With Strings Attached: Grandparent-Provided Child care, Fertility, and Female Labor Market Outcomes

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Abstract

Grandparents are regular providers of free child care. Similar to any other form of child care, availability of grandparent-provided child care affects fertility and labor market decisions of women positively. We find that West German women, residing close to parents or in-laws are more likely to have children and that as mothers they are more likely to hold a regular part-or fulltime job. However, different from any other type of child care, for individuals to enjoy grandparent-provided child care on a regular basis, residence choices must coincide with those of parents or in-laws. Thus while living close provides access to free child care, it imposes costly spatial restrictions. We find that hourly wages of mothers residing close to parents or in-laws are lower compared to those residing further away, and having relatives taking care of one's children increases the probability of having to commute. We build a general equilibrium model of residence choice, fertility decisions, and female labor force participation that can account for the relationships between grandparent-provided child care, fertility and labor market outcomes. We simulate our model to analyze how women's decisions regarding residence, fertility, and labor force participation change under different family policies and how these decisions affect their wage income.

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1 Introduction

Grandparents are an important source of child care. Between 16% (Denmark) and 36% (Italy) of grandparents take care of their grandchildren on a daily or weekly basis. In the Netherlands, Belgium, Switzerland, and Ireland more than 20% of grandparents take care of their grandchildren each week, while in Italy, Greece, and Poland more than 20% of grandparents provide daily care (see Figure 1.1).[1]

Figure 1.1: Grandparent-Provided Care
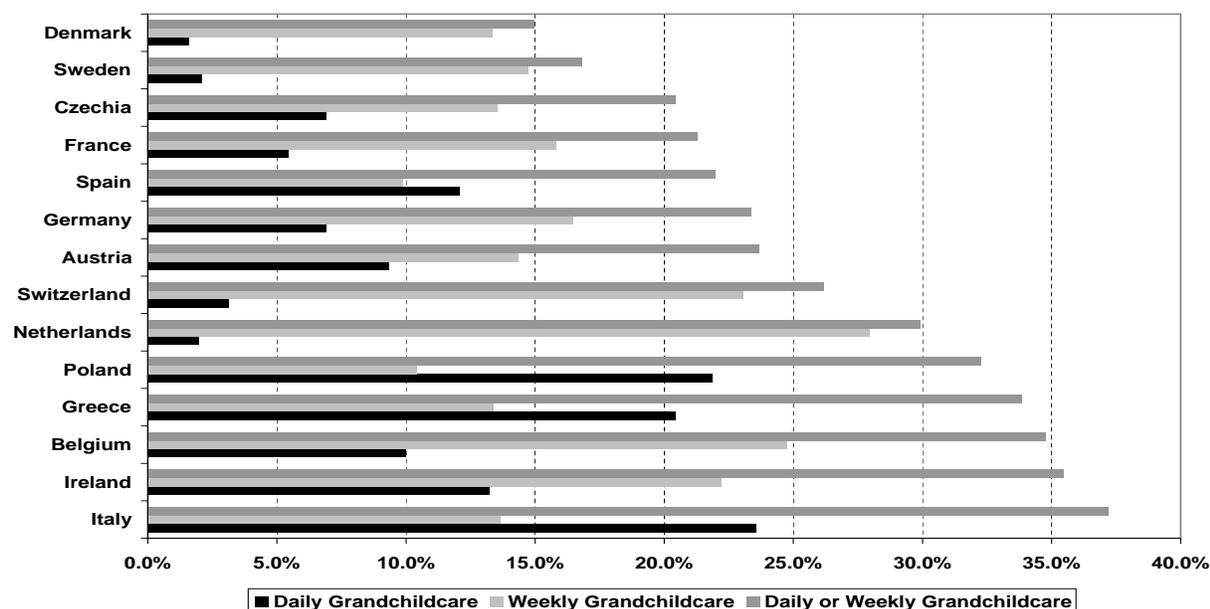
Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2nd wave

The availability of child care and especially cheap or even costless child care has important effects on fertility and mothers' labor force participation. This is important, because while female labor force participation has increased tremendously over the last decades, mothers are still participating significantly less than other women. Studies have found that mothers' labor force participation has important effects on children's well-being, see Waldfogel [2002] for a review of the literature. The main barrier that mothers face at the time of working is to obtain affordable child care (e.g. child care costs in the US can amount to 30% of the income of a family living below the poverty line).[2]

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[1]In the US, 22.7% of children under 5 years are regularly cared for by their grandparents (Overturf Johnson [2005]).

[2]US Census Bureau [2011].

In this sense, grandparent-provided child care provides a relief. However, for parents to enjoy grandparent-provided child care on a regular basis, their residence has to coincide with that of their parents. As numbers in Figure 1.2 show, potential grandparents and care givers tend to reside close by. While in France, Denmark, and Sweden, less than 50% of the elderly reside within 5km of at least one of their adult children, in Spain, Italy, and Poland percentages are up to 80%. In Germany, 55% of parents reside within 5km of at least one of their adult children.

Figure 1.2: Distance to nearest living adult child (> 25 years)
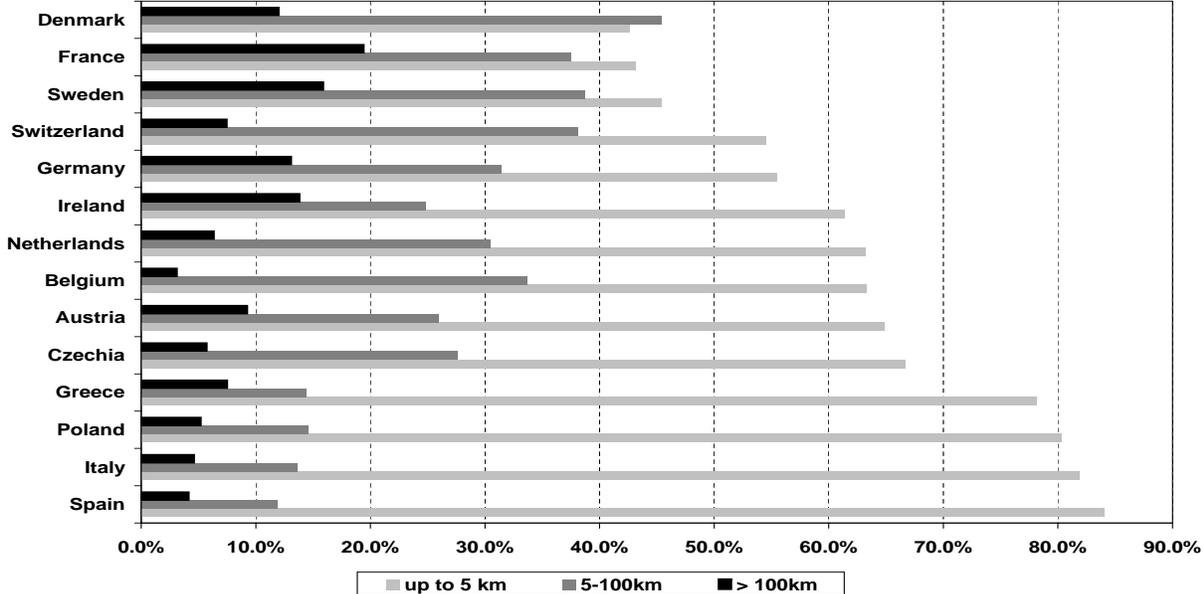
Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2nd wave.

Hence, while grandparent-provided child care comes with all the positive effects on fertility and mothers' labor force participation, different from any other type of child care, it imposes spatial restrictions that might affect labor market outcomes negatively. In this paper we document benefits and costs of grandparent-provided child care. Looking at German data we find that women residing close to parents or in-laws are more likely to have children and as mothers they are more likely to hold a regular full-or part time job. However, their wages are lower and they are more likely to incur daily commutes. We then build a general equilibrium model of residence choice, fertility decisions, and female labor force participation that can account for the relationships between grandparent-provided child care, fertility and labor market outcomes. We simulate our model to analyze how women's decisions on residence, fertility, and labor force participation change under different family policies and how these decisions affect their wage income.

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1.1 Data

We consider data from the German Socio-Economic Panel (GSOEP). This annual panel survey that has been carried out since 1984 provides extensive information on individuals' labor market participation, marital and family status, wages, education, the size of the town they live in etc. For our empirical analysis we make use of two alternative ways of measuring the effect of grandparent-provided child care. The first one is an indirect measure that consists of the variables 'where does mother live' and 'where does father live'. However, only during four waves of the survey (1991, 1996, 2001, and 2006) were participants asked to categorize their parents' relative residence as in: i)the same house, ii)the same neighborhood, iii)the same town, iv)another town but within one hour by car, v)further away, or vi)in a foreign country. Thus, for our analysis we use an unbalanced sample of individuals with at least one parent or in-law alive and pool observations from these four waves. We construct a dummy variable 'parents close' that takes on value one for those individuals whose mother, father, or in-law lives in the same neighborhood or town. We exclude individuals who live in the same house as their parent or in-law, given that this particular form of co-residence often arises due to the need for intensive care of parents and in most cases represents a temporary living arrangement.

Our second measure is a more direct one and uses the variable 'regular child care by relatives'. While this includes child care by any relative, grandparent-provided child care is the most common form of relative-provided child care and even for child care by relatives other than grandparents similar spatial restrictions apply. The variable 'regular child care by relatives', on the other hand is only available for the waves: 1997, 1999, 2000, 2001, 2002, 2004, 2005, and 2006. For our analysis we focus on individuals with children younger than six years and again we pool data from the available waves. We construct a dummy variable 'child care by relatives' for all mothers with children younger than six years that includes the information if relatives regularly take care of this child.

Given stark differences in mothers' labor force participation rates between East and West Germany, for both analysis we restrict our sample to West German women age 25 to 50 living in West Germany.[3] We exclude those born outside of Germany given that for these individuals both variables, availability of child care by relatives and residence relative to

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[3]Labor force participation rates for East German mothers of small children (0-3 years) have traditionally been very high and even today they continue to be around 15 percentage points higher than rates for West German mothers (Bundesministerium fur Familie, Senioren, Frauen und Jugend [2005].)

parents might be determined by very different aspects compared to individuals who were born in Germany. We define three levels of education following the International Standard Classification of Education (ISCED 1997) designed by the UNESCO[1997]. These levels correspond to (i) primary education (ISCED levels 0 and 1), (ii) secondary education (ISCED levels 2,3, and 4) and (iii) tertiary education (ISCED levels 5 and 6).[4] Town sizes are grouped into small communities (up to 20.000 inhabitants), medium-sized communities (20.000-100.000 inhabitants), and large communities (more than 100.000 inhabitants). We use individual weighting factors for all regressions.

Table 1.1: Effect of close presence of grandparents on fertility

married	5.190***	(0.005)
log(spouseincome)	1.033***	(0.000)
age	1.773***	(0.001)
age^2	0.993***	(0.000)
education level 1 (ISCED: 0,1)	3.587***	(0.018)
education level 3 (ISCED: 5,6)	0.475***	(0.000)
parents or in-laws close	1.384***	(0.001)
small community	0.891***	(0.001)
large community	0.543***	(0.001)
Constant	0.000***	(0.000)
Observations	33,422,069	

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1 Logistic Estimation; Data: GSOEP unbalanced panel 91,96,01,06; West German women 25-50 not living in parents' or in-laws' house. All regressions include year dummies. Reference group: unmarried women with education level 2 (ISCED: 3,4,5) in 1991, in a medium-sized town, far from parents or in-laws.

Proximity to Parents and Fertility Women living in the same neighborhood or town as their parents or in-laws are 1.4 times more likely to have children. Table 1.1 displays odd ratios from the logit estimation of the probability of having children. Controlling for marital status, spouse's income, the size of the community, age, year effects, and education, proximity to potential grandparents has a significantly positive effect on fertility.

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[4]Results change little when using years of education instead. Tables C-1-C-4 in Appendix display results from these alternative estimations.

Concerning the other variables of the regression, the likelihood of being a mother for West German women between 25 and 50 is clearly positively influenced by their marital status. Being married raises the odds of having children by more than 5 times. Furthermore, higher spouse's income increases the odds. Age also has an initially positive effect on the probability to have children, however, as the odds ratio for age squared shows, this effect is not linear but turns negative from a certain age on. Higher education reduces the odds as does living in a large community, relative to living in a medium-sized community.

Proximity to Parents, Child Care by Relatives and Participation of Mothers
For our estimations regarding labor force participation we only consider a woman in the labor force if she works a regular part or fulltime job. The probability to hold a regular part or full time job for mothers residing close to their parents is 5 percentage points higher compared to mothers residing further away. The first column of Table 1.2 displays the marginal effects from a probit regression for the probability of having a regular part or full time job for West German mothers age 25 to 50. In addition to the control variables of the first regression, we also include a dummy variable that indicates if the mother has a small child (age 0 to 3). The probability of holding a regular part-or fulltime job decreases in the presence of a young child, decreases with marriage, is higher in smaller communities, and increases with age and education.

We obtain stronger results for our alternative analysis that uses the more direct measure 'child care by relatives' (see column two of Table 1.2). For mothers of children age six and younger, having relatives taking care of their child increases chances of having a regular full-or part time job by 26 percentage points, an effect much stronger than that caused by having the child attending a nursery, associated to an increase of 12 percentage points. Hence, the net effect of relative-provided child care on the probability of holding a regular part-or fulltime job is given by the difference of 14 percentage points. For this alternative estimation, marginal effects of all other variables on the probability of holding a regular part-or fulltime job are similar, with the exception of the significant and positive effect of living in a large community and the negative and significant effect of age squared.

Proximity to Parents and Wages   While grandparent-provided child care seems to be a way to promote fertility and mothers' labor force participation, the required proximity to one's parents or in-laws may imply a cost given the spatial restriction it imposes on one's potential labor market. In order to study the possible negative effect of living close to parents or in-laws on wage incomes of mothers we exclude self-employed individuals and

Table 1.2: Effect of grandparent-provided child care on mothers' labor force participation

	Regular Part or Fulltime Job		Regular Part or Fulltime Job	
	(1)		(2)	
children 0-3 years	0.759***	(0.022)	0.800***	(0.022)
married	0.838***	(0.024)	0.926***	(0.030)
logspouseincome	0.999	(0.003)	0.998	(0.003)
age	1.036*	(0.019)	1.051**	(0.026)
age^2	1.000*	(0.000)	0.999*	(0.000)
education level 1 (ISCED: 0,1)	0.905	(0.091)	0.931	(0.133)
education level 3 (ISCED: 5,6)	1.200***	(0.030)	1.143***	(0.028)
parents or in-laws close	1.051**	(0.023)		
children $<= 6$ years cared for by relatives			1.254***	(0.030)
children in nursery			1.119***	(0.026)
small community	1.046*	(0.027)	1.019	(0.027)
large community	1.0013	(0.028)	1.068**	(0.030)
Observations	5,608		5,666	

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Probit Estimation; Data: GSOEP unbalanced panel

1) 91,96,01,06; West German mothers 25-50 not living in parents' or in-laws' house. Reference group: unmarried mothers with education level 2(ISCED: 3,4,5) in 1991, in a medium-sized community, far from parents or in-laws, with children older than 3.

2) 97,99,00,01,02,03,05,06; West German mothers (25-50) of children $<= 6$ years. Reference group: unmarried mothers in 1997, with education level 2 (ISCED: 3,4,5), in a medium-sized town, with children older than 3 who are nor in nursery nor cared for by relatives. All regressions include year dummies.

consider only dependent workers. We also exclude individuals who report to have worked fewer than twenty hours a month. Controlling for selection effects, we find that mothers living close to their parents earn significantly lower hourly wages. The first column of Table 1.3 displays the coefficients for the Heckman selection model for log hourly wages for West German mothers age 25 to 50. While living close to parents or in-laws increases the probability of holding a regular part-or fulltime job, it reduces hourly wages by 4.1%.[5]

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[5]Monthly wages, controlled for by hours worked, show a even bigger discount of 5.6% for living close to parents or in-laws (see Table C-5 of the Appendix). Note that while we include year dummies, we do not adjust explicitly for wage growth in our pooled sample, given stagnant real hourly net wages in Germany between 1991 and 2006 (see Figure 1 in DIW [2009]).

Table 1.3: Effect of close presence of grandparents on hourly wages

	Log hourly wage		Selection Equation	
	(1)		(2)	
married	-0.049**	(0.023)	-0.540***	(0.053)
age	0.036**	(0.017)	0.111***	(0.033)
age^2	-0.000*	(0.000)	0.001***	(0.000)
education level 1 (ISCED: 0,1)	-0.191**	(0.089)	-0.182	(0.170)
education level 3 (ISCED: 5,6)	0.331***	(0.022)	0.494***	(0.048)
parents or in-laws close	-0.041**	(0.018)	0.150***	(0.038)
small community	0.017	(0.021)	0.160***	(0.046)
large community	0.067***	(0.023)	0.050	(0.049)
logincomespouse		0.015***	(0.006)	
children 0-3 years			-0.755***	(0.054)
tenure in firm	0.013***	(0.001)		
Constant	1.087***	(0.334)	-1.768***	(0.618)
Observations	4,849		4,849	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include year dummies. Heckman Selection

Model; Data: GSOEP unbalanced panel 91,96,01,06; West German mothers 25-50 not living in parents' or in-laws' house.

All regressions include year dummies. Reference group: unmarried mothers of children older than 3 with education level 2

(ISCED: 3,4,5) in 1991, in a medium-sized town, far from parents or in-laws.

Concerning the other variables and controlling for selection effects (see column two of Table 1.3), hourly wages of West German mothers between 25 and 50 are clearly influenced by their marital status.[6] Being married lowers hourly wages by 4.9% while an individual's spouse's income affects hourly wages positively. Each additional year of age and tenure in a firm increases hourly wages by around 3.6% and 1.3% respectively. Living in a large community increases hourly wages by 6.7%. Compared to having secondary education, having completed tertiary education increases hourly wages by 33.1%, while having only primary education reduces them by 19.1%.

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[6]Note that coefficients of the selection equation and marginal effects for our participation equation (see column 1 of Table 1.2) are comparable but not equivalent due to the additional restrictions made on the sample.

Table 1.4: Effect of grandparent-provided child care on working and residing in same town

married	0.627***	(0.001)
logincomespouse	1.007***	(0.000)
age	0.759***	(0.002)
age^2	1.004***	(0.000)
education level 1 (ISCED: 0,1)	22.348***	(0.674)
education level 3 (ISCED: 5,6)	1.051***	(0.002)
tenure in firm	0.972***	(0.000)
children $<=$ 6 years cared for by relatives	0.811***	(0.001)
children in nursery	1.264***	(0.003)
small community	0.189***	(0.000)
large community	1.423***	(0.003)
Constant	287.071***	(12.902)
Observations	6,258,238	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Logit Estimation Data: GSOEP unbalanced panel, 97,99,00,01,02,03,05,06 , West German mothers 25-50 of children $<=$ 6 years. Reference Group: unmarried mothers in 1997 with education level 2 (ISCED: 3,4,5) in a medium-sized town, with children older than 3, who are nor in nursery nor cared for by relatives. All regressions include year dummies.

Proximity to Parents and Commutes   Lower wages are just one way in which costs of spatial restrictions may become apparent. Other costs may arise from longer commutes, as suggested by Rupert et al [2009] who looking at French data find that mothers in particular with small children have low bargaining power as workers and they thus have to incur in longer commutes. We find that for working mothers of children age six and younger the odds of residing and working in the same town are around 20% lower, and hence they are more likely to have to incur in costly commuting if their children are regularly cared for by relatives. Table 1.4 displays odd ratios from the logit estimation for the probability of working and residing in the same town, i.e. not having to commute, for West German mothers age 25 to 50 with children of age six and younger.[7] While having relatives caring for children on a regular basis increases chances of having to commute, having children in a nursery on the other hand, clearly increases the odds of being able to work and reside in the same town. These odds are also increasing for mothers in large communities, but they decrease with age and firm tenure, and they are smaller for married women living in small communities.

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[7]Again we exclude women reporting to have worked fewer than twenty hours a month.

Table 1.5: Grandparent-provided child care and participation with individual fixed effects

	Regular Part or Fulltime Job		Regular Part or Fulltime Job	
	(1)		(2)	
children 0-3 years	0.278***	(0.005)	0.000	(0.000)
married	0.421***	(0.007)	0.142***	(0.001)
logspouseincome	0.745***	(0.002)	0.876***	(0.001)
age	0.748***	(0.004)	0.158***	(0.000)
age^2	1.007***	(0.000)	0.995***	(0.000)
education level 1 (ISCED: 0,1)	0.000	(0.000)		
education level 3 (ISCED: 5,6)	11.843***	(0.131)	25.521***	(0.243)
parents or in-laws close	4.013***	(0.037)	2.652***	(0.020)
small community	0.123***	(0.003)	0.356***	(0.004)
large community	0.688***	(0.015)	0.050***	(0.001)
Observations	378		246	
Number of persnr.	189	123		

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Fixed Effect Estimation Data: (1) GSOEP balanced panel 91-01 (2) GSOEP balanced panel 96-06 (education level one omitted because of no within-group variance); West German mothers 25-50 not living in parents' or in-laws' house Reference group: unmarried mothers with education level 2 (ISCED: 3,4,5) in a medium-sized community, living far from their parents or in-laws, with children older than 3.

Individual Fixed Effects   We also try to exploit the panel nature of this data set and run individual fixed effect regressions. This allows us to control for unobservable individual heterogeneity (for instance in preferences for living close to one's parents) which might be correlated with the outcome variables: having children or participating in the labor market. To this end, we consider two groups of West German women aged 25 to 50: (i) those who stayed in the sample from 1991 to 2001 and (ii) those remaining in the sample from 1996 through 2006.[8] Given the small size of the balanced sample and in particular very few women becoming first-time mothers during the course of staying in the sample, most regressions produce insignificant estimates. However, we can report significant estimates for the probability of holding a regular part-or fulltime job (see Table 1.5). Controlling for individual fixed effects, mothers living close to their parents or in-laws are two to four times more likely to hold a regular part-or fulltime job. Odd ratios of other control variables of the individual fixed effect estimation are comparable to the

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[8]Longitudinal weights were constructed as products of the cross-section weight of the first sample year considered and the inverse staying probabilities, as suggested in SOEP [2005].

marginal effects in our estimation using the pooled sample (see Table 1.2). While higher education increases the odds of holding a regular full-or part time job, marriage, age, and higher spouse income have negative effects as does living in small or large communities compared to medium sized towns.

While we found a positive relationship between grandparent-provided child care and fertility and grandparent-provided child care and regular labor force participation by mothers, we also saw that for mothers, grandparent-provided child care is related to lower wages and longer commutes. From these opposing relationships a set of interesting questions arise: What are the net effects of grandparent-provided child care on aggregate employment and fertility? How costly is grandparent-provided child care for parents in terms of forgone wages and additional commutes? How valuable is grandparent-provided child care in terms of fertility and employment? In order to answer these question, we build a model economy that explicitly takes into account the spatial restrictions of grandparent-provided child care. Our goal is to account for the relationships between grandparent-provided child care, fertility and labor market outcomes of mothers observed in the data. In a first step we calibrate our model to the German economy along several key dimensions. We then highlight the model's mechanism behind women's decisions that can potentially generate the observed relationships. Finally, we perform several counterfactual exercises to analyze how women's decisions change when public policy changes. To the best of our knowledge the current paper is the first one that documents the opposing effects of grandparent-provided child care and proposes a general equilibrium model that studies the conflicting forces of availability of this type of child care and its spatial restrictions.

1.2   Literature

There is an extensive empirical literature concerning the link between child care and female labor force participation. Del Boca and Viuri [2007] offer a summary of the literature and point out that most studies find that high child care costs deter female labor supply, while availability of child care has a positive effect on labor force participation by mothers. Many papers propose a joint analysis of the effect of child care costs on fertility and labor force participation. For Italy, Del Boca [2002] shows that both the availability of child care and the possibility of part time work increase labor force participation and fertility. Blau and Robins [1989] establish a similar pattern for the US. Within the context of already high female participation rates in Sweden, Moerck et al [2009] is one of the few papers that focuses exclusively on the effect of child care costs on fertility.

On the other hand, the literature on intergenerational linkages has mainly focused on two aspects: (i) monetary transfers in terms of bequests from parents to children and (ii) time transfers in terms of care from children to elderly parents. One interesting paper regarding the latter aspect that also incorporates residence choices is Konrad et al [2002]. The authors develop a game theoretical model of strategic choice of residence among siblings who try to avoid having to take care of elderly parents. Looking at German data, they find support for their model's predictions of older siblings locating further away from their parents than younger siblings. With a similar approach in mind, Stern [1996] estimates care choices of elderly parents together with location decisions of children. However, his work is even more closely related to the current paper as he also takes into account how the child's location decision affects his or her work decision. Some of the few empirical works that consider time transfers from parents to children in form of grandparent-provided child care is Dimova and Wolff [2009] who look at data from the Survey of Health, Ageing and Retirement in Europe (SHARE) and find a positive effect on the extensive margin of female labor force participation but no effect along the intensive margin.

In the spirit of our indirect measure of grandparent-provided child care, distance to parents, Holdswoth and Dale [2009] study labor force participation of mothers in Spain and Britain and estimate that for Spanish women whose parents live in the same town ('municipio') the probability of being in employment is 1.24 times higher than for those who do not live close to their parents. Studying fertility intentions rather than outcomes Raymo et al [2010] find that Italian and Japanese women living close to their parents have higher fertility intentions.

Other authors such as Smith Koslowski [2009] have focused on the costs that grandparent-provided child care implies for grandparents. In this sense we consider the paper by Cardia and Ng [2003] complementary to the current paper, as it also proposes a general equilibrium model for grandparent-provided child care but explicitly takes into account grandparents' decisions. The authors suggests that subsidizing grandparents' time to be the most effective policy in terms of output and capital accumulation. However, different from the current paper, the authors do not consider the spatial restrictions and thus potential costs of grandparent-provided child care nor do they model the effect of the close presence of potential grandparents on fertility.

Our paper is also related to another strand of literature that uses general equilibrium models to assess how different public policies interact with family decisions.[9] Greenwood, Guner and Knowles [2000] for instance investigate the effect of the rise in the generosity of

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[9]See Attanassio, Low and Sanchez-Marcos [2010], Guner and Knowles [2009] among others

welfare payments on the rising incidence of single motherhood while García-Morán [2010] evaluates the effect of child care subsidies on female labor force participation, fertility and children's educational levels. She finds that child care subsidies promote employment, fertility and education, especially for children in single parent households. Erosa, Fuster and Restuccia [2010] develop a model of fertility choice and labor market decisions to account for the observed gender differences in job attachment, employment and earnings. Their aim is to provide a framework to study the interactions of fertility choice and labor market turnover in the determination of employment and wages. They argue that having this framework is important for the evaluation of family policies. Our aim is similar to these papers, as within a general equilibrium framework we assess the effects of different family policies on women's decisions regarding residence, fertility, and labor force participation and we analyze how these decisions affect their labor market outcomes in the presence of grandparent-provided child care that imposes costly spatial restrictions. However, for the sake of tractability we abstain form several features present in the papers mentioned, such as a marriage market or employers demand for labor.[10] Also related to this paper is Bick [2010] who within a life cycle model analyzes data for Germany and concludes that informal child care (by relatives) plays an important role given that mothers' labor force participation exceeds child care enrollment for children up to 2 years. However, different from the current paper the author does not model informal child care nor takes into account the spatial restrictions that it imposes.

The remaining of this paper is organized as follows. The next section presents the model in greater detail. Section 3 describes our calibration strategy and Section 4 presents the results of the paper. In Section 5 we describe the mechanisms at work in greater detail and we perform two counterfactual experiments in Section 6. Section 7 concludes.

2 The Model

We have a model of fertility and employment choice in which individuals also decide where to live. They choose between living close or far from their parents (or in-laws), and thus whether to be able to access free child care and whether to access a restricted or unrestricted labor market. We only model women's decisions and even though marriage and joint residence choices may have an important impact on the distance to ones' parents we do not model a marriage market in order to keep the analysis tractable.

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[10]However, these features could be included in future analysis.

The model economy is inhabited by a continuum of overlapping generations of female individuals of mass one. Individuals live for three periods, one as children (0-20 years), one as fertile adults (20-40 years), and one as old adults (40-60 years).[11] When individuals are young fertile adults they decide where to reside - close to their parents or far away -, how many children to have, and how much time to spend working and how much resources to spend on their children's education - in terms of money and their own time. When individuals are old, they only have to decide how much to work. There is also a government in this economy that taxes labor income at rate τ, and may provide family benefits T conditional on having children and/or conditional on family income being below a certain threshold, $\bar{T}$. The government may also subsidize child care at rate ω. Individuals are born close to their parents so initially they reside in 'Home', H. If they decide to move they will reside in 'Far', F. We assume that moving away provides access to a labor market with better wage opportunities. The region of residence of each individual is denoted by j, where $j = \{H, F\}$.

Residence Choice Individuals decide whether to exclusively access the labor market of their region in order to stay close to their parents or whether to move away so as to access the labor market of the whole economy. Individual's residence choice, D is thus a binary variable that takes on value 0 if individuals reside close to their parents and 1 if their possible residence covers the whole economy

$$D = \begin{cases} 1 & if \quad j = F \\ 0 & if \quad j = H. \end{cases}$$

Endowments Women differ in their productivity levels, denoted by x. Let x belong to a finite set. Attached to each female, there is a male whose productivity is denoted by z. Let z also belong a finite set. Possible combinations of x and z values are denoted by an exogenous matching matrix $\Pi(x, z)$, with each entry giving the fraction of households formed by a particular (x, z) combination. The entries of $\Pi(x, z)$ sum up to 1. As we abstract from formation and dissolution of marriages, $\Pi(x, z)$ is the same for both periods of adulthood. Below we denote by $z(x)$, a particular husband that a female has. All decisions are made by females and husbands provide an exogenous source of income.

Working Choice Individuals can decide on the extensive and intensive margin of their labor force participation where l is the fraction of time they allocate to work.

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[11]Availability of free child care obviously depends on grandparents being able to take care of grandchildren. Even though individuals might still be working as old adults, we assume that in 'Home' there is some type of family network that takes care of children free of charge.

They thus have the following after-tax wage income

$$w = (1 - \tau)(1 + D\kappa)xl,$$

where κ is the wage premium in region F. Therefore, individuals earn wages that depend not only on how productive they are, but also on their region of residence.

Children   Individuals can have children when they are fertile. Children receive education depending on the resources in terms of money and time that the mother decides to spend on the child. We denote by b the amount of money that an individual decides to spend on her children, and t is the amount of time that she dedicates to take care of the child. Time spent in child care (t_c) can also enhance the child's education. We assume that time spent in child care is equal to the amount of time an individual is at work, and thus t_c is actually equal to l. If a mother does not work, children will not receive any child care education. The child's education function is denoted by

$$e = E(k, t, t_c, b).$$

There is no link between the education that children receive and their labor market productivity as young adults. We assume that each period a new exogenous distribution of young adults with the same productivities as the previous generation enter the economy.

Child care   Individuals with children who work require child care. The price of child care, $p(D)$ depends on the individuals' residence choice in the following way: $p(0) = 0$ and $p(1) > 0$. Thus, if the individual lives close to her parents she obtains free child care, else she has to purchase child care at price $p(1)$. The individual might receive a subsidy ω from the government, thus actually paying $(1 - \omega)p(1)$ for each unit of time the child spends in child care.[12]

Utility   Fertile adults derive utility from consumption, children, and leisure. Let k be the number of children an individual decides to have. The utility that individuals enjoy each period is given by

$$U(c, 1 - l, k, e) = u(c) + u^l(1 - l) + u^e(k, e),$$

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[12]We assume that this subsidy is only paid to those individuals who purchase child care at price $p(1)$, i.e. to those living in 'Far'.

After one period, children become young adults and they leave the parent's household. Therefore, old adults do not receive utility from their children. They only get utility from consumption and leisure. Children do not take any decisions but simply receive education.

Timing of Decisions   When individuals become fertile adults, they observe their productivity and decide whether to reside close to their parents or not. After residence decisions have been taken, individuals have to decide how many children to have, and how to split their time between working, taking care of children, and leisure. Individuals move or not, they work their respective share of time, and if they have children, they might purchase child care if they live away from their parents. Individuals decide how much of their resources to devote to their children, and they consume. From then on, they remain in the chosen region of residence. Old adults only decide on how much to work.

Government   The government in this economy collects labor income taxes τ, pays lump-sum transfers T conditional on having children and having an income below a certain threshold, $\bar{T}$, provides a child care subsidy, ω and consumes G. The budget constraint of the government has to be balanced each period.

$$\tau Y = G + P,$$

where Y is the total income in the economy and P is the amount of subsidies and transfers that the government pays out to individuals.

2.1   Value functions

We start by defining the value functions of old adults. In the last period of individuals' lives, residence decisions do not change and children are no longer present in the household. Thus old adults have neither benefits nor costs from children. Old adults derive utility from consumption and leisure.[13]

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[13]We assume that there is no costs associated with taking care of grandchildren as, for now, we are only concerned about the effects of free child care on mothers' labor market outcomes. We model the sources of income in the last period of individuals' lives as labor income but equivalently we could also interpret them as retirement benefits.

Old adult living close An old individual who has not moved when young only has access to a restricted labor market. She has a source of extra income, $z(x)$ representing her husband's labor income. She has to choose how much to work when old. The value of being an old individual living close is given by

$$H^o(x, z(x)) = \max_l U(c, 1 - l, 0, 0)$$

subject to the following budget constraint

$$(1 - \tau)(xl + z(x)) = c.$$

The old individual will pay taxes on her labor income and her husband's income. As she has no other expenditures, she will consume all of her disposable income. The optimal labor decision of an old individual living close is denoted by $L_o^h(x, z(x))$.

Old adult living away An old individual living further away earns more per unit of time compared to those who stayed close to their parents. As her children do not live in her household anymore, she does not have to pay for child care. The value function for an old individual living far away is

$$F^o(x, z(x)) = \max_l U(c, 1 - l, 0, 0)$$

subject to the following budget constraint

$$(1 - \tau)(\kappa xl + z(x)) = c.$$

Again she consumes all of her disposable income. In the last period of an individual's life, the only difference between living at Home and living further away is that the latter situation implies higher wages per unit of time. For old adults, child care costs are no longer an issue as children are now young fertile adults. The optimal labor decision of an old individual living further away is denoted by $L_o^f(x, z(x))$.

Young fertile adult Young fertile adults have to decide whether to stay close to their parents or not. If they stay close they face a restricted labor market but they obtain free child care. If they move they earn a wage premium κ, but if they have children they have to pay child care costs per unit of time worked. Once they have decided where to live, they decide how much to work and how many children to have and how much resources

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to spend on educating their children. The value of being a young fertile woman remaining close to her parents $(D = 0)$ is given by

$$H^y(x, z(x)) = \max_{k,l,t,b} U(c, 1 - t - l, e, k) + \beta H^o(x, z(x)),$$

subject to the following budget constraint

$$(1 - \tau)(xl + z(x)) + TI_{\bar{T}}I_k = c + b$$

and the education production function

$$e = E(k, t, t_c, b).$$

Note that young fertile adults living at home have access to free child care as they remain close to their parents. Thus, they spend an amount b of resources on their children and during a fraction t of their available time they take care of their children. If they work they leave their children with their grandparents. Women staying close to their parents work in a restricted labor market thus they do not earn as much per unit of time as those living further away. If the individual has children and her family income is below the threshold $\bar{T}$ she might receive some family benefits from the government, T. We denote by $I_{\bar{T}}$ the indicator function that takes the value of one if the family income is below the threshold, $\bar{T}$. The indicator function I_k equals one if the individual has children. The continuation value of living in region H is the value of being an old woman living in region H because there is no uncertainty about the future and no residence decisions are being made in the last period of individuals' lives. For a woman living close to her parents or in-laws, the optimal decision regarding how much to work is denoted by $L_y^h(x, z(x))$, the optimal number of children is given by $K_y^h(x, z(x))$. The optimal amount of time spent taking care of her children is $T_y^h(x, z(x))$ and the optimal amount of money spent on her children is given by $B_y^h(x, z(x))$.

If the individual decides to move away $(D = 1)$, then the value of living further away is denoted by

$$F^y(x, z(x)) = \max_{k,l,t,b} U(c, 1 - t - l, e, k) + \beta F^o(x, z(x)),$$

subject to the following budget constraint

$$(1 - \tau)((1 + \kappa)xl + z(x)) + TI_{\bar{T}}I_k = c + (1 - \omega)p(1)l + b$$

and the education production function

$$e = E(k, t, t_c, b).$$

A young fertile adult living further away has to purchase child care at price $p(1)$ for each unit of time she decides to work. She has to decide how to divide her time between work, l, taking care of her children, t, and leisure. She also decides on how much to spend on the education of her children, b. A young fertile adult also disposes of an additional source of income, $z(x)$. If her family income is below a certain threshold and she has children she receives family benefits from the government. Moreover, if she works, she might also receive child care subsidies, ω per unit of time her children spend in child care. Optimal decisions for a woman living further away are denoted by $L_y^f(x, z(x))$, $K_y^f(x, z(x))$, $T_y^f(x, z(x))$ and $B_y^f(x, z(x))$.

Residence Decision   Women have to decide whether to stay home or move away. They face a trade-off between higher wage rates and lower child care costs. They decide to move if the utility of living further away exceed the utility of staying close by, i.e.

$$D(x, z(x)) = \begin{cases} 1 & if \quad\quad F^y > H^y \\ 0 & otherwise. \end{cases}$$

Let $\Omega^F(x, z)$ be the endogenous distribution of individuals who decide to move away, that is, $D(x, z(x)) = 1$. And let $\Omega^H(x, z)$ denote the endogenous distribution arising from individual deciding to remain close, $D(x, z(x)) = 0$.

Equilibrium   The optimal decision rules for fertile young adults are as follows: $L_y^j(x, z(x))$ is the labor force participation decision, $T_y^j(x, z(x))$ denotes time spent with her children, $B_y^j(x, z(x))$ is the amount of money spent on children and $C_y^j(x, z(x))$ is the level of consumption, where $j = \{H, F\}$ denotes the region where the individual resides. Optimal decision rules for old individuals are as follows: $L_o^j(x, z(x))$ is the labor force participation decision and $C_o^j(x, z(x))$ is the level of consumption, where $j = \{H, F\}$. The distribution of residence is given by $\Omega^j(x, z)$ for $j = \{H, F\}$. Given a government policy $(\tau, T, \bar{T}, \omega, G)$ and a matching matrix $\Pi(x, z)$, a stationary equilibrium is a set of decision rules, a distribution of residential choices, and the number of children born, K_y^F and K_y^H such that

1. The decision rules are the solutions to the value functions.

2. The distribution of residential choices is consistent with the decisions.

3. The government budget is balanced.

3 Calibration Strategy

3.1 Functional Forms

In this part of the paper we present the explicit functional forms for the utility function and the children's education function. Individuals' utility is separable in consumption, children, and leisure. We assume log utility in consumption and in leisure, while the utility in children is linear. There are two weighting parameters in the utility function. The weighting parameter for children is denoted by ϕ_e and the weighting parameter for leisure in the utility function is ϕ_l. The weighting parameter for consumption is normalized to 1. The explicit functional form for an individual's utility function is thus given by

$$U(c, 1 - t - l, e, k) = log(c) + \phi_e Q(e, k) + \phi_l log(1 - l - t).$$

Individuals receive utility from the number of children in the household and from their children's level of education. Following Becker and Tomes [1976], we assume that there is a trade-off between the number of children in the household and the education that households can provide for their children. To model this quantity-quality trade-off, we choose the following Cobb Douglas specification for the 'children term' in the utility function of an individual

$$Q(e, k) = e^\lambda k^{1-\lambda},$$

where λ denotes the share of children's education in quantity-quality trade-off.[14]

Children's education depends on the woman's time spent taking care of her children, t, the amount of money spent on children's education, b and if the mother works, education will also depend on the time spent in child care. Money and time are assumed to have a unit elasticity of substitution. We denote the share of time mothers spend taking care of their children by θ. There are two types of child care: grandparent-provided child care and privately or publicly provided child care. Grandparent-provided child care is only available to those living close to their parents. We assume that both types of child care are equally productive in terms of education.[15] Women who live far away from their parents can spend money on their children in two different ways. If they work an amount of time, l their children have to spend that same amount of time in private or public child care and they have to pay an hourly cost of $p(1)$. The other possible expenditure on children is b, which represents any other type of expenditure related to children's education. A woman living close to her parents does not have to spend money on child care. To her

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[14]A similar specification has also been used by Greenwood et al [2000].

[15]However, this assumption can easily be relaxed.

the price for child care is 0. Given that time spent with grandparents is assumed to be as productive as time spent in private or public child care, leaving children with their grandparents while working is equivalent to investing in child care. The chosen functional form we choose for the relationship between expenditure in private child care and other education related expenditure is of the CES type. Hence, the elasticity of substitution between the two types of expenditures is equal to $\frac{1}{(1-\rho)}$ and the weight of expenditures b is represented by α. This functional form is flexible enough to capture any degree of substitutability between these two different types of expenditure. We thus specify the functional form of the education function as

$$e = ((\alpha(b)^{\rho} + (1-\alpha)l^{\rho})^{\frac{1}{\rho}})^{\theta} t^{1-\theta}.$$

3.2   Parameters

Some parameters of the model are fixed based on available evidence. We calibrate the model's remaining parameters to match several labor market statistics of the German economy as well as German data on fertility. Most statistics used for calibrating the remaining parameters come from the German Socio-Economic Panel (GSOEP). For our statistics we use pooled data from waves 1991, 1996, 2001, and 2006, in which information on the relative location of parents and adult children is available (see Section 1.1 for more details on the GSOEP). Finally, we have a set of policy parameters which we will choose such as to represent German family policies. For our calibration we only consider data on married women.

Women and men are matched according to an exogenous matching matrix $\Pi(x,z)$. In order to construct $\Pi(x,z)$, we assume there is a log normal distribution of different females types and another log normal distribution of male types. Let μ_x and σ_x denote parameters of the log normal distribution for females and let μ_z and σ_z be those for males. We approximate these two distributions on finite sets $\{x_1, x_2, ..., x_N\}$ and $\{z_1, z_2, ..., z_N\}$. Given these finite approximations, we assume that each female type x_i matches with her own type (z_i) with probability ψ and with probability $\frac{(1-\psi)}{(N-1)}$ she matches with other types. In the simulations below we assume that N is 10, hence $\Pi(x,z)$ has 100 entries, representing all possible marriages.

The parameters in the model set a priori are the discount factor β, the parameters related to the productivity distribution over individuals $\mu_x, \mu_z, \sigma_x, \sigma_z$, the wage premium earned in Far, κ and the assortative matching parameter, ψ. One model period is equivalent to 20 years. The discount factor, β is set to a value of 0.44 in order to match a yearly

interest rate of 4%. Estimates for mean and standard deviation of the productivity distributions are taken from log-hourly wages in the GSOEP data, which gives us the following parameter values for women $\mu_x = 2.44$ and $\sigma_x = 0.479$ and $\mu_z = 2.98$ and $\sigma_z = 0.72$ for men. In order to assign an exogenous income to each woman, representing her husband's income, we use a matching matrix based on information on who marries whom in Germany. According to Fernandez et al. [2005] the degree of assortative matching (ψ) in Germany is estimated to be 0.7, i.e. 70% of each type of women matches with the exactly same type of men while the remaining 30% are equally likely to match with other types of men. From our regressions, we obtain that controlling for individual characteristics, women living far from their parents or in-laws earn 4.1% higher hourly wages than women who remain close to their parents (see Table 1.3). We thus set κ equal to 0.041. Table 3.6 displays all parameters set a priori.

Table 3.6: Parameters based on a priori information

Parameter	Explanation	Value
β	Discount Factor	0.44
μ_x	mean log productivity of women	2.44
σ_x	standard deviation of women's log productivity	0.479
μ_z	mean log productivity of men	2.98
σ_z	standard deviation of men's log productivity	0.72
n	average working time of men	0.4
κ	wage premium for living far away	0.041
ψ	assortative matching parameter	0.7

The remaining parameters to be calibrated are the utility parameters, ϕ_e, ϕ_l and the children's education parameters, $\lambda, \rho, \alpha, \theta$. Even though in a general equilibrium model all parameters affect all targets, we discuss briefly the data moments that each parameter is most likely to determine. The weight of children's quality in utility, ϕ_e is set to a value of 5, such as to match the difference in fertility rates between women living close to their parents or in-laws (1.73) and fertility rates of those living far away (1.69). The weight of leisure in the utility function, ϕ_l is given a value of 2.4 in order to match a labor force participation rate of 54% for married women in Germany. The share of the number of children in the quality-quantity trade-off function, λ is set to 0.47 in order to match an overall fertility rate of married women in Germany of 1.71.[16] Values for the three pa-

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[16]Fertility is lower than 2. Therefore, we assume that each period a mass 1 of individuals enter the economy to replace those who die.

rameters of the education production function, ρ, α, θ are chosen such as to match data on expenditure on children as a percentage of average income, time spent with children by parental working status, and mothers' productivities. According to the German Federal Office of Statistics, in 2003 families spent on average 500 euros per month on each child and the average family income in Germany was 3,750 Euros per month (German FSO) while German households with children had on average 1.9 children.[17] Therefore, expenditure on children for a German average household is close to 25% of family income. According to Ichino and Sanz de Galdeano [2004], the ratio of time that a working mother spends with her children to time spend by a non working mother is 0.65. Using data provided by Sayer et al. [2004], we also calculate the ratio of time a highly educated mother (corresponding to a highly productive woman in our economy) dedicates to her children in comparison to a low educated mother to be equal to 1.4. Hence parameters ρ, α, θ of the education production function are assigned values 0.43, 0.8, and 0.58 respectively. Table 3.7 displays the calibrated parameters of the model.

Table 3.7: Calibrated Parameters

Parameter	Explanation	Value
ϕ_e	weight of children	5
ϕ_l	weight of leisure	2.4
λ	share of education in Q function	0.47
α	weight of b in the education function	0.8
ρ	elasticity parameter between b and child care	0.43
θ	share of expenditures in the education function	0.58

Finally, the model's policy parameters are the income tax rate, τ, and the family policy in terms of child care subsidies, family benefits, and the threshold for eligibility of family benefits, i.e. ω, T, and $\bar{T}$ respectively. In our model, all working individuals pay a proportional tax, τ on their labor income. We set τ to be equal to 37% which is equivalent to the income tax revenue collected by the German government as a fraction of GDP (OECD [2010]). According to the OECD [2009], all German families receive some family benefits for each child up to the age of eighteen (*Kindergeld*). In particular, they receive 184 Euros per month for the first child, 190 for the second and 205 for the third, fourth, fifth child etc. We set the amount of family benefits in our economy, T equal to 1.04 such as to match the amount of *Kindergeld* as a percentage of average family income

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[17]See German Federal Office of Statistics, Press release No.314, $2006 - 08 - 01$, $http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Navigation/press/NaviStartPress.psml$

received by a family with the average number of children in Germany (1.9). As all families receive this subsidy, the threshold $I_{\bar{T}}$ is not binding and $\bar{T} = 0$. According to the same source, child care subsidies are negligible in Germany and therefore we set ω to be equal to zero. For the cost of child care $p(1)$, the OECD [2007] estimates that child care costs in Germany amount to 9.1% of average income. In order to match this target, the $p(1)$ is set to 0.32. All policy parameters are displayed in Table 3.8.

Table 3.8: Policy Parameters

Parameter	Explanation	Value
Calibrated		
T	Family Benefits	1.04
$p(1)$	cost of child care	0.32
Set a priori		
ω	child care subsidy	0
$\bar{T}$	eligibility threshold	0

4   Results: Benchmark Economy

Table 4.9 presents moments of our model's benchmark economy together with the corresponding data moments. Our model underestimates the labor force participation of married women by four percentage points. The share of women who participate in the labor market in Germany is equal to 54.21%, while in our economy this share is slightly below 50%. In terms of fertility and the fertility differential between women living close to and far away from their parents, the model does a fairly good job. The fertility rate in German data is equal to 1.71 while in our model economy it is equal to 1.5. In the data the difference in fertility between women living close and far is not large and this is also true in our model. Regarding time spent by non working mothers with their children in comparison to time spent by working mothers, the model predicts that non-working mothers spend 25% more time with their children than working mothers, seven percentage points less than in the data. In our model we calculate differences in time spent with children by highly educated and medium educated women by assuming that medium educated women are those whose productivity is below the mean productivity of the economy. Our model overestimates the time that more educated mothers spend looking after their children by 5 percentage points. While the average German family spends 25% of their income on

Table 4.9: Data and Model Moments

	Data	Model
Fertility rate	1.71	1.5
Labor force participation of married women	54.21	49.94
Difference in Fertility close vs far away	1.02	1.09
Time spent with non-working vs working mother	1.32	1.25
Time spent with high vs medium educated mother	1.08	1.13
Expenditure on children as per cent of income	25	33.21
Child care costs as per cent of average income	9.1	2.0
Family benefits as per cent of income	10	10

children, our model predicts this number to be 33%. The model is able to replicate well the amount of family benefits available in Germany. However, we clearly underestimate the cost of child care. On average, the cost of child care is 9% of average income, while in our model it is only 2%.

Turning to other statistics of the model that have not been used for calibration (see Table 4.10), in Germany, women living close to their parents or in-laws participate more in the labor market compared to those living further away. This difference in participation rate is equal to 4 percentage points. We find that in the model there is also a difference but it is too small. The differences in participation between women who live far to their parents and those who live close to their parents is significant but small in the data. Therefore, in the model, this difference is also small. Even though in Germany there is a difference between participation rates of all women and mothers, our benchmark economy is not able to capture this difference given that under the current calibration scenario all women decide to have children. Our model also produces statistics on how many women move away from both parents or in-laws. In Germany, around 45% per cent of women live far from their parents (see Figure 1.2), while in our model, only 20% per cent live far away from parents or in-laws. Therefore, given the conservative estimate of living away from parents, our model can account for around 40% of women moving in the German economy.

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Table 4.10: Data and Model Moments: Not used for calibration

	Data	Model
Labor force participation of mothers	55.18	49.94
Labor force participation of mothers, close	56.55	49.96
Labor force participation of mothers, far away	53.70	49.85
Labor force participation of women, far away	53.31	49.85
Labor force participation of women, close	55.07	49.96
share of population moving away	45	20

5   Mechanisms at work: Who moves and who works

When women decide whether to move or not they face a trade-off between better labor market opportunities and free child care. If they move away they face better opportunities in the labor market. However, if they have children and they want to work, they will have to pay for child care services for each unit of time they work. We represent better labor market opportunities by the fact that women who choose to live in the Far region earn a higher wage rate, receiving a wage premium, κ. If women decide to stay Home, they only have access to a restricted labor market and they earn their labor market productivity. However, if they have children, they have access to free informal child care. Thus we would expect high productivity type women to move away as they can afford to pay for child care if they work. However, the woman's exogenous income (husband's type) also plays an important role in the residence decision.

In our model we observe that high productivity type women who are married to relatively lower productivity type men move away from their parents and in-laws. In the Far region they earn more and they can afford the necessary child care costs. On the other hand, low productivity type women who are married to higher productivity type men also move away. While these women could also afford to pay for child care, they decide not to work. In this case, the reason for moving is not a higher wage premium but the fact that if they remain close to their parents, they would find it optimal to work. However, if they move away, they will not work and they receive higher utility from leisure. Moving away and enjoying leisure is preferred to staying close and working. As these women dispose of a relatively high exogenous income they prefer not to work and their marginal value of leisure is higher in the Far region.

Remaining in the Home region are thus those women who have married similar productivity type men. In terms of the allocation of income according to the matching matrix, those who are on the diagonal of the matching matrix are the ones remaining close to parents or in-laws. Low productivity women who are married to low productivity men will work as their income effect dominates. While high productivity type women married to high productivity type men will also decide to stay close to parents and in-laws, they will not work. These women prefer to spend their time between leisure and taking care of their children. High productivity type women married to high productivity type men will not work in any of the two regions. Child care costs do not have any effect on their working decision.

We can thus identify four subgroups of women in our model: (i) low productivity type women married to low productivity type men, (ii) low productivity type women married to high productivity type men, (iii) high productivity type women married to low productivity type men, and (iv) high productivity type women married to high productivity type men. Two sub-groups will remain close: the low-low productivity and the high-high productivity matches. Therefore, women on the diagonal of the matching matrix will remain in the Home region. The other two sub-groups will move to the Far region: low-high productivity and high-low productivity matches. In Table 5.11 we display the share of women who move away by these four sub-groups. In our model low productivity individuals are identified as the five lowest types on the productivity distribution while the high productivity individuals are the five highest types. We see that all women belonging to the high-low subgroup and to the low-high subgroup move away. Meanwhile, only around 6% of women in the low-low subgroup move away. The same is true for the high-high subgroup, where only also around 6% of them move away. The majority of women in these last two subgroups remain close to their parents or in-laws.

Table 5.11: % of women moving away by type and husband's type

	Low productivity men	High productivity men
Low productivity women	6.20	100
High productivity women	100	6.07

In section 1.1 we found that women work less if they live far away from their parents or

in-laws, even after controlling for education and wage of their spouses (see Table 1.2). Our model replicates this fact as in both regions there are both high and low productivity women, equivalent to high and low educated women and in both regions there are also women married to high and low productivity type men. In the presence of child care costs, the existence of free informal child care arrangements allows mothers with low productivity to work. In absence of grandparents, their income would be too low to pay for child care costs and therefore they would not work. These are the women who remain in the Home region. Meanwhile those women who dispose of a relatively high exogenous income will have a higher marginal value of leisure in the Far region and they will decide to move but they will not work.

6 Counterfactual Experiments

In order to highlight the importance of two key elements of our model, grandparents and child care subsidies, we will run two counterfactual experiments. First, we analyze a situation in which there are no grandparents available and everyone has to pay for child care. Table 6.12 provides the moments of the model for this counterfactual experiment together with moments of the benchmark economy. When no grandparent-provided child care is available, all women who are of higher productivity than their husbands will move away and all of them will work. Women whose husbands are of a higher productivity type will remain close and none of them will work. Women who cannot afford child care, stay close and are not able to participate in the labor market. Therefore, we observe a decrease in the participation rate of women. In a situation without informal child care arrangements, the labor force participation rate for married women drops to 12.37%, from an approximate 50% in the benchmark economy. The overall fertility rate drops to 1.36 from 1.5. Hence, our counterfactual experiment confirms the importance of grandparent-provided child care for fertility and mothers' labor force participation. However, contrary to our expectations, grandparents-provided child care does not seem to hamper mobility. In case no grandparents are available only 12.37% of women move, compared to 20% in the benchmark economy. This is due to a change in the marginal value of leisure. When there was grand-parent provided child care, the marginal value of leisure was higher in the Far region. Therefore, women who married relatively higher type men would move to the Far region where they did not work. However, when there is no grand-parent provided child care, the marginal value of leisure is the same in both regions. Thus, those women who were moving due to that effect do not move away anymore. Fewer women moving drives the increase in the fertility differential. As more individuals, and in particular those with high exogenous income stay close, do not work but take care of their children, they also decide to have more children.

Table 6.12: No Grand-parent provided child care

	No grandparents	Benchmark economy
Fertility rate	1.36	1.5
Labor force participation of married women	12.37	49.94
Difference in Fertility close vs far away	1.2	1.09
Labor force participation of women, far away	1	49.85
Labor force participation of women, close	0	49.96
share of population moving far away	12.37	20

In a second counterfactual experiment we consider a public policy that intents to en-
courage mothers' labor force participation: child care subsidies financed through taxes.
As this policy will be government consumption neutral, the amount of tax revenue col-
lected that is going to government consumption has to be the same as in the benchmark
economy which might imply higher taxes. We consider a policy that subsidizes 50% of
child care costs and set ω equal to 0.5. Therefore, if women stay close they have access
to grand-parent provided child care and if they move away they have access to formal
subsidized child care.[18] Table 6.13 displays the model's moments for this second counter-
factual experiment together with moments from the benchmark case. The overall fertility
rate of the economy remains almost unaltered by this policy. However, women moving
far away now have relatively fewer children and the ratio of fertility between close and far
increases under this policy. In terms of the economy's aggregate participation rate there
are no changes, which is consistent with some findings in the literature that argue that
child care subsidies might not affect maternal labor force participation but that instead
they simply induce a shift from informal child care to formal child care (Havnes and
Mogstad [2011]). However, there are still some women who cannot afford to work even if
50% of child care costs are subsidized. 50% of women remain close. Out of these women
remaining close, 5% will work. These women remain close to their parents so they have
access to free child care. This implies that 10% of all the women in the economy remain
close and work as they still cannot afford the child care costs.

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[18]We assume that women staying close only have access to grand-parent provided child care. As we
take formal child care and grand-parent child care to be equally productive in terms of education, allowing
women who stay close to choose between grand-parent and formal child care will have no effect on the
results.

Table 6.13: Child care subsidized, $\omega = 0.5$

	$\omega = 0.5$	Benchmark economy
Fertility rate	1.54	1.5
Labor force participation of married women	49.94	49.94
Difference in Fertility close vs far away	1.2	1.09
Labor force participation of women, far away	95	49.85
Labor force participation of women, close	5	49.96
share of population moving far away	49.74	20
Tax rate	0.38	0.37

7 Conclusion

In this paper we document benefits and costs of grandparent-provided child care. Looking at German data we find that women residing close to parents or in-laws are more likely to have children and as mothers they are more likely to hold a regular full-or part time job. However, we find that mothers living close to parents or in-laws have lower wages and that mothers using relative-provided child care are more likely to incur daily commutes. We build a general equilibrium model of residence choice, fertility decisions, and female labor force participation to account for these opposing relationships of grandparent-provided child care and mothers' labor market outcomes. We simulate the model to match the German economy in terms of fertility, women's labor force participation and other dimensions related to time spent with children and expenditures on children. We then perform two counterfactual exercises to analyze the effect of grand-parent provided child care and child care subsidies on women's decisions. We find that if there is no grandparent-provided child care, there are fewer women participating in the labor market. They cannot afford child care costs and hence they decide not to work. In addition, fertility decreases. This is consistent with empirical evidence showing that having access to free child care increases fertility and mothers' labor force participation. We also show that subsidizing 50% of child care costs does not increase aggregate women's employment rates with respect to the benchmark case. However, most of the women working before move away and thus labor mobility is increased. Still, 10% of all women remain close to their parents or in-laws and work. These women still cannot afford these reduced child care costs. In this sense it seems that providing child care subsidies does not increase women's labor market participation but rather encourages labor mobility. However, in the absence of child care subsidies, grandparent-provided child care plays an important role by allowing some

women to work.

In this paper we simply assumed that being close to one's grandparents' implies that grandparents take care of their grandchildren and we do not consider grandparents' decisions to provide child care to their grandchildren. However, this decision is likely to be related to individuals' retirement decisions and in particular in the case of grandmothers, to previous labor force participation decisions. In this sense, opposing forces for cohort effects of female labor force participation could arise. On the one hand, having a mother who is actively participating in the labor force could increase chances for women to also do so, while a negative effect could come from the fact that a grandmother actively participating in the labor market might be less likely to provided child care for her grandchild. An analysis of how late first birth and improved health after retirement might interact with these aspects is something we consider a very interesting road for future research. In a similar sense, we also hope that the current paper could provide inspiration to study the macroeconomic effects of spatial restrictions imposed by grandparent-provided child care on optimal labor mobility and the optimal allocation of talent.

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A-1 Appendix

Table C-1: Effect of close presence of grandparents on fertility

married	5.114***	(0.005)
log(spouseincome)	1.038***	(0.000)
age	1.802***	(0.001)
age^2	0.993***	(0.000)
years of education	0.814***	(0.000)
parents or in-laws close	1.266***	(0.001)
small community	0.862***	(0.001)
large community	0.590***	(0.001)
Constant	0.000***	(0.000)
Observations	33,287,525	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Logistic Estimation; Data: GSOEP unbalanced panel 91,96,01,06;

West German women 25-50 not living in parents' or in-laws' house

All regressions include year dummies.Reference group: unmarried women

in 1991, in a medium-sized community living far from parents or in-laws.

Table C-2: Effect of grandparent-provided child care on mothers' labor force participation

	Regular Part or Fulltime Job		Regular Part or Fulltime Job	
	(1)		(2)	
children 0-3 years	0.749***	(0.022)	0.788***	(0.022)
married	0.830***	(0.024)	0.894***	(0.020)
logspouseincome	0.998	(0.003)	0.997	(0.003)
age	1.034*	(0.019)	1.043**	(0.026)
age^2	1.000*	(0.000)	0.999***	(0.000)
years of education	1.032***	(0.003)	1.029***	(0.004)
parents or in-laws close	1.056**	(0.023)		
children $<= 6$ years cared for by relatives			1.249***	(0.030)
children in nursery			1.118***	(0.026)
small community	1.048*	(0.027)	1.018	(0.027)
large community	1.007	(0.028)	1.057*	(0.031)
Observations	5,582		5,646	

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Probit Estimation; Data: GSOEP unbalanced panel

1) 91,96,01,06; West German mothers 25-50 not living in parents' or in-laws' house. Reference group: unmarried

mothers in 1991, in a medium-sized community living far from parents or in-laws, with children older than 3.

2) 97,99,00,01,02,03,05,06; West German mothers (25-50) of children $<= 6$ years. Reference group: unmarried

mothers in 1997, in a medium-sized community with children older than 3 who are nor in nursery

nor cared for by relatives. All regressions include year dummies.

Table C-3: Effect of close presence of grandparents on hourly wages

	Log hourly wage		Selection Equation	
	(1)		(2)	
married	-0.044**	(0.024)	-0.575***	(0.054)
age	0.020	(0.016)	0.107***	(0.033)
age^2	-0.000	(0.000)	0.001***	(0.000)
years of education	0.077***	(0.004)	0.092***	(0.009)
parents or in-laws close	-0.033*	(0.017)	0.165***	(0.038)
small community	0.025	(0.020)	0.166***	(0.046)
large community	0.067***	(0.023)	0.049	(0.049)
logincomespouse		0.015**	(0.006)	
children 0-3 years			-0.788***	(0.055)
tenure in firm	0.012***	(0.001)		
Constant	0.656*	(0.338)	-2.616***	(0.618)
Observations	4,825		4,825	

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 All regressions include year dummies.

Table C-4: Effect of grandparent-provided child care on working and residing in same town

married	0.638***	(0.001)
logincomespouse	1.004***	(0.000)
age	0.740***	(0.002)
age^2	1.004***	(0.000)
years of education	0.992***	(0.004)
tenure in firm	0.971***	(0.000)
children $<=$ 6 years cared for by relatives	0.819***	(0.001)
children in nursery	1.228***	(0.003)
small community	0.189***	(0.000)
large community	1.482***	(0.003)
Observations	6,247,668	

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Logit Estimation Data: GSOEP unbalanced panel

West German mothers 25-50 not living in parents' house: 97,99,00,01,02,03,05,06)

Table C-5: Effect of close presence of grandparents on monthly wages

	Log monthly wage		Selection Equation	
	(1)		(2)	
married	-0.056**	(0.023)	-0.550***	(0.054)
age	0.020	(0.017)	0.112***	(0.033)
age^2	-0.000	(0.000)	-0.001***	(0.000)
education level 1 (ISCED: 0,1)	-0.173*	(0.091)	-0.178	(0.171)
education level 3 (ISCED: 5,6)	0.311***	(0.022)	0.489***	(0.048)
parents or in-laws close	-0.056**	(0.018)	0.152***	(0.038)
small community	0.012	(0.022)	0.155***	(0.046)
large community	0.087***	(0.023)	0.055	(0.049)
logincomespouse			0.010	(0.006)
children 0-3 years			-0.759***	(0.054)
tenure in firm	0.013***	(0.001)		
hours worked	0.009***	(0.000)		
Constant	5.205***	(0.340)	-1.779***	(0.619)
Observations	4,849		4,849	

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.All regressions include year dummies.