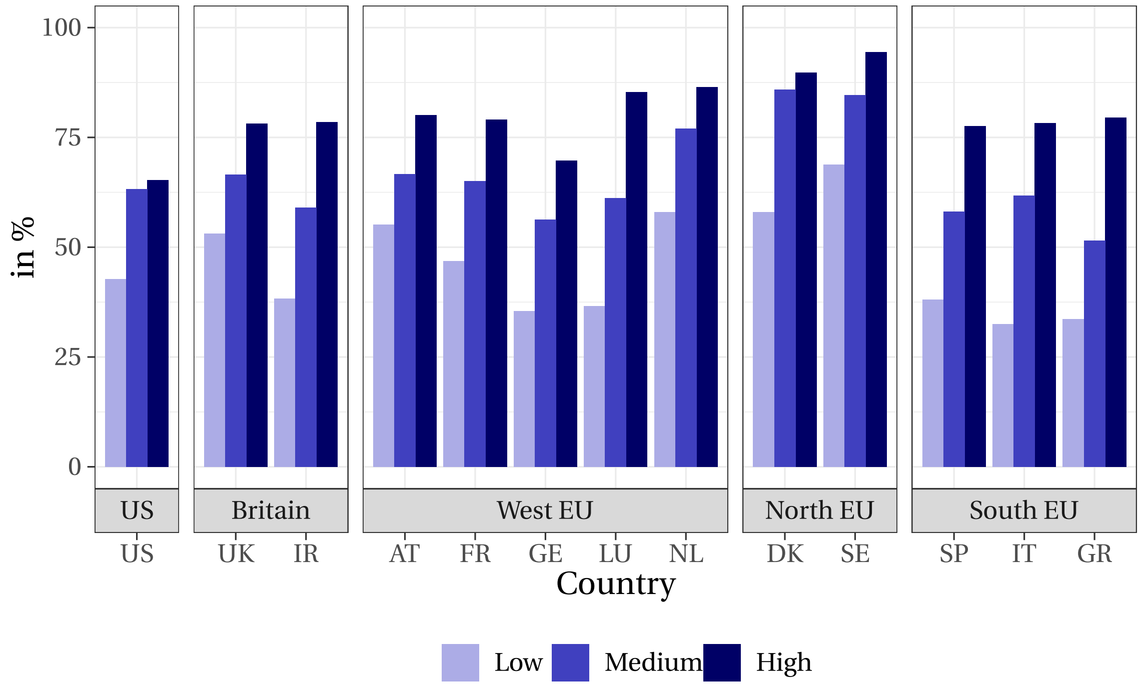
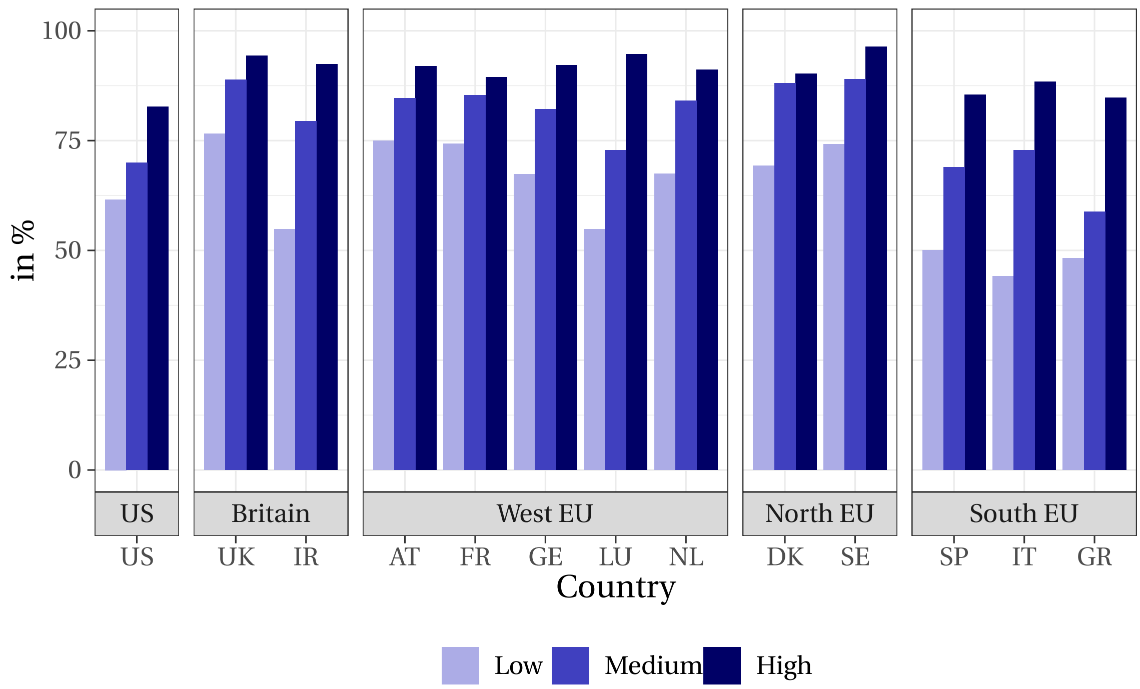


Figure A.4: Employment Rates of Married Women with No Children, 2004-2007



Notes Figure A.3 and Figure A.4: Data for the US comes from the CPS, while employment rates for European countries are based on the ELFS. The sample is restricted to married women between the ages of 25 and 49. Married women without pre-school children include both married women without children and married women with children older than the age of 14. Data for Denmark and Sweden comes from the 2010-2015 ELFS Speciality Files as married women with pre-school children cannot be distinguished in earlier waves.

Finally, the law of motion for the distributions of household types in period $j > 1$ are determined as follows for married, single female and single male households, respectively:

$$\chi_j^M(a', h', \mathbf{s}^M) =$$
$$\int_{A\times H} \chi_{j-1}^M(a, h, \mathbf{s}^M)\mathbb{I}\{a^M(a, h, \mathbf{s}^M, j-1) = a', h^M(a, h, \mathbf{s}^M, j-1) = h'\}\, da\, dh$$
$$\chi_{f,j}^S(a', h', \mathbf{s}_f^S) =$$
$$\int_{A\times H} \chi_{f,j-1}^S(a, h, \mathbf{s}_f^S)\mathbb{I}\{a^S(a, h, \mathbf{s}_f^S, j-1) = a', h^S(a, h, \mathbf{s}_f^S, j-1) = h'\}\, da\, dh$$
$$\chi_{m,j}^S(a', \mathbf{s}_m^S) =$$
$$\int_A \chi_{m,j-1}^S(a, \mathbf{s}_m^S)\mathbb{I}\{a^S(a, \mathbf{s}_f^S, j-1) = a'\}\, da$$

Initial distributions for married couples, single females and single males at $(j = 0)$ are given by

$$\chi_1^M(a', h', \mathbf{s}^M) = \begin{cases} \Omega(z, x)\phi_{b,g}^M(x, z)p(q|z) & \text{if } a = 0,\ h = \eta(x) \\ 0, \text{ otherwise} \end{cases}$$

$$\chi_{f,1}^S(a', h', \mathbf{s}_f^S) = \begin{cases} F(x)\phi_{b,g}^S(x) & \text{if } a = 0,\ h = \eta(x) \\ 0, \text{ otherwise} \end{cases}$$

$$\chi_{m,1}^S(a', \mathbf{s}_m^S) = \begin{cases} M(z) & \text{if } a = 0 \\ 0, \text{ otherwise} \end{cases}$$

Given these recursions, the stationary competitive equilibrium for the economy is given by:

1. The value function $V^M(\chi^M)$, and the policy functions $c(\chi^M)$, $a(\chi^M)$, $l_f(\chi^M)$ and $l_m(\chi^M)$ solve the household optimization problem for married couples given tax functions, factor prices and initial conditions. Similarly, the value function $V_f^S(\chi_f^S)$ and the policy functions $c(\chi_f^S)$, $a(\chi_f^S)$, $l_f(\chi_f^S)$ and solve the optimization problem for single females, and value function $V_m^S(\chi_m^S)$ with policy functions $c(\chi_m^S)$, $a(\chi_m^S)$, and $l_m(\chi_m^S)$ for single males given tax functions, factor prices and initial conditions.

2. Markets for aggregate capital K and labor L clear:

$$K = \sum_j \mu_j \Big\{ \sum_z \sum_x \sum_b \sum_g \sum_q \int_{A\times H} a\chi_j^M(a, h, \mathbf{s}^M)\, dh\, da$$
$$+ \sum_x \sum_b \sum_g \int_{A\times H} a\chi_{f,j}^S(a, h, \mathbf{s}_f^S)\, dh\, da$$
$$+ \sum_z \int_A \chi_{m,j}^S(a, \mathbf{s}_m^S)\, da \Big\}$$

and

$$L = \sum_j \mu_j \Big\{ \sum_z \sum_x \sum_b \sum_g \sum_q \int_{A \times H} [h l_f^M(a,h,\mathbf{s}^M,j) + \omega(z,j) l_m^M(a,h,\mathbf{s}^M,j)] \chi_j^M(a,h,\mathbf{s}^M)\, dh\, da + \sum_x \sum_b \sum_g \int_{A \times H} a \chi_{f,j}^S(a,h,\mathbf{s}_f^S)\, dh\, da + \sum_z \int_A \chi_{m,j}^S(a,\mathbf{s}_m^S)\, da \Big\}$$

3. The factor prices are determined competitively and satisfy

$$w = (1-\alpha)\left(\frac{K}{L_y}\right)^{\alpha} \qquad \text{and} \qquad r = \alpha\left(\frac{K}{L_y}\right)^{\alpha-1} - \delta_k$$

4. The distributions $\chi_j^M(a,h,\mathbf{s}^M)$, $\chi_{f,j}^S(a,h,\mathbf{s}_f^S)$ and $\chi_{m,j}^S(a,\mathbf{s}_m^S)$ are consistent with individual decisions.

5. The government budget balances, i.e. the tax revenue finances government consumption G, childcare transfers TR_c and mean-tested transfers TR_m

$$G + TR_c + TR_m = \Big\{ \sum_z \sum_x \sum_b \sum_g \sum_q \int_{A \times H} T^M(I,k)\, \chi_j^M(a,h,\mathbf{s}^M)\, dh\, da + \sum_x \sum_b \sum_g \int_{A \times H} T^S(I,k)\, \chi_j^S(a,h,\mathbf{s}_f^S)\, dh\, da + \sum_z \int_A T^S(I,0)\, \chi_{m,j}^S(a,\mathbf{s}_m^S)\, da \Big\} + \tau_a r K$$

and government spending on childcare services is defined as

$$TR_c = \theta \sum_{\{\mathbf{s}^M|b\}} \sum_{b=1,2} \sum_{j=b,b+2} \mu_j \int_{A \times H} \mathbb{I}(I \leq \bar{I}) \omega \psi_i \mathbb{I}(l_f > 0) \chi_j^M(a,h,\mathbf{s}^M)\, dh\, da + \theta \sum_{\{\mathbf{s}_f^S|b\}} \sum_{b=1,2} \sum_{j=b,b+2} \mu_j \int_{A \times H} \mathbb{I}(I leq \bar{I}) \omega \psi_i \mathbb{I}(l_f > 0) \chi_{f,j}^S(a,h,\mathbf{s}_f^S)\, dh\, da$$

and means-tested transfers as

$$TR_m = \sum_j \mu_j [\sum_{\mathbf{s}^M} \int_{A \times H} TR^M(I,k) \chi_j^M(a,h,\mathbf{s}^M)\, dh\, da + \sum_{\mathbf{s}_f^S} \int_{A \times H} TR_f^S(I,k) \chi_{f,j}^S(a,h,\mathbf{s}_f^S)\, dh\, da + \sum_{\mathbf{s}_m^S} \int_A TR^S(I,0) \chi_{m,j}^S(a,\mathbf{s}_m^S)\, da]$$

6. The social security balances

$$\tau_p wL = \sum_{j\geq J}[\sum_{\mathbf{s}^M}\int_{A\times H} b^M(z,x)\chi_j^M(a,h,\mathbf{s}^M)\,dh\,da + \sum_{\mathbf{s}_f^S}\int_{A\times H} b_f^S(x)\chi_{f,j}^S(a,h,\mathbf{s}_f^S)\,dh\,da + \sum_{\mathbf{s}_m^S}\int_{A} b_m^S(z)\chi_{m,j}^S(a,\mathbf{s}_m^S)\,da]$$

C Calibration

Table C.3: Evolution of Female Labor Market Productivity (%)

	USA			
	hs	sc	col	col+
25-29	0.129	0.153	0.207	0.145
30-34	0.091	0.109	0.134	0.111
35-39	0.061	0.076	0.083	0.085
40-44	0.036	0.050	0.043	0.064
45-49	0.014	0.027	0.009	0.047
50-54	−0.008	0.006	−0.025	0.032
55-60	−0.029	−0.014	−0.062	0.019

Notes: The table displays values for the human capital appreciation parameter α_j^x, which governs the evolution of female labor efficiency over the lifecycle. Data for the US comes from the 2004 CPS.

Table C.4: Initial Labor Productivity Differences, by Education and Gender

	USA		
	males (z)	females (x)	x/z
hs	0.640	0.511	0.799
sc	0.802	0.619	0.771
col	1.055	0.861	0.816
col+	1.395	1.139	0.817

Notes: The table displays initial productivity levels for males and females, ages 25-29, based on weekly wages. Data for the US comes from the 2004 March Supplement.

Table C.5: Evolution of Female Labor Market Productivity (%)

	USA			
	hs	sc	col	col+
25-29	0.129	0.153	0.207	0.145
30-34	0.091	0.109	0.134	0.111
35-39	0.061	0.076	0.083	0.085
40-44	0.036	0.050	0.043	0.064
45-49	0.014	0.027	0.009	0.047
50-54	−0.008	0.006	−0.025	0.032
55-60	−0.029	−0.014	−0.062	0.019

Notes: The table displays values for the human capital appreciation parameter α_j^x, which governs the evolution of female labor efficiency over the lifecycle. Data for the US comes from the 2004 CPS March Supplement.

Table C.6: Distribution of Married Couples By Education

	Females			
Males	hs	sc	col	col+
hs	28.44	9.19	3.55	0.81
sc	7.54	12.50	5.13	1.50
col	2.14	4.52	10.65	3.63
col+	0.44	1.24	4.39	4.33

Notes: The table shows the fraction of married couples broken down by wife and husband education. The data comes from the 2004 CPS March Supplement. The statistics are based on age group 30-39. All entries add up to 100.

Table C.7: Distribution of Individuals by Gender, Education, and Marital Status

	Males			Females		
	All	Married	Singles	All	Married	Singles
hs	40.42	31.12	9.30	38.39	29.56	8.83
sc	26.58	20.47	6.11	29.33	22.58	6.75
col	21.72	16.72	5.00	23.01	17.72	5.29
col+	11.02	8.49	2.53	9.28	7.15	2.13

Notes: The table shows the fraction of individuals by gender, education and marital status. The data comes from the 2004 CPS March Supplement. The statistics are based on age group 30-39. The breakdown between married and singles is derived under the stationary population assumption that is described in the text.

Table C.8: Childbearing Status of Single Females

	Childless	Early	Late
hs	29.44	59.27	11.29
sc	34.80	48.40	16.80
col	53.07	31.45	15.31
col+	70.56	8.33	21.11

Notes: The table shows the fraction of single females by education and childbearing status. The data comes from the 2002 CPS June Supplement due to the small sample size of the 2004 CPS June Supplement.

Table C.9: Childbearing Status of Married Couples

	Childless				Early			
	Female				Females			
Male	hs	sc	col	col+	hs	sc	col	col+
hs	9.29	10.63	14.63	18.47	68.03	59.90	42.14	42.39
sc	10.44	10.29	12.95	15.30	60.72	59.91	38.72	29.38
col	8.05	10.64	11.48	13.85	59.78	54.13	32.46	19.62
col+	7.79	9.89	8.99	13.13	56.73	39.50	31.30	23.98

Notes: The table shows the distribution of married couples by education type of husband and wife and by childbearing status. The data comes from the 2002 CPS June Supplement due to the small size of the 2004 CPS June Supplement.

Table C.10: Social Security Benefits for Singles

	USA		Denmark	
	Males	Females	Males	Females
hs	1	0.914	1	1.019
sc	1.173	1.059	1.128	1.243
col	1.213	1.067	1.962	1.732
col+	1.291	1.066	1.962	1.732

Notes: The table shows the distribution of social security income for single males and females. The US data comes from the 2000 Census and includes all individuals 70 years and older.

Table C.11: Social Security Benefits for Married Couples

	USA			
	Female			
Male	hs	sc	col	col+
hs	1.755	1.874	1.969	1.879
sc	1.888	1.996	1.978	2.141
col	2.012	2.057	2.096	2.200
col+	2.033	2.110	2.175	2.254

Notes: The table shows the distribution of social security income for married couples by education type of husband and wife. The data comes from the 2000 CPS Basic monthly data.

Table C.12: Parameters governing the distribution for q

Male	k_z	θ_z
hs	1.230	0.345
sc	0.224	2.050
col	0.125	7.780
col+	0.150	2.480

Notes: The flexible gamma distribution is characterized by shape parameter k_z and scale parameter θ_z. Conditional on the husband's type both parameters are chosen to match the average employment rates of all married women by education type.