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 women in Germany, 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 ones' 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.

JEL classification: J13, J61, H42, R23
Keywords: informal child care, fertility, labor force participation, spatial restrictions, regional labor markets

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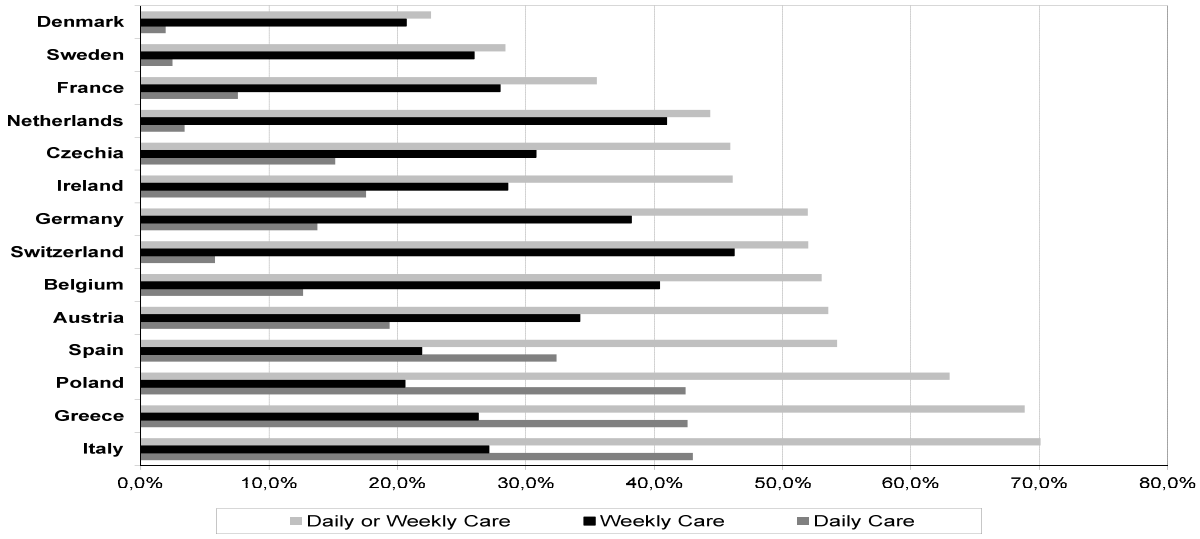
1 Introduction

Grandparents are an important source of child care. According to data from the 2^{nd} wave of the Survey of Health, Ageing and Retirement in Europe (SHARE), between 23% (Denmark) and 70% (Italy) of grandparents take care of their grandchildren age ten or younger on a daily or weekly basis. In the Netherlands, Belgium, and Switzerland more than 40% of grandparents take care of their small grandchildren each week, while in Italy, Greece, and Poland more than 40% of grandparents provide daily care for grandchildren age ten or younger (see Figure 1.1).[1] 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.

Figure 1.1: Grandparent-Provided Care for Children $\leq$ 10 years



Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2^{nd} wave.

There exists an extensive empirical literature that has studied the link between female labor force participation and child care. Many papers propose a joint analysis of the effect of child care costs on fertility and labor force participation. For Italy, Del Boca [2002]

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

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. In a literature summary, Del Boca and Viuri [2007] 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. Thus these findings suggest that 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 amount to 30% of the income of a family living below the poverty line).[2]

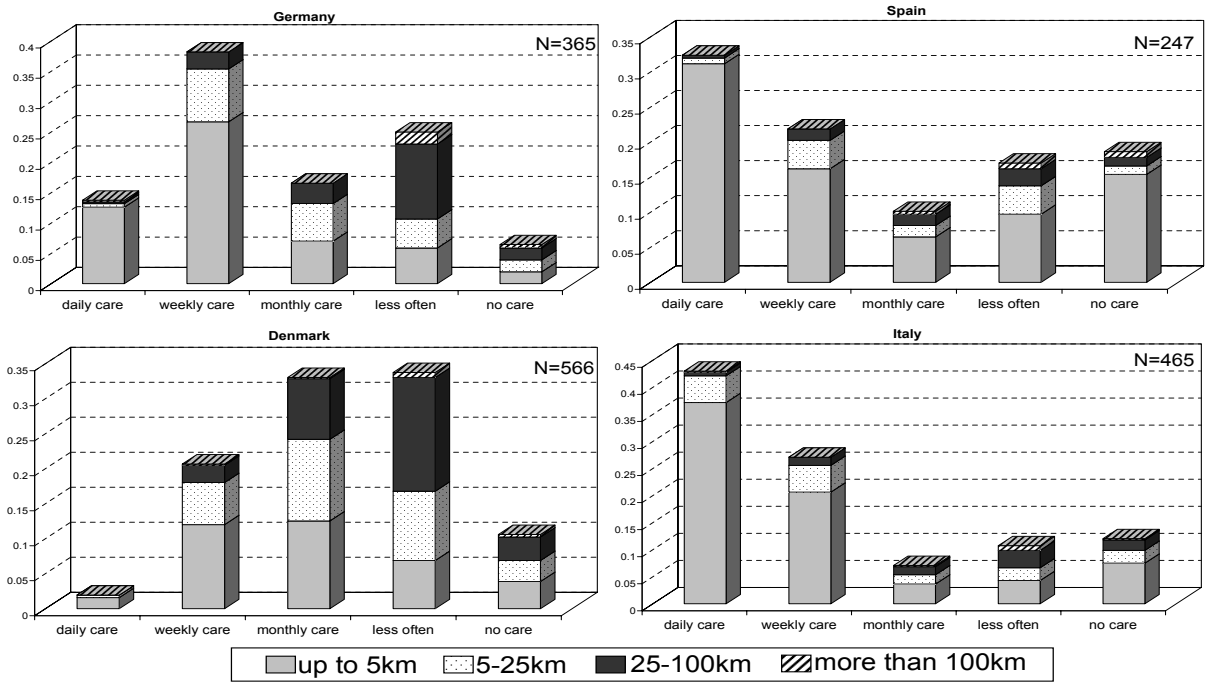
In this sense, free grandparent-provided child care seems to be the perfect solution for working mothers. However, in order to enjoy grandparent-provided child care on a regular basis, residence choices of adult children and elderly parents have to coincide. Data from the 2^{nd} wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) shows that the frequency of grandparent-provided child care is clearly linked to the geographical distance between caregivers and caretakers. Figure 1.2 displays the geographical distance between grandparents and their small grandchildren (younger than 10 years) together with the frequency of care provided, for Italy, Spain, Germany, and Denmark. As already suggested in Figure 1.1, the overall frequency of care varies strongly across the four selected countries, with Italian and Spanish grandparents clearly providing child care more frequently than German or Danish grandparents. However, similar across all countries, those who provide more frequent care tend to live close by.[3]

Hence, while grandparent-provided child care may induce 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 commute. 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 regarding residence, fertility, and labor force participation change under different family policies.

[2]US Census Bureau [2011].

[3]The same pattern can be observed across the rest of the countries included in the SHARE data set; see Figures A-1-A-3 of the Appendix.

Figure 1.2: Frequency of Care and Distance to Closest Grandchild Age 10 and Younger



Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2^{nd} wave.

The current paper thus contributes to the literature by being the first paper, to the best of our knowledge, that explicitly incorporates spatial restrictions imposed by grandparent-provided child care into a general equilibrium model of fertility and labor force participation decisions. To the best of our knowledge, our paper is also the first one to document both costs and benefits of the geographical proximity between parents and adult children implied by grandparent-provided child care. The existing literature, on the contrary, has solely highlighted the positive implications of geographical proximity between parents and adult children. 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. For the US, Compton and Pollak [2011] using proximity as an instrument for child care transfers, estimate labor force participation of mothers to be 5.1 to 6.2 percentage points higher if their mothers or mothers-in-law take care of their children. 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.

Our paper is also related to the literature on intergenerational transfers. The majority of this literature focuses mainly 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 [1995] estimates care choices of elderly parents together with location decisions of children. His work is 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 [2011] 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. For Italy, Arpino et al [2010] find that grandparent-provided child care increases, in particular labor force participation of low educated mothers of young children. Other authors such as Smith Koslowski [2009] have focused on the costs that grandparent-provided child care implies for grandparents.

With this in mind, Cardia and Ng [2003] explicitly incorporate grandparents' decisions into a general equilibrium model for grandparent-provided child care. 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 potential costs in terms of labor market outcomes implied by grandparent-provided child care. Both papers, that we view as complementary, are also part of the literature that uses general equilibrium models to assess how different public policies interact with family decisions.[4] Greenwood, Guner and Knowles [2000] for instance, investigate the effect of the rise in the generosity of 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

[4]See Attanasio, Low and Sanchez-Marcos [2010] or Guner and Knowles [2009] among others.

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 spatial restrictions imposed by grandparent-provided child care. However, for the sake of tractability we abstain from several features present in the papers mentioned, such as a marriage market or employers' demand for labor.[5] Also related to this paper are the works by Bick [2010] and Mendez [2008]. Within a life cycle model, the former 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 relative-provided child care nor does he take into account the spatial restrictions that it imposes. The paper by Mendez [2008] on the other hand attempts to account for differences in geographical mobility and female labor force participation across European countries. Similar to the current paper, the author provides a model of residence choice, fertility and female labor force participation. However, different from the current paper regions in his model only differ in terms of child care arrangements and hence there is no cost associated to living close to parents or in-laws.

The remaining of this paper is organized as follows. The next section presents our empirical analysis. Section 3 presents the general equilibrium model. Section 4 describes our calibration strategy and Section 5 presents the results of the paper. In Section 6 we describe the mechanisms at work in greater detail and we perform two counterfactual experiments in Section 7. Section 8 concludes.

2 Empirical Analysis

For our empirical analysis, we consider data from the German Socio-Economic Panel (GSOEP). The GSOEP is an annual household survey that has been carried out since 1984. The first sample in 1984 included 5,921 households with 16,205 individuals (76% adults, 24% children) of which 44% still remained in the sample in 2004, after 20 years. In addition, new samples for refreshment of the data and for specifically targeting certain groups of the population (East Germans, foreigners, high-income individuals) were added in 1990, 1994, 1995, 1998, 2000, and 2002. The GSOEP provides extensive information

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

on individuals' labor market participation, marital and family status, wages, education, the size of the town they live in etc.[6] For our analysis we only consider women age 25 to 50 living in Germany. We exclude those born outside of Germany, given that for these individuals both key variables of our analysis, (i) availability of child care by relatives and (ii) residence relative to parents, might be determined by very different aspects compared to individuals who were born in Germany. Given stark differences in mothers' labor force participation rates between East and West Germany, we introduce dummy variables to distinguish between individuals living in East and West Germany.[7] To account for possible cultural differences, we also distinguish among those of German nationality and those of other nationalities. 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). 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).

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 information on the relative residence of parents or in-laws and we pool observations from these four waves.[8] We construct a dummy variable "parents or in-laws close" that takes on value one for individuals whose mother, father, or in-law lives in the same neighborhood or town and another dummy variable "parents or in-laws far" for individuals who live more than one hour or further away from their parents or in-laws. For individuals who live in the same house as their parents or in-laws we construct a different dummy variable "parents or in-laws in same house", given that this particular form of co-residence often arises because young individuals still live at home or due to the need for intensive care of parents and in most cases it represents a temporary living arrangement. This indirect

[6]For more details on the GSOEP and its development, see SOEP [2005].

[7]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 für Familie, Senioren, Frauen und Jugend [2005].) In our first sample, labor force participation rates for mothers are 64% and 47% respectively in East and West Germany.

[8]For 1991, we exclude individuals living in East Germany given that in this particular wave information for most labor market variables (participation, wages) are missing for East Germans.

measure reflects more than actually provided child care by grandparents. If living close to parents or in-laws before having children affects fertility decisions, this measure might also reflect "potentially" provided child care and thus would prove particularly useful to test effects on fertility. On the other hand, if individuals continue to live close to parents or in-laws after children have grown beyond the child care age, the measure might reflect "child care provided in the past", which could be useful to test effects on current wages.

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 age three and younger and again we pool data from the available waves. We consider mothers of children age three and younger, given that in Germany availability of public or publicly subsidized nursery for children of age three and older is almost guaranteed, while for those younger very few places are available.[9] Hence child care by relatives is particularly important for mothers of children age three and younger. We thus construct a dummy variable "child care by relatives" that takes on value one for all mothers with children age three or younger if relatives regularly take care of this child. Another dummy variable "child care nursery" takes on value one if the child of age three and younger is attending nursery school. From both of our samples we exclude individuals with incomplete or inconsistent information.[10] Tables 2.1 and 2.2 provide summary statistics for both samples, for both women and mothers.

Description of the sample Our first sample consists of 10,732 women and 8,129 mothers. In the second sample we have information for 27,810 women and 3,390 mothers of children age three or younger.

[9] According to data from the Statistische Ämter des Bundes und der Länder [2011], in 2011 only around 15% of children age three and younger in care attended public or publicly subsidized nurseries, while 85% attended some form of private day care, compared to less than 1% of children between three and six.

[10] Hence, from both of our samples we exclude those who report to have worked regular full-or part time jobs but who also report to have worked fewer than twenty hours a month. For our first sample we exclude individuals who report to work regular full-or part time jobs but do not report their wage income or firm tenure or report zero or negative values for any of the two variables. For our second sample this exclusion criteria concerns those who report to work regular full-or part time jobs and who do not answer the question if they work and reside in the same town.

Table 2.1: Means (Std.) - GSOEP pooled sample-
- 1991, 1996, 2001, 2006-

First Sample:	Women 25-50	Mothers 25-50
Age	37.43 (7.09)	38.80 (6.58)
25-29	0.17 (0.38)	0.10 (0.30)
30-34	0.20 (0.40)	0.18 (0.39)
35-39	0.22 (0.41)	0.24 (0.43)
40-44	0.21 (0.41)	0.25 (0.42)
45-50	0.20 (0.40)	0.23 (0.42)
Married, living together	0.68 (0.46)	0.79 (0.40)
Other than German nationality	0.02 (0.13)	0.01 (0.12)
Children	0.76 (0.43)	1 (0)
Children 0-3	0.17 (0.37)	0.22 (0.42)
Primary education	0.01 (0.10)	0.01 (0.09)
Secondary education	0.72 (0.45)	0.73 (0.44)
Tertiary education	0.27 (0.45)	0.26 (0.44)
Regular fulltime job	0.36 (0.48)	0.25 (0.43)
Regular part time job	0.24 (0.43)	0.29 (0.45)
Small community	0.45 (0.50)	0.48 (0.50)
Medium community	0.26 (0.44)	0.26 (0.44)
Large community	0.29 (0.46)	0.26 (0.44)
in West Germany	0.75 (0.43)	0.72 (0.45)
in East Germany	0.25 (0.43)	0.28 (0.45)
Parents or in-laws in same house	0.14 (0.34)	0.13 (0.34)
Parents or in-laws close	0.42 (0.49)	0.44 (0.50)
- Parents or in-laws in same neighborhood	0.19 (0.39)	0.21 (0.41)
- Parents or in-laws in same town	0.23 (0.42)	0.24 (0.42)
Parents or in-laws far away	0.44 (0.50)	0.43 (0.49)
- Parents or in-laws one hour away	0.29 (0.45)	0.29 (0.45)
- Parents or in-laws further away	0.15 (0.35)	0.13 (0.34)
Parents or in-laws in foreign country	0.005 (0.07)	0.005 (0.07)
Spouse's income*	2844.46 (2361.99)	2865.04 (2159.02)
Hourly wage**	12.36 (6.22)	12.05 (6.21)
Tenure in firm**	8.40 (7.33)	8.89 (7.56)
N	10,732	8,129

*Only taking into account strictly positive income ($N = 7,323$, $N = 6,083$ for mothers) **Among those working regular part-or fulltime jobs ($N = 6,471$,$N = 4,348$ for mothers)

Table 2.2: Means (Std.) - GSOEP pooled sample -
-1997, 1999, 2000, 2001, 2002, 2004, 2005, 2006-

Second Sample:	Women 25-50	Mothers 25-50 of children age ≤ 3
Age	38.09 (7.14)	33.06 (4.40)
25-29	0.15 (0.36)	0.23 (0.43)
30-34	0.18 (0.39)	0.40 (0.49)
35-39	0.21 (0.41)	0.28 (0.45)
40-44	0.22 (0.41)	0.08 (0.27)
45-50	0.23 (0.42)	0.005 (0.07)
Married, living together	0.66 (0.47)	0.80 (0.40)
Other than German nationality	0.02 (0.15)	0.05 (0.20)
Children	0.75 (0.43)	1 (0)
Children 0-3	0.16 (0.37)	1 (0)
Primary education	0.01 (0.10)	0.008 (0.09)
Secondary education	0.71 (0.45)	0.72 (0.45)
Tertiary education	0.28 (0.45)	0.27 (0.45)
Regular fulltime job	0.35 (0.48)	0.07 (0.25)
Regular part time job	0.24 (0.43)	0.14 (0.34)
Small community	0.48 (0.50)	0.47 (0.50)
Medium community	0.25 (0.43)	0.27 (0.44)
Large community	0.27 (0.44)	0.26 (0.44)
in West Germany	0.74 (0.44)	0.77 (0.42)
in East Germany	0.26 (0.44)	0.23 (0.42)
Children in Nursery	-	0.46 (0.50)
Children cared for by relatives	-	0.34 (0.47)
Spouse's income*	3122.98 (2259.43)	3126.92 (1853.81)
Tenure in firm**	8.68 (7.61)	7.11 (5.41)
Job in town**	0.39 (0.49)	0.39 (0.49)
N	27,810	3,390

*Only taking into account strictly positive income ($N = 17,544$, $N = 2,581$ for mothers)**Among those working regular part-or fulltime jobs ($N = 16,343$ $N = 690$, for mothers)

Both samples only include women between 25 and 50, with an average age of 38 years. With an average age of around 33 years, mothers in our second sample are slightly younger given that in this sample we only consider mothers of children age three and younger. We construct five different age groups, each containing about one fifth of women in both samples. Given average late birth, the first age group in our first sample only contains about one tenth of all mothers, while in our second sample that only considers mothers of children age three and younger less than 1% are older than 44. Around two thirds of women and 80% of mothers in both samples are married and around 1-5% has a nationality different from the German one. Approximately 75% of women between 25 and 50 in both samples have children and around 20% are mothers of small children (age 0-3). Among both mothers and women, around 1% has only completed primary education, 72% finished secondary education, and around 27% completed tertiary education. For mothers this last percentage is slightly lower, while a larger fraction of mothers has completed secondary education.[11]

Around 35% of women have a regular fulltime job and 25% hold a regular part time job. For mothers in our first sample both percentages are similar of around 25% and 29% respectively. In our second sample that only considers mothers of children age three and younger 7% work regular fulltime jobs while 14% hold a regular part time job. More women live in small communities than in medium sized or large communities. The large majority (72-77%) of women and mothers in both samples lives in West Germany. Around 43% of women and mothers in the sample live in the same neighborhood or town as their parents or in-laws, while 13% live in the same house or household and around 44% live at least one hour away from their parents or in-laws. Almost half of all mothers in our second sample use nursery care for their children age three and younger, while a little over one third has their children cared for by relatives on a regular basis. Considering only those women or mothers whose spouse has a strictly positive income, the average monthly spouse's income is around 3000€.[12] Hourly wages of women and mothers are around 12€. On average, these individuals have been with their current employer for the last 7 to 9 years. Around 40% of women and mothers work and reside in the same town.

[11] Given few women and mothers who only completed primary education, for our estimations we group those having completed primary and secondary education and only differentiate between women with and without tertiary education.

[12] Note that when pooling the sample we only adjust wages for the change from Deutschmark to Euro. We do not adjust for wage growth, given stagnant real hourly net wages in Germany between 1991 and 2006 (see Figure 1 in DIW [2009]).

Proximity to Parents and Fertility For women living in the same neighborhood or town as their parents or in-laws the probability to have children is around 4 percentage points higher compared to women living further away. Table 2.3 displays marginal effects from the probit estimation for the probability of having children. Controlling for marital status, spouse's income, region of residence, the size of the community, age, year effects, and education, geographical proximity to potential grandparents has a significantly positive effect on fertility. Concerning the other variables of the regression, the likelihood of being a mother for women in Germany between 25 and 50 is clearly positively influenced by their marital status. Being married raises the probability of having children by almost 30 percentage points. Furthermore, higher spouse's income and living in East Germany and in a small community increases the probability while higher education reduces the probability as does living in a large community, relative to living in a medium-sized community. Including an interaction term between living close to parents or in-laws and educational attainment into the regression, we find that the positive effect of living close to parents or in-laws on women's fertility is particularly strong for women with university education.[13]

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 fulltime job for mothers residing close to their parents or in-laws is 3 percentage points higher compared to mothers residing further away. The first column of Table 2.4 displays the marginal effects from a probit regression for the probability of having a regular part-or fulltime job in Germany for 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 strongly in the presence of a small child, decreases with marriage, and increases with tertiary education compared to primary or secondary education. The probability that a mother is working is lower for those of a foreign nationality, it is higher if she is residing in East Germany and it also increases with her age, because mothers age jointly with their children and older children facilitate mothers' labor force participation. Higher spouse's income is associated positively to mothers' labor force participation. While higher spouse's income relaxes the household's budget constraint and thus allows a mother to stay home, many of those married to men of higher income are high-skilled women (assortative matching) for whom staying home implies higher forgone

[13]See Table A.1 of the Appendix. Estimation results are consistent to the inclusion of a polynomial for age instead of age group dummies as well as to including years of education instead of educational categories. Given that marital status and spouse's income might be correlated with living close to parents or in-laws we also check consistency of results, excluding both variables (see Table A.2 of the Appendix).

Table 2.3: Effect of close Presence of Grandparents on Fertility
Marginal Effects from Probit Estimation for Having Children

Married, living together	0.287***	(0.012)
Other than German nationality	0.007	(0.027)
Log (Spouse's income)†	0.004***	(0.001)
in East Germany	0.153***	(0.008)
Tertiary education (ISCED: 5,6)	-0.089***	(0.010)
Parents or in-laws close	0.041***	(0.009)
Parents or in-laws in same house	0.002	(0.013)
Small community	0.029***	(0.010)
Large community	-0.060***	(0.012)
Observations	10,732	

†Missing values and values < 1 are set to 0. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1 Probit Estimation; Data: GSOEP unbalanced panel 91,96,01,06; Women 25-50. All regressions include year dummies and age group dummies. Reference group: unmarried women age 25-29 living in West Germany with education level 1 or 2 (ISCED: 0-4) in 1991, in a medium-sized town, far from parents or in-laws.

wages. Here the latter effect seems to dominate the former. Living in the same house with parents or in-laws has a stronger effect on mother's labor force participation than simply living close by. This result might be due to the fact that if living in the same house as parents or in-laws is due to the need for intensive care for parents or represents a temporary living arrangement this might detain women from having children. However, for women who have decided to become mothers, living in the same house as parents or in-laws is probably not related to this type of situation. On the contrary, for mothers having parents or in-laws as close as possible facilitates their participation in the labor market.

We obtain stronger results for our alternative analysis that uses the more direct measure 'child care by relatives' (see column two of Table 2.4). For mothers of children age three and younger, having relatives taking care of their child increases chances of holding a regular full-or part time job by around 15 percentage points, an effect much stronger than that caused by having the child attending a nursery school, associated to an increase of 9 percentage points. Hence, the net effect of relative-provided child care on the probability

Table 2.4: Effect of Grandparent-Provided Child Care on Mothers' Participation
Marginal Effects from Probit Estimation for Mothers' Labor Force Participation

	Regular Part or Fulltime Job		Regular Part or Fulltime Job	
	(1)		(2)	
Children 0-3	-0.373***	(0.015)		
Married, living together	-0.137***	(0.017)	-0.062***	(0.021)
Other than German nationality	-0.127**	(0.053)	-0.070**	(0.031)
Log (Spouse's income)†	0.007***	(0.002)	0.003	(0.002)
in East Germany	0.126***	(0.014)	0.106***	(0.020)
Tertiary education (ISCED: 5,6)	0.173***	(0.013)	0.075***	(0.017)
Parents or in-laws close	0.029**	(0.013)		
Parents or in-laws in same house	0.034*	(0.018)		
Children cared for by relatives			0.155***	(0.016)
Children in nursery			0.090***	(0.014)
Small community	-0.005	(0.014)	-0.014	(0.017)
Large community	0.017	(0.016)	0.029	(0.019)
Observations	8,129		3,390	

†Missing values and values < 1 are set to 0. Standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1; Data: GSOEP unbalanced panel 1) 91,96,01,06; Mothers 25-50. Reference group: unmarried mothers age 25-29 with education level 1 or 2 (ISCED:0-4) in 1991, in a medium-sized town in West Germany, far from parents or in-laws, with children older than 3. 2) 97,99,00,01,02,03,05,06; Mothers (25-50) of children <= 3 years. Reference group: unmarried mothers age 25-29 in 1997, with education level 1 or 2 (ISCED: 0-4), in a medium-sized town in West Germany, with children age 0-3 who are not in nursery nor cared for by relatives. All regressions include, year dummies and age group dummies.

of holding a regular part-or fulltime job is given by the difference of 6 percentage points.[14] 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 coefficient for spouse's income not being significant.[15]

[14]This number lies in the range of values estimated by Compton and Pollak [2011] for the US of 5.1 to 6.2 percentage points.

[15]All estimation results are consistent to the inclusion of a polynomial for age instead of age group dummies as well as to including years of education instead of educational categories. Marital status and spouse's income might be correlated with living close to parents or in-laws, and having a child in a nursery may be correlated with child care by relatives. Hence, we also check the robustness of our results to the exclusion of these variables (see Table A.3 of the Appendix). Including interaction terms for living close

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 restrictions 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 consider wage incomes of dependent workers of regular full-or part time jobs.[16] Controlling for selection effects, we find that mothers living close to their parents or in-laws earn significantly lower hourly wages. The first column of Table 2.3 displays the coefficients for the Heckman selection model for log hourly wages for mothers in Germany age 25 to 50.

While living close to parents or in-laws or in the same house with them increases the probability of holding a regular part-or fulltime job, it reduces hourly wages by 5%.[17] Concerning the other variables and controlling for selection effects (see column two of Table 2.5), hourly wages in Germany of mothers between 25 and 50 are higher for those living in large communities and they increase with firm tenure, each additional year increases hourly wages by 1.6%. In addition, having tertiary education rather than primary or secondary education increases hourly wages by around 30%. On the other hand, living in small communities, not being German and living in East Germany are all aspects that negatively influence hourly wages.[18]

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 who have low bargaining power as workers incur in longer commuting times. We find that for working mothers of children age three and younger

to parents and education, or child care by relatives and education does not change results and coefficients of these terms turn out to not be statistically significant.

[16]The effect of spatial restrictions on wages is best measured by "parents or in-laws close", more so than by the fact if children are actually cared for by grandparents, because an effect on wages might be long-lasting even after children are grown up given that initial wages can condition future wages. This consideration together with the fact that our second sample only includes mothers of children age three and younger of which only 21% work regular part-or fulltime jobs (see Table 2.2) is the reason why we use our first indirect measure of grandparent-provided child care to measure the effect on wages.

[17]Log monthly wages, controlled for by hours worked, show a slightly higher discount for living close (see Table A.4 of the Appendix) as does not controlling for selection (see Table A.5 of the Appendix for an OLS regression of log hourly wages).

[18] Estimation results are consistent to the inclusion of a polynomial for age instead of age group dummies as well as to including years of education instead of educational categories. Marital status and spouse's income might be correlated with living close to parents or in-laws. Hence, we also check the robustness of our results to the exclusion of these variables (see Table A.6 of the Appendix). Including interaction terms for living close to parents or in-laws and education does not change results and coefficients of these terms turn out to not be statistically significant.

Table 2.5: Effect of Close Presence of Grandparents on Hourly Wages
Coefficients of Heckmann Selection Model for Mothers' Log Hourly Wages

	Log hourly wage		Selection Equation	
	(1)		(2)	
Married, living together	-0.020	(0.016)	-0.348***	(0.044)
Other than German nationality	-0.130*	(0.078)	-0.320**	(0.138)
Tertiary education (ISCED: 5,6)	0.296***	(0.015)	0.446***	(0.036)
Parents or in-laws close	-0.051***	(0.014)	0.071**	(0.032)
Parents or in-laws in same house	-0.051**	(0.021)	0.083*	(0.047)
Small community	-0.032**	(0.016)	-0.012	(0.036)
Large community	0.057***	(0.018)	0.044	(0.041)
in East Germany	-0.206***	(0.015)	0.319***	(0.035)
Log (Spouse's income)†			0.016***	(0.005)
Children 0-3			-0.999***	(0.044)
Tenure in firm	0.016***	(0.001)		
Constant	1.833***	(0.046)	0.060	(0.080)
Observations	8,129		8,129	

†Missing values and values < 1 are set to 0. Standard errors in parentheses *** p<0.01,** p<0.05, * p<0.1. Heckman Selection Model; Data: GSOEP unbalanced panel 91,96, 01,06; Mothers 25-50. Reference group: unmarried mothers of age 25-29 of children older than 3 living in West Germany, with education level 1 or 2 (ISCED:0-4) in 1991, in a medium-sized West German town, far from parents or in-laws. All regressions include year dummies and age group dummies.

the probability of residing and working in the same town is around 12 percentage points lower, and hence they are more likely to have to incur in costly commuting if their children are regularly cared for by relatives. Table 2.6 displays marginal effects from the probit estimation for the probability of working and residing in the same town, i.e. not having to commute, for mothers in Germany age 25 to 50 with children of age three and younger.[19] 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, does not significantly affect the probability of being able to work and reside in the same town. On the other hand, the

[19] Contrary to the effect of grandparent-provided child care on wages, the effect on commuting is much more contemporaneous as commuting time in previous jobs should in principle not influence future commuting time. Thus the effect on commuting could be measured using any of the two measures but given data restriction we cannot provide results for commuting for our first sample. The question for commuting was introduced in 1997 into the GSOEP and is thus not available for 2 out of 4 years of our first sample.

probability to be able to work and reside in the same town is higher for foreign mothers, those living in large communities and those residing in East Germany, while it decreases with marriage, and is lower for mothers living in small communities.[20]

Table 2.6: Effect of Grandparent-Provided Child Care on Commutes
Marginal Effects from Probit Estimation of Working and Residing in Same Town

Married, living together	-0.113**	(0.048)
Other than German nationality	0.517***	(0.098)
Log (Spouse's income)†	0.012	(0.008)
Tertiary education (ISCED: 5,6)	-0.013	(0.044)
Tenure in firm	0.004	(0.004)
Children cared for by relatives	-0.119***	(0.040)
Children in nursery	-0.062	(0.045)
Small community	-0.271***	(0.045)
Large community	0.260***	(0.053)
in East Germany	0.113**	(0.051)
Observations	690	

†Missing values and values < 1 are set to 0. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Probit Estimation Data: GSOEP unbalanced panel, 97,99,00,01,02,03,05,06; mothers 25-50 of children <= 3 years. Reference Group: unmarried mothers of age 25-29 in 1997 with education level 1 or 2 (ISCED: 0-4) in a medium-sized West German town, with children age 0-3 who are not in nursery, nor cared for by relatives. All regressions include age group dummies and year dummies.

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 or in-laws) which might be correlated with the outcome variables: having children or participating in the labor market. To this end, we consider women in Germany aged 25 to 50 who stayed in the sample from 1991 to 1996. Given the reduced size of the balanced sample we join

[20] Again results are consistent to the way age and education are included. Having a child in a nursery may be correlated with child care by relatives. Hence, we also check the robustness of our results to the exclusion of this variable (see Table A.7 of the Appendix). Including interaction terms for having relatives taking care of one's children and education does not change results and coefficients of these terms turn out to not be statistically significant. Similarly, one could look at the effect of child care by relatives on commuting distance to work. However, in this case the coefficient for the variable ¨child care by relative¨ turns out to be positive as expected but is not significantly different from zero.

the variables "parents or in-laws in same house" and "parents or in-laws close" into one variable. As very few women become first-time mothers during the course of staying in the sample, none of the coefficients in individual fixed effect regressions for fertility turn out to be significant. Similarly, in individual fixed wage regressions the coefficient for the variable "parents or in-laws close" is not significant. However, we can report significant estimates for the probability of holding a regular part-or fulltime job (see Table 2.5). Controlling for individual fixed effects, mothers living close to their parents or in-laws are more likely to hold a regular part-or fulltime job. Coefficients of other control variables of the individual fixed effect estimation are comparable to the marginal effects found for the pooled sample (see Table 2.2). Marriage and the presence of small children negatively affect mothers' labor force participation.

Table 2.7: Grandparent-provided Child Care and Participation
Coefficients of Individual Fixed Effects Estimation

	Regular Part or Fulltime Job	
Children 0-3	-2.009***	(0.435)
Married, living together	-2.100**	(0.862)
Log (Spouse's income)†	0.025	(0.080)
Parents or in-laws close ‡	1.277**	(0.564)
Small community	0.129	(0.954)
Large community	0.152	(1.000)
in East Germany	-14.422	(1,099.009)
Observations	328	
Number of person.	164	

†Missing values and values < 1 are set to 0. ‡includes in same house.
Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;
Fixed Effect Estimation Data: (other nationality and educational category omitted because of no within-group variance) GSOEP balanced panel 91-96 mothers 25-50 Reference group: unmarried mothers age 25-29 with education level 1 or 2 (ISCED:0-4) in West Germany in a medium-sized town, living far from their parents or in-laws, with children older than 3. All regressions include age group dummies and year dummies.

While we find a positive relationship between grandparent-provided child care and fertility, and grandparent-provided child care and regular labor force participation by mothers,

on the other hand, we observe that for mothers, grandparent-provided child care is related to lower wages and more 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 valuable is grandparent-provided child care in terms of fertility and employment? In order to answer these question, in the next section we present our 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 observed in the data. Hence, we then calibrate our model to the German economy along several key dimensions and highlight the model's mechanism behind women's decisions that can potentially generate the observed relationships. Finally, we perform several counterfactual experiments to analyze how women's decisions change when public policy changes.

3 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). Living close provides access to free child care. We only model married 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.

The model economy is inhabited by a continuum of overlapping generations of married women of mass one. Women live for five periods, two as children (0-9 years and 10-19 years), one as young fertile adults (20-29 years), one as fertile middle-aged adults (30-39 years) and one as old adults (40-49 years).[21] Decisions in this economy are only taken by adults. When they 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 many resources to spend on their children's education - in terms of money and their own time. When they are fertile middle-aged adults they decide on how many children to have, how much to work, and on how many resources in terms of money and time to spend on educating their children. When old, adults decide on how much to

[21] Availability of free child care obviously depends on grandparents being able and willing to take care of grandchildren. Even though individuals might still be working as old adults, we assume that close to parents or in-laws there is some type of family network that takes care of children free of charge. We also assume that there are no costs associated with taking care of grandchildren as, for now, we are only concerned about the effects of spatially restricted free child care on mothers' labor market outcomes

work and on how many resources in terms of money and time to spend on educating their children. 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. The region of residence of each individual is denoted by j, where $j = H, F$.

Regions There are two regions in this economy, 'Home', H and 'Far', F. Grandparent-provided child care is only available in 'Home'.

Life-Course Offers At the beginning of their life as young fertile adults, individuals receive two 'life-course offers', one associated to living in 'Home' and another 'life-course' associated to living in 'Far'. A 'life-course offer' is i) a realization of labor productivity x^j and ii) an exogenous source of income, z^j representing a spouse's income, where $j = H, F$. There are N possible labor productivities and N possible exogenous incomes. Therefore, for married women there are NxN possible offers for staying 'Home' and NxN possible offers for moving 'Far'. The probability that a married woman receives an offer (x^H, z^H) in 'Home' and an offer (x^F, z^F) if she moves to 'Far' is given by the matching matrix $\Pi(x^H, z^H, x^F, z^F)$. A woman who receives an offer in 'Home' where the labor productivity is equal to x will receive an offer in 'Far' where the labor productivity is equal to $(1+\kappa x')$. This implies that in case she receives the same productivity offer in both regions, she will earn a wage premium in 'Far', representing a larger labor market, where her exact same skills can be matched better. However, productivity offers do not need to be the same, they can be higher in 'Far' $x^F > x^H$, equal in both regions $x^F = x^H$, or higher in 'Home' $x^F < x^H$. Individuals are endowed with one unit of productive time.

Residence Choice Individual's residence choice, D is 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

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

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. Individuals thus have the following after-tax wage income, W

$$W = (1-\tau)x^j(1+D\kappa)l,$$

where $j = H, F$, and $\kappa > 0$.

Children Individuals can have children when they are fertile. Children receive education depending on the resources 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 them. The time a child spends in child care (t_c) can enhance the child's education. The child's education function is denoted by

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

Child care Individuals with young children (0-9 years) who work require child care. Hence, we assume that time spent in child care is equal to the time a mother is at work, and thus t_c equals l . The price of child care, $p(D)$ depends on the individual's residence choice in the following way: $p(0) = 0$ and $p(1) > 0$. 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 her child spends in child care.[22] Mothers with children older than 9 years do not pay for child care independently of where they reside, given that these children have access to a free public school.[23]

Utility 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

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

Children do not take any decisions but simply receive education.

Timing of Decisions When individuals become young fertile adults, they receive their 'life-course offers' and they decide which one to realize, i.e. whether to reside close to

[22] 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'.

[23] For now we assume that older children attend school during the time their mother works.

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 the respective share of time, and if they have children, they have to purchase child care if they work and live far away from their parents. Individuals decide how many resources to devote to their children, and they consume. From then on, they remain in the chosen region of residence.

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 of the economy and P is the amount of subsidies and transfers that the government pays out to individuals.

3.1 Value functions

We start by defining the value functions of old adults. Old adults cannot have small children but they might have older children born the previous period.

Old adult In the last period of individuals' adults lives, residence decisions do not change, but older children (10-19 years) born in the previous period, might still be present in the household. Let k_m denote these children. Old adults thus have to decide how many resources to spend on their children and how much to work. Old adults derive utility from children, consumption, and leisure. The value of being an old individual living close is given by

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

subject to the following budget constraint

$$(1-\tau)(x^H l + z^H) + TI_{\bar{T}} I_k = \Psi(a, k_m)c + b$$

and the education production function

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

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 on value one if the family income is below the threshold, $\bar{T}$. The indicator function I_k equals one if the individual has children. There are economies of scale in consumption, $\Psi(a,k)$, where a indicates the number of adults in the household and thus is equal to 2 for a married couple. The optimal labor decision of an old individual living close is denoted by $L_o^H(x^H, z^H)$. Optimal decisions in terms of money and time devoted to children are denoted by $B_o^H(x^H, z^H)$ and $T_o^H(x^H, z^H)$ respectively. Given that only older children might be present in the household, old individuals living far away do not have to purchase child care. The value of being an old individual living far is given by

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

subject to the following budget constraint

$$(1-\tau)(x^F(1+\kappa)l + z^F) + TI_{\bar{T}}I_k = \Psi(a, k_m)c + b$$

and the education production function

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

The optimal labor decision of an old individual living further away is denoted by $L_o^F(x^F, z^F)$. Optimal decisions in terms of money and time devoted to children are denoted by $B_o^F(x^F, z^F)$ and $T_o^F(x^F, z^F)$ respectively.

Middle-aged adult Middle-aged adults have to decide how many children to have, how much to work, and if they have children they have to decide how many resources in terms of time and money to spend on the education of their children. Middle-aged adults can have both small (k_m) and/or older (k_y) children who were born the previous period living in the household, $k = k_m + k_y$. The value of being a middle-aged individual living close is given by

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

subject to the following budget constraint

$$(1-\tau)(x^H l + z^H) + TI_{\bar{T}}I_k = \Psi(a, k)c + b$$

and the education production function

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

Note that middle-aged 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 small children with their grandparents. The optimal labor decision of a middle-aged individual living close is denoted by $L_m^c(x^H, z^H)$. The optimal number of small children is given by $K_m^H(x^H, z^H)$, optimal decisions in terms of money and time devoted to all children are denoted by $B_m^H(x^H, z^H)$ and $T_m^H(x^H, z^H)$ respectively. Given that small children require child care while the mother works, individuals living far might have to pay child care for their small children. The value of being a middle-aged individual living far is given by

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

subject to the following budget constraint

$$(1-\tau)(x^F(1+\kappa)l + z^F) + TI_{\bar{T}}I_k = \Psi(a,k)c + b + (1-\omega)p(1)I_{k_m}$$

and the education production function

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

where I_{k_m} is an indicator function that takes on value one if there are small children in the household. A middle-aged fertile adult with small children 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. Moreover, if she works, she might also receive child care subsidies, ω per unit of time her children spend in child care. The optimal labor decision of a middle-aged individual living further away is denoted by $L_m^F(x^F, z^F)$. The optimal number of small children is given by $K_m^F(x^F, z^F)$, optimal decisions in terms of money and time devoted to all children are denoted by $B_m^F(x^F, z^F)$ and $T_m^F(x^F, z^F)$ respectively.

Young fertile adult Young fertile adults have to decide which 'life-course offer' to accept, i.e. whether to stay close to their parents or not. If they stay they obtain free child care. If they move they might be able to enjoy higher labor productivity and a higher spouse's income. However, if individuals 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 many resources to spend on educating their children. The value of being a young fertile woman remaining close to her parents ($D = 0$) is given by

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

subject to the following budget constraint

$$(1-\tau)(x^H l + z^H) + TI_{\bar{T}} I_k = \Psi(a, k_y)c + b$$

and the education production function

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

The continuation value of living in region H is the value of being a middle-aged woman living in region H, because residence decisions cannot be reconsidered. For a woman living close to her parents the optimal decision regarding how much to work is denoted by $L_y^H(x^H, z^H)$, the optimal number of children is given by $K_y^H(x^H, z^H)$. The optimal amount of time spent taking care of her children is $T_y^H(x^H, z^H)$ and the optimal amount of money spent on her children is given by $B_y^H(x^H, z^H)$.

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

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

subject to the following budget constraint

$$(1-\tau)(x^F(1+\kappa)l + z^F) + TI_{\bar{T}} I_k = \Psi(a, k_y)c + (1-\omega)p(1)lI_{k_y} + b$$

and the education production function

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

Optimal decisions for a young fertile woman living further away are denoted by $L_y^F(x^F, z^F)$, $K_y^F(x^F, z^F)$, $T_y^F(x^F, z^F)$ and, $B_y^F(x^F, z^F)$.

Residence Decision Women have to decide whether to stay home or to move away. They decide to move if the utility of living further away exceeds the utility of staying close by, i.e.

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

where $j = H, F$.

Equilibrium The optimal decision rules for fertile young adults are as follows: $L_y^j(x^j, z^j)$ is the labor force participation decision, $K_y^j(x^F, z^F)$ denotes the optimal number of children, $T_y^j(x^j, z^j)$ denotes time spent with children, $B_y^j(x^j, z^j)$ is the amount of money spent on children and $C_y^j(x^j, z^j)$ is the level of consumption, where $j = H, F$ denotes the region where the individual resides. Optimal decisions for fertile middle-aged adults are as follows: $L_m^j(x^j, z^j)$ is the labor force participation decision, $K_m^j(x^F, z^F)$ denotes the optimal number of small children, $T_m^j(x^j, z^j)$ denotes time spent with children, $B_m^j(x^j, z^j)$ is the amount of money spent on children and $C_m^j(x^j, z^j)$ is the level of consumption, for $j = H, F$. The optimal decision rules for old individuals are as follows: $L_o^j(x^j, z^j)$ is the labor force participation decision and $C_o^j(x^j, z^j)$ is the level of consumption, $T_o^j(x^j, z^j)$ denotes time spent with children, $B_o^j(x^j, z^j)$ is the amount of money spent on children, where $j = H, F$. Given a government policy $(\tau, T, \bar{T}, \omega, G)$, an initial matrix of 'life-course offers' $\Pi(x^H, z^H, x^F, z^F)$, a stationary equilibrium is a set of decision rules, a distribution of residential choices, and the number of children born, $K = K_m + K_y$ 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.

4 Calibration Strategy

4.1 Functional Forms

In this part of the paper we present the explicit functional forms for the utility function and the education production function. Individuals' utility is separable in consumption, children, and leisure. We assume log utility in consumption and in leisure, while the utility in children's quality is linear. There are two weighting parameters. 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 utility of an individual is thus given by

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

Individuals receive utility from the number of children in the household and from the level of education that their children have received. 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 which is represented by $Q(e, k)$.

To obtain this quantity-quality trade-off regarding children in the utility function, we choose the following Cobb Douglas specification

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

where λ denotes the share of education in the production function of a child's quality.[24]

The education production function depends on a woman's time spent taking care of her children, t, the amount of money spent on the education of children, b and the form of child care. Money and time are assumed to have a unit elasticity of substitution. The share of time spent taking care of children in the education production function is equal to 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.[25]

If women live far away from their parents, money can be spent on children in two different ways. If the mother works an amount of time, l her children have to spend that same amount of time in private or public child care and she has to pay an hourly cost of $p(1)$. Private child care enhances children's education. 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 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 her children with her parents while working is equivalent to investing in child care. The chosen functional form to represent the relationship between expenditure in private child care and other education related expenditure is of the CES type. The elasticity of substitution between these 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 the degree of substitutability between these two different types of expenditure. We thus specify the functional form of the education production function as

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

[24] Other papers in the literature use this specification; see for instance Greenwood et al [2000].

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

4.2 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. We consider weighted statistics for married women age 20 to 50 born in Germany for whom information on parents' residence is available.[26] Note that we will join the variables "parents or in-laws in same house" and "parents or in-laws close" (see Section 2 for more details on this data). Finally, we have a set of policy parameters which we will set such as to represent German family policies.

In the model economy, there is an initial distribution of 'life-course offers', $\Pi(x^H, z^H, x^F, z^F)$. This matrix is chosen such that it be consistent with the existence of an initial distribution of young women's labor productivities, $\Omega(x)$ and an initial distribution of men's labor productivities $\Theta(z)$. We assume a log normal distribution over productivity types and we discretize the distribution to obtain different productivity levels, where the mean and standard deviation are denoted by μ_x and σ_x respectively for women and μ_z and σ_z for men. Women and men are matched according to the matching matrix $\Phi(x, z)$, where the probability that a woman of productivity type x_1 (being the lowest type) meets with a man of the same productivity type, z_1 is equal to ψ. We specify ten different productivity types for women and we also have ten different types of exogenous incomes. There will thus be a hundred different types of matches between a woman and an exogenous income (spouse).

Parameters set a priori are the discount factor β, parameters related to the productivity distribution over individuals $\mu_x, \mu_z, \sigma_x, \sigma_z$, and the assortative matching parameter, ψ. Given that one model period is equivalent to 10 years, the discount factor, β is set to a value of 0.675 in order to match a yearly interest rate of 4%. Estimates for mean and standard deviation of the productivity distribution for women are taken from log-hourly wages in our first pooled sample, which gives us the following parameter values, $\mu_x = 2.41$ and $\sigma_x = 0.47$. Similarly for spouses we have $\mu_z = 2.66$ and $\sigma_z = 0.45$. As we abstain from modeling a marriage market we assign an exogenous income to each woman to represent her spouse's income. To this end, we use a matching matrix that assigns an exogenous income to each woman based on information on who marries whom in the German economy.

[26] We consider only married women in the model and calibration as only 7% of single women are mothers, while 76% of married women are mothers.

In order to build this matrix we take the degree of assortative matching, i.e. how likely it is to meet your own productivity type, ψ in Germany from Fernández et al. [2005]. The authors calculate this value to be 0.7 in Germany, i.e. 70% of women match with men of the exact same type, while the remaining 30% are equally likely to match with men of types different from their own. Table 4.8 displays all parameters set a priori.

Table 4.8: Parameters based on a priori information

Parameter	Explanation	Value
β	Discount Factor	0.675
μ_x	mean log productivity of women	2.41
σ_x	standard deviation of women's log productivity	0.47
μ_z	mean log productivity of spouses	2.66
σ_z	standard deviation of spouses' log productivity	0.45
n	average working time of men	0.4
ψ	assortative matching parameter	0.7

Parameters to be calibrated are the parameters of the utility function, ϕ_e, ϕ_l and the parameters of the education production function for children, $\lambda, \rho, \alpha, \theta$ as well as the wage premium of working in 'Far', κ. 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 1.3, such as to match the ratio of the fertility rate between women living close to their parents or in-laws and those living far away, 1.02. The weight of leisure in the utility function, ϕ_l is given a value of 1.15 in order to match a labor force participation rate of 56.82% for married women in Germany. The share of the number of children in the quality-quantity trade-off function, λ is set to 0.38 in order to match a fertility rate of married women in Germany of 1.71.

Values for the three parameters of the education production function, ρ, α, θ are chosen so as to match data on expenditure on children as 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. The average family income in Germany was 3,750 Euros per month in 2003 (German FSO) and German households with children have on average 1.9 children. Therefore, the expenditure on children for an average household is close to 10% of family income. The ratio of time that a non-working mother spends with her

children in comparison to a working mother is 1.32. We calculate this ratio using data provided in Ichino and Sanz de Galdeano [2004]. We take from Sayer et al. [2004] the time high educated mothers (corresponding to the four most productive women in our model economy) spend with their children as a percentage of their disposable time (16 hours per day), 11.25% . [27] Hence parameters ρ, α, θ of the education production function are assigned values 0.7, 0.6, and 0.35 respectively. The percentage of married women working close, 54.54 is used to match the premium κ which takes the value of 0.05. Note that this wage premium is very much in line with our empirical results (see Table 2.5). Table 4.9 displays the calibrated parameters of the model.

Table 4.9: Calibrated Parameters

Parameter	Explanation	Value
ϕ_e	weight of children	1.3
ϕ_l	weight of leisure	1.15
λ	share of education in Q function	0.38
α	weight of b	0.7
ρ	elasticity parameter between b and child care	0.6
θ	share of expenditures	0.35
κ	wage premium in 'Far'	0.05

Finally, the model's policy parameters are the income tax rate, τ, and the family policy in terms of child care subsidies and family benefits, i.e. ω, T, and the threshold for eligibility of family benefits $\bar{T}$ respectively. All working individuals pay a proportional tax, τ on 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 such as to match the amount of *Kindergeld* as a percentage of average family income received by a family with the average number of children in Germany (1.9). Hence, T is set equal to 1.04. As all families receive this

[27] In the model economy productivity types refer to hourly wage rates. However, when comparing productivity types in the model to data we use education types as proxies for productivity types, given that we also want to consider women who decide not to work and for whom we do not observe wages. The six lowest types represent 70% of the total population. This is equivalent to the share of individuals who have less education than college or tertiary type of education in Germany

help, the threshold $I_{\bar{T}}$ is not binding and $\bar{T} = \infty$. According to the same source, child care subsidies are negligible in Germany and therefore, we set child care subsidies (ω) to be equal to zero. For the cost of child care $p(1)$, the OECD [2008] estimates that child care costs in Germany amount to 9.1% of average income. Thus we set the price of child care per hour such that child care costs in our model economy matches the average cost in Germany. Hence $p(1)$, takes on value 1. All policy parameters are displayed in Table 4.10.

Table 4.10: Policy Parameters

Parameter	Explanation	Value
Calibrated		
T	Family Benefits	0.522
$p(1)$	cost of child care	1
Set a priori		
ω	child care subsidy	0
$\bar{T}$	eligibility threshold	∞

5 Results: Benchmark Economy

In Table 5.11 we present model moments of our benchmark economy together with the corresponding data moments. We use data moments along several dimensions relevant to the analysis of women's fertility behavior, labor force participation and time and money invested in the education of children.

We consider two moments related to fertility. The first one is the average fertility rate. The second is the difference in average fertility rates between women who live close and women who live far measured as a ratio. The average fertility rate in Germany among women between 20 and 50 years of age is equal to 1.71. Meanwhile in our economy it is slightly lower and equal to 1.24. Thus the model underestimates the fertility rate observed in the German economy. In terms of the second fertility moment, the ratio of the average fertility rate of women living close and the average fertility rate of women living far, the model replicates the fact that this ratio is just larger than one. Thus women who live close have a higher fertility rate than those who live far but the differences is small. The ratio of average fertility rates is equal to 1.02 in the German economy while in our model

Table 5.11: Data and Model Moments

	Data	Model
Average fertility rate	1.71	1.24
Difference in fertility rates close vs far	1.02	1.06
LFP rate of married women	56.82	49
LFP rate of married women close	58	54.52
Time spent with child non-working vs working mother	1.32	1.66
% of time spent by high educated mother	11.25	18.38
Expenditure on children as % of income	25	14.77
Child care costs as % of average income	9.1	10
Family benefits as % of income	10	10

this ratio is equal to 1.06.

We use two moments related to the participation of women in the labor market to match the model to the data. The first one is the labor force participation of married women and the second is the labor force participation of women who live close. In Germany, 56.82% of married women participate in the labor market. If women live close to their parents or in-laws, their participation rate is higher, 58%. In the model economy, the labor force participation of married women is 49%. Hence, our model underestimates labor force participation (LFP) of married women by seven percentage points. The model also underestimates the labor force participation of women who live close. The share of married women who live close and participate in the labor market is equal to 54.52 in the model. Nonetheless, the model replicates the fact that the labor force participation of married women who live close is higher that the average participation. The mechanism behind this observation is the access to free child care provided by grandparents if women live close to them. Married women who decide to have children will have access to free child care if they stay close. Thus their labor force participation rates are higher.

Now we consider the data moments that refer to the investment made by mothers in terms of time and money. We consider two moments that show differences in terms of time investment between mothers by education and by working status. According to German data, non-working mothers spend an additional one third of time with their children compared to working mothers. Our model over predicts this difference to be equal to two thirds. Regarding the fraction of disposable time highly educated mothers spent look-

ing after their children, our model also overestimates this number. In the data, German mothers with tertiary education spend on average 108 minutes per day taking care of their children. This represents 11% of their disposable time, while in the model, this percentage is around 18%. We also consider monetary investment on children. The data moment we use is the expenditure on children as a share of average family income. According to the data, the average German family spends 25% of their income on children while in our model this number is slightly lower and equal to 14.77%.

Finally, we also use the family benefits as a share of average family income available in Germany and the expenditure on child care costs as a share of average income to match our model to the German data. In Germany, families with children receive benefits equivalent to 10% of their average income. Meanwhile, the cost of child care that they face is equal to 9% of their average income. The model replicates perfectly the amount of family benefits available in Germany and it also does a good job in replicating the cost of child care.

On the whole the model does match the data even though it performs better along some dimensions than others. However, we have targeted the model moments in Table 5.11 explicitly. In order to assess the validity of the model to carry out policy analysis, we need to consider its performance in matching moments that have not been used to calibrate the parameters of the model. The model produces several statistics and we are going to concentrate on five statistics on the participation of women in the labor market. The first one is the share of women who live away and participate in the labor market. The other four statistics refer to the labor force participation of mothers by age of the mother and where they reside. Table 5.12 shows these further data statistics and the corresponding model moments.

In Germany, the labor force participation of married women living further away is equal to 55%, while in our model this number is equal to 43.9%. Thus the model slightly underestimates participation rates of married women living further away. Even though the model underestimates the participation of married women living away, the model replicates the observation that participation of married women living away is lower then the participation of women living close.

The model also generates statistics on the participation rates of mothers. In particular, we are interested in the participation rates of mothers with small children (in the model , small children refers to children younger than 10). We argue that the main barrier for participating in the labor market that women face when they move away is the high cost

of child care. Child care costs are highest when children are young. Therefore we would want our model to be consistent with the shares of working mothers with small children in Germany. The participation rate of young mothers (between 20 and 29) with small children who live close in Germany is equal to 31%, while the participation rate of young mothers who live further away is equal to 24%. The model overestimates these two statistics but the model generates the observation that young mothers with small children who live far participate less in the labor market than those who live close. The observed labor market participation rates in Germany of middle aged mothers (between 30 and 39) with small children are higher than those of younger mothers, 46% for those who live close and 39% for those who live further away. Even though the model overestimates labor force participation rates of middle aged mothers, it generates the fact that middle aged mothers work more than young mothers. The mechanism driving this result in the model is that most middle aged mothers had a child from the previous period, thus it is more expensive to have more children. This means that they need to work more than when they were young. To summarize, even though the model overestimates labor force participation rates of almost all groups of mothers of small children it generates the observed differences in participation rates by distance to parents and by age profile.

In addition, our model also replicates well the share of women who move away from parents or in-laws. While in the data, around 46% per cent of women live far away from their parents (see Figure 1.2), in our model, almost 47% of women live far away from parents or in-laws.

Table 5.12: Data and Model Moments: Not used for calibration

	Data	Model
LFP rate of women, away	43.9	55
LFP rate of married young mothers with small children, close	50.68	31
LFP rate of married young mothers with small children, far	31.71	24
LFP rate of married middle-aged mothers with small children, close	54.68	46
LFP rate of married middle-aged mothers with small children, far	39	43.9
share of female married population moving away	45.63	46.82

6 Mechanisms at work: Who moves

In our model, young fertile women receive two different 'life-course offers', one for living in 'Home' and another one for living in 'Far'. These offers include realizations of labor productivities as well as an exogenous income, representing a spouse's income. In addition, if women decide to have children they have access to free grandparent-provided child care if they remain in 'Home' while if they move away, they have to pay child care costs for each hour that they work. Thus, when women decide whether to move or not they face a trade-off between potentially better labor market opportunities and free child care. If they receive a better labor productivity offer in 'Home', there is no doubt that they will stay. In case the offer is higher in Far, women who decide to not have children will move, while among those who plan to have children only those who can afford to pay for child care move. For instance, women who receive the same labor productivity offer in 'Home' and 'Far' and thus receive a wage premium κ in 'Far' only move if the premium allows them to pay for child care costs. However, this is not the whole story, a married woman's exogenous income (spouse's productivity type) also plays an important role in her residence decision. Thus if a woman receives a high exogenous income she might decide to move as child care costs are no longer a barrier.

In order to analyze who moves and who does not in our model economy we 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. In Table 6.13 we display the share of women who move in the model and the data by these four sub-groups. In our model low productivity individuals are identified as the six lowest types of the productivity distribution while the high productivity individuals are the four highest types.[28]

The model does quite a good job in matching how many women remain close for the subgroups mentioned above. We observe that 50% of married women belonging to the high-low subgroup move, while in the data around 47% of them move. These statistics are very similar for the low-high subgroup. The low-low subgroup is the one that displays the lowest mobility. In the model, around 41% of women belonging to the low-low group move while in the data this share is close to 43%. On the contrary, the high-high subgroup display the highest mobility both in the data, 52.77% and in the model, 52.34%.

[28]The six lowest types represent 70% of the total population. This is equivalent to the share of individuals who have without tertiary education in Germany.

Table 6.13: % of women moving away by type and husband's type

	Low productivity men		High productivity men	
	data	model	data	model
Low productivity women	43.24%	41.17%	47.65%	49.23%
High productivity women	47.19%	50%	52.77%	52.34%

We find 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 2.2). Our model replicates this fact as in both regions there are both high productivity women, equivalent to high educated women, and low productivity women. And in both regions there are women who are married to high productivity type men and also low productivity type men. Those who belong to the low-low group are less mobile as child care costs constitute an important barrier for them. Meanwhile, those who belong to the high-high subgroup are the most mobile individuals. Child care costs are not binding for them. Thus, in the presence of child care costs, the existence of free informal child care arrangements allows especially mothers of low productivity to work. In absence of grandparents, their income would be too low to pay for child care costs and therefore they would decide to not work or not to have children. Meanwhile women who dispose of a relatively high exogenous income are able to not work, stay home taking care of the children and enjoying leisure.

7 Counterfactual Experiments

First, we analyze a situation in which there are no grandparents available and everyone has to pay for child care. Table 7.14 provides the moments for this counterfactual experiment when there is no grandparent-provided child care available together with the corresponding moments from our benchmark economy. Women face high child care costs if they have children and want to work in the Far region. Therefore, the main reason for not moving away is the access to free child care at Home. When women have no longer access to a source of free child care at Home, the incentive to remain close is gone. Thus, we observe that some women who were staying close to enjoy this free child care now move away. This translates into an increase of 3 percentage points in the share of women moving away with respect to the benchmark economy. The women who remain close are the ones who either received a better 'life-course offer' in 'Home' or the ones who cannot

afford to pay for child care and thus they cannot participate in the labor market. As a result of some women who previously worked moving away and facing child care costs, the participation rate of mothers who remain close drops. At Home, only 9% of young mothers with small children work and 31% of middle-aged mothers with small children work. Meanwhile, the percentage of mothers living away who participate in the labor market is higher than in our benchmark economy. Around 38% of young mothers living further away work, while the percentage of working middle-aged mothers is 48. The rise in the participation rates in Far is due to working women moving away to work for a higher wage rate as they face the same child care costs in both regions.

We observe a decrease in the participation rate of mothers who remain close and an increase in the labor force participation of mothers who move away. Looking at these statistics, the net effect of non availability of grandparent provided child care is not clear. We turn to what the effect of no grandparent provided child care is on women's aggregate labor market participation rate. The aggregate labor force participation of women drops by 9 percentage points compared to the benchmark economy. The aggregate participation of women is now 40%. Thus having no access to a free source of child care implies a drop of 9 percentage points in the share of women who work.

Having no access to grandparent provided child care has effects on the average fertility rate of the economy. We observe a slight decrease in the average fertility rate of women, 1.18 compared to the benchmark economy, 1.24. If women have to pay for child care, children become more expensive, making women decide to have fewer children.

Table 7.14: No Grand-parent provided child care

	No grandparents	Benchmark economy
Fertility rate	1.18	1.24
Labor force participation of married women	40.01	49
LFP rate of young mothers with small children, close	9	50.68
LFP rate of young mothers with small children, far	38	31.71
LFP rate of middle mothers with small children, close	31	54.68
LFP rate of middle mothers with small children, far	48	39
share of population moving away	48.62	45.63

In a second counterfactual experiment we consider a public policy meant to encourage mothers' labor force participation: child care subsidies. Child care subsidies are financed through taxes. Therefore, child care subsidies might imply higher taxes. This policy is government consumption neutral and thus the amount of tax revenues collected used for government consumption remains the same as in our benchmark economy. We consider subsidizing 50% of child care costs. Therefore, the policy parameter corresponding to child care subsidies, ω is set equal to 0.5.

Table 7.15 displays moments from this counterfactual experiment, next to moments of our benchmark economy without any child care subsidies. The percentage of women moving away increases by 6 percentage points compared to our benchmark economy with no child care subsidies. More women can now afford child care costs in 'Far' and hence more women decide to move. As a result, the percentage of mothers, both young and middle aged, participating in the labor market in 'Home' drops, while there is an increase in the participation rate of mothers in 'Far'. However, the aggregate employment rate of women does not change. Still 49% of married women participate in the labor market. This is consistent with findings in the literature that argue that child care subsidies might not affect maternal employment but simply induce a shift from informal child care to formal child care, see Havnes and Mogstad [2011].

The aggregate fertility rate increases slightly under this policy. Women who move away now face lower child care costs and so it is cheaper for them to have children while women who remain close face zero costs of child care as before.

Table 7.15: Child care subsidized, $\omega = 0.5$

	$\omega = 0.5$	Benchmark economy
Fertility rate	1.28	1.24
Labor force participation of married women	49	49
LFP rate of young mothers with small children, close	41.55	50.68
LFP rate of young mothers with small children, far	51.18	31.71
LFP rate of middle-aged mothers with small children, close	46.82	54.68
LFP rate of middle-aged mothers with children, far	53	39
share of population moving away	51.36	45.63

8 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 mothers are more likely to hold a regular full-or part time job. However, we find that their wages are lower and they 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 this trade-off. 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 made on children. We then perform two counterfactual exercises to analyze the effect of grandparent-provided child care and publicly provided child care 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. 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, there is an increase of 6 percentage points in the share of women moving away and thus labor mobility is increased. 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 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 or not child care to their grandchildren. However, this decision might be very related to individuals' retirement age and especially in the case of grandmothers to previous decisions about labor force participation. 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 provide child care for her grandchild.[29] We consider further analysis of how late first birth and improved health after retirement might interact with these aspects a very interesting road for future research. Another interesting path for future research could be to consider the macroeconomic effects of spatial restrictions imposed by grandparent-provided child care on optimal labor mobility and the optimal allocation of talent.

[29] See Fernandez et al [2005] and Farre and Vella [2007] on the intergenerational transmission of attitude towards the role of women in the economy and its effect on female labor force participation.

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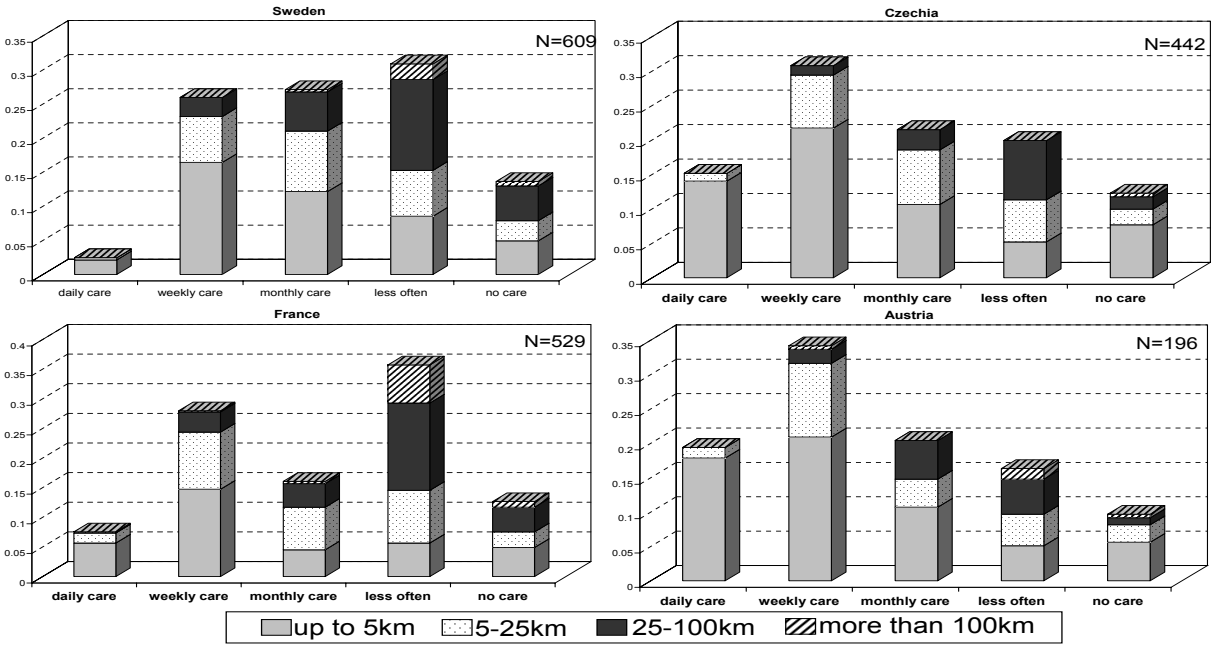
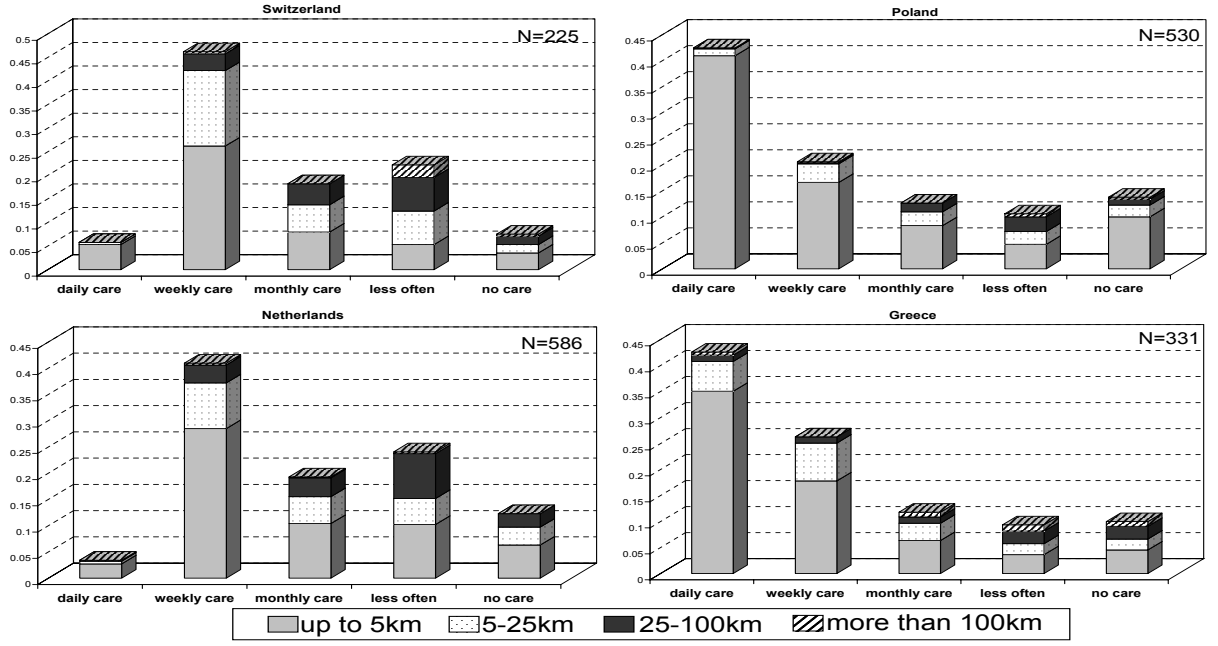
A Appendix

Figure A-1: Frequency of Care and Distance to Closest Grandchild Age 10 and Younger



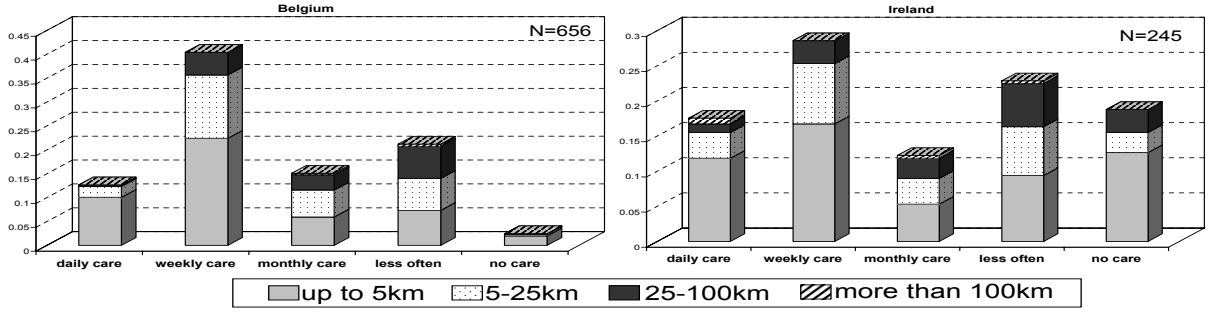
Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2^{nd} wave.

Figure A-2: Frequency of Care and Distance to Closest Grandchild Age 10 and Younger



Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2^{nd} wave.

Figure A-3: Frequency of Care and Distance to Closest Grandchild Age 10 and Younger



Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2^{nd} wave.

Table A.1: Effect of Close Presence of Grandparents on Fertility
Marginal Effects from Probit Estimation for Having Children
with Interaction Terms

Married, living together	0.287***	(0.012)	0.287***	(0.012)
Other than German nationality	0.007	(0.027)	0.007	(0.027)
Log (Spouse's income)†	0.004***	(0.001)	0.004***	(0.001)
in East Germany	0.152***	(0.008)	0.152***	(0.008)
Tertiary education (ISCED: 5,6)	-0.102***	(0.013)		
Primary/Secondary edu (ISCED: 0-4)			0.102***	(0.013)
Parents or in-laws close	0.033***	(0.010)	0.064***	(0.016)
Parents in-laws close*Tert edu	0.031*	(0.017)		
Parents in-laws close*Non-Tert edu			-0.033*	(0.020)
Parents or in-laws in same house	0.001	(0.013)	0.001	(0.013)
Small community	0.029***	(0.010)	0.029***	(0.010)
Large community	-0.060***	(0.012)	-0.060***	(0.012)
Observations	10,732		10,732	

†Missing values and values < 1 are set to 0. Standard errors in parentheses: *** p<0.01, ** p<0.05,* p<0.1 Data: GSOEP unbalanced panel 91,96,01,06; Women 25-50. All regressions include year dummies and age group dummies. Reference group: unmarried women age 25-29 living in West Germany in 1991, in a medium-sized town, far from parents or in-laws.

Table A.2: Effect of Close Presence of Grandparents on Fertility
Marginal Effects from Probit Estimation for Having Children
without Variables Posing a Possible Endogeneity Problem: Marital Status and Income of Spouse

Other than German nationality	0.030	(0.025)
in East Germany	0.140***	(0.008)
Tertiary education (ISCED: 5,6)	-0.089***	(0.010)
Parents or in-laws close	0.062***	(0.009)
Parents or in-laws in same house	0.018	(0.012)
Small community	0.043***	(0.010)
Large community	-0.089***	(0.012)
Observations	10,732	

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Data: GSOEP unbalanced panel 91,96,01,06; Women 25-50. All regressions include year dummies and age group dummies. Reference group: women age 25-29 living in West Germany with education level 1 or 2 (ISCED:0-4) in 1991, in a medium-sized town, far from parents or in-laws.

Table A.3: Effect of Grandparent-Provided Child Care on Participation
Marginal Effects from Probit Estimation for Mothers' Labor Force Participation without Variables Posing a Possible Endogeneity Problem: (1): Marital Status and Income of Spouse and (2): Children in Nursery

	Regular Part or Fulltime Job		Regular Part or Fulltime Job	
	(1)		(2)	
Children 0-3	-0.376***	(0.015)		
Married, living together			-0.052***	(0.020)
Other than German nationality	-0.140***	(0.053)	-0.072**	(0.031)
Log (Spouse's income)†			0.004*	(0.002)
in East Germany	0.135***	(0.013)	0.127***	(0.020)
Tertiary education (ISCED: 5,6)	0.169***	(0.013)	0.083***	(0.017)
Parents or in-laws close	0.024*	(0.013)		
Parents or in-laws in same house	0.026	(0.018)		
Children cared for by relatives			0.161***	(0.016)
Small community	-0.009	(0.014)	-0.013	(0.017)
Large community	0.023	(0.016)	0.032	(0.019)
Observations	8,129		3,390	

†Missing values and values < 1 are set to 0. Standard errors in parentheses;*** p<0.01,** p<0.05, * p<0.1; Probit Estimation; Data: GSOEP unbalanced panel 1) 91,96,01,06; Mothers 25-50. Reference group: unmarried mothers age 25-29 with education level 1 or 2 (ISCED: 0-4) in 1991, in a medium-sized town in West Germany, far from parents or in-laws with children older than 3. 2) 97,99,00,01,02,03,05,06; mothers (25-50) of children <= 3. Reference group: unmarried mothers age 25-29 in 1997, with education level 1 or 2 (ISCED: 0-4), in a medium-sized town in West Germany, with children who are not cared for by relatives. All regressions include year dummies and age group dummies.

Table A.4: Effect of Close Presence of Grandparents on Monthly Wages
Coefficients of Heckmann Selection Model for Mothers' Log Monthly Wages

	Log hourly wage		Selection Equation	
	(1)		(2)	
Married, living together	-0.047***	(0.017)	-0.352***	(0.044)
Other than German nationality	-0.111	(0.084)	0.320**	(0.138)
Tertiary education (ISCED: 5,6)	0.284***	(0.016)	0.445***	(0.036)
Parents or in-laws close	-0.058***	(0.015)	0.073**	(0.032)
Parents or in-laws in same house	-0.059***	(0.022)	0.084*	(0.047)
Small community	-0.029*	(0.017)	-0.012	(0.036)
Large community	0.063***	(0.019)	0.044	(0.041)
in East Germany	-0.162***	(0.018)	0.320***	(0.035)
Log (Spouse's income)†			0.017***	(0.005)
Children 0-3			-0.993***	(0.044)
Tenure in firm	0.017***	(0.001)		
Monthly hours worked	0.008***	(0.000)		
Constant	5.693***	(0.052)	0.053	(0.080)
Observations	8,129		8,129	

†Missing values and values < 1 are set to 0. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Heckman Selection Model; Data: GSOEP unbalanced panel 91,96,01,06; mothers 25-50. Reference group: unmarried mothers of age 25-29 of children older than 3 with education level 1 or 2 (ISCED: 0-4) in 1991, in a medium-sized West German town, far from parents or in-laws. All regressions include age group dummies and year dummies.

Table A.5: Effect of Close Presence of Grandparents on Hourly Wages
Coefficients of OLS Estimation of Mothers' Log Hourly Wages

Married, living together	-0.006	(0.015)
Other than German nationality	-0.112	(0.078)
Tertiary education (ISCED: 5,6)	0.279***	(0.014)
Tenure in firm	0.016***	(0.001)
Parents or in-laws close	-0.055***	(0.014)
Parents or in-laws in same house	-0.055***	(0.020)
Small community	-0.032**	(0.016)
Large community	0.055***	(0.018)
in East Germany	-0.224***	(0.014)
Constant	1.926***	(0.037)
Observations	4,348	
R-squared	0.251	

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1 OLS Estimation; Data: GSOEP unbalanced panel 91,96,01,06; mothers 25-50 with full-or part time regular job. All regressions include age group dummies and year dummies Reference group: unmarried women age 25-29 living in West Germany, with education level 1 or 2 (ISCED: 0-4), in 1991, in a medium-sized town, far from parents or in-laws.

Table A.6: Effect of Close Presence of Grandparents on Hourly Wages
Coefficients of Heckmann Selection Model for Mothers' Log Hourly Wages without Variables Posing a Possible Endogeneity Problem: Marital Status and Income of Spouse

	Log hourly wage		Selection Equation	
	(1)		(2)	
Other than German nationality	-0.132*	(0.078)	-0.353***	(0.137)
Tertiary education (ISCED: 5,6)	0.296***	(0.015)	0.436***	(0.036)
Parents or in-laws close	-0.051***	(0.014)	0.059***	(0.032)
Parents or in-laws in same house	-0.052**	(0.021)	0.064	(0.047)
Small community	-0.032**	(0.016)	-0.022	(0.036)
Large community	0.058***	(0.018)	0.057 (0.041)	
in East Germany	-0.204***	(0.015)	0.343***	(0.035)
Children 0-3			-1.006***	(0.044)
Tenure in firm	0.016***	(0.001)		
Constant	1.815***	(0.046)	-0.088	(0.075)
Observations	8,129		8,129	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Heckman Selection Model; Data: GSOEP unbalanced panel 91,96,01,06; mothers 25-50. Reference group: mothers of age 25-29 of children older than 3 living in West Germany, with education level 1 or 2 (ISCED: 0-4) in 1991, in a medium-sized West German town, far from parents or in-laws. All regressions include age group dummies and year dummies.

Table A.7: Effect of Grandparent-Provided Child Care on Commutes
Marginal Effects from Probit Estimation of Working and Residing in Same Town without Variable Posing a Possible Endogeneity Problem: Children in Nursery

Married, living together	-0.117**	(0.048)
Other than German nationality	0.520***	(0.096)
Log (Spouse's income)†	0.012	(0.008)
in East Germany	0.140***	(0.008)
Tertiary education (ISCED: 5,6)	-0.020	(0.044)
Tenure in firm	0.004	(0.004)
Children cared for by relatives	-0.118***	(0.040)
Small community	-0.270***	(0.045)
Large community	0.261***	(0.053)
in East Germany	0.088*	(0.047)
Observations	690	

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Data: GSOEP unbalanced panel 97,99,00,01,02,03,05,06; mothers 25-50 of children ≤ 3. All regressions include year dummies and age group dummies. Reference group: unmarried mothers age 25-29 in 1997 living in West Germany with education level 1 or 2 (ISCED:0-4) in 1991, in a medium-sized town, far from parents or in-laws, with children who are not in nursery, nor cared for by relatives.