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**With strings attached : grandparent-provided  
child care, fertility, and female labor market  
outcomes**

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# 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 female labor market outcomes. We simulate our model to analyze how women's decisions on residence, fertility, and labor force participation change under distinct scenarios regarding availability of grandparent-provided child care and 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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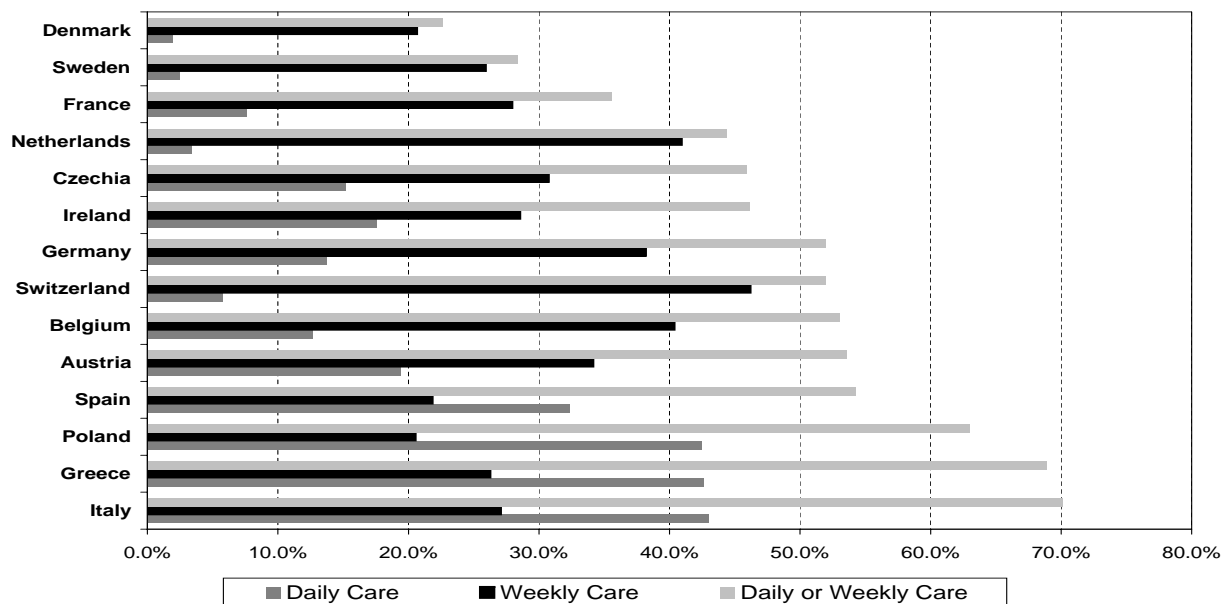
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# 1 Introduction

Grandparents are an important source of child care. According to data from the 2<sup>nd</sup> 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).<sup>1</sup> 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.<sup>2</sup>

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



Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2<sup>nd</sup> wave.

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

<sup>2</sup>Considering OECD countries, the average difference in labor force participation rates for women and mothers (of children age 3 or younger) is around 10 (20) percentage points. Scandinavian countries are an exception where labor force participation rates of mothers are equal to or even higher compared to those of women in general, OECD [2008].

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] 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 labor force participation rates in Sweden, Mörck et al [2009] is one of the few papers that focuses exclusively on the positive effect of lower 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.<sup>3</sup>

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<sup>nd</sup> 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 (age 10 and younger) together with the frequency of care provided, for Italy, Spain, Germany, and Denmark. As already suggested in Figure 1.1, 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, similarly across all countries, those who provide care more frequently tend to live close by.<sup>4</sup>

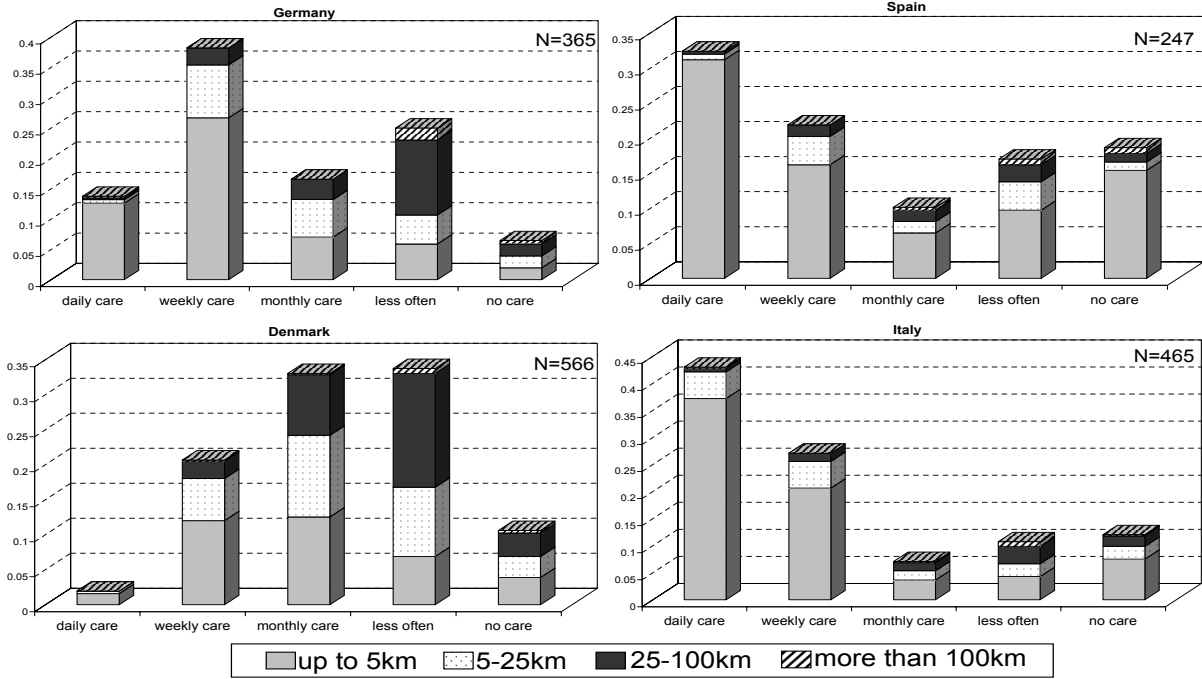
Hence, while grandparent-provided child care may induce positive effects on fertility and mothers' labor force participation, different from any other type of child care, it imposes spatial restrictions that might affect female labor market outcomes negatively. In this paper we document benefits and costs of grandparent-provided child care. Looking at data from the German Socio-Economic Panel (GSOEP) 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. Given strong interdependencies of decisions regarding residence, fertility, child care arrangements, and female labor force participation, our empirical analysis

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<sup>3</sup>For instance, for a US family living below the poverty line, child care costs amount to 30% of income (US Census Bureau [2011]).

<sup>4</sup>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<sup>nd</sup> wave.

faces various endogeneity problems. Using proximity between adult children and their parents as an indirect measure for grandparent-provided child care, we address the interdependency of child care arrangements and female labor force participation and we also run individual fixed effect regressions to account for the fact that residence choices might be related to an individuals' unobservable characteristics that also determine their labor force participation choice. However, certain caveats remain and we cannot claim to establish causal relationships between geographical proximity and fertility or labor market outcomes. Thus, to be able to better disentangle individuals' decisions, 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 female labor market outcomes. We simulate our model to analyze how women's decisions on residence, fertility, and labor force participation change under distinct scenarios regarding availability of grandparent-provided child care and different family policies.

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, a necessary condition for frequent grandparent-provided child care. The existing literature, on the contrary, has solely highlighted the positive implications of geographical proximity between parents and adult 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. Holdsworth 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] find that married women with small children living close to mothers and mothers-in-law have a 10 percentage point higher probability to be in employment compared to those living further away. The authors argue that proximity is a good instrument for child care arrangements as the positive effect of proximity on labor force participation does not extend to groups for which grandparent-provided child care is not a determinant for their labor supply like men, unmarried women without children, or those with sick mothers or sick mothers-in-law.<sup>5</sup> Similarly, the positive and significant effect of proximity to parents on labor force participation found in the current paper only holds for mothers and does not extend neither to men nor to single childless women.

Our paper is also related to the literature on intergenerational time transfers. The majority of this literature focuses on time transfers in terms of care from children to elderly parents. One interesting paper 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. Apart from the aforementioned paper by Compton and Pollak [2011], 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]. The authors use data from the Survey of Health, Ageing and Retirement in Europe (SHARE) to estimate a simultaneous equation model of labor supply, grandparent-provided child care, and financial transfers and find a positive effect

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<sup>5</sup>Furthermore, and by using a sample of military wives, whose residence is determined by their husbands' being stationed in a certain base, the authors are also able to address the additional endogeneity problem of residence choice.

of grandparent-provided child care 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, instrumented by grandparents being alive, increases, in particular labor force participation of low educated mothers of young children.

Our paper is also part of the literature that uses general equilibrium models to assess how different public policies interact with family decisions.<sup>6</sup> Closely related is Cardia and Ng [2003] who differ from the current paper, explicitly incorporate grandparents' decisions into a general equilibrium model for grandparent-provided child care. The authors suggest that subsidizing grandparents' time to be the most effective policy in terms of output and capital accumulation. However, the authors do not consider the spatial restrictions and potential costs in terms of labor market outcomes implied by grandparent-provided child care, something we take into account in the current paper. Other related works are Greenwood et al [2000] who investigate the effect of the rise in the generosity of welfare payments on the rising incidence of single motherhood or García-Morán [2010] who evaluates the effect of child care subsidies on female labor force participation, fertility, and children's educational outcomes and finds that child care subsidies promote employment, fertility and education, especially for children in single parent households. Erosa et al [2010] develop a model of fertility choice and labor market decisions to account for the observed gender differences in job attachment, employment, and earnings. The authors argue that having this framework is important for the evaluation of family policies. 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 individual cost associated to living close to parents or in-laws.

Our aim is similar to these papers, as within a general equilibrium framework that explicitly incorporates the spatial restrictions imposed by grandparent-provided child care, we assess distinct scenarios regarding availability of grandparent-provided child care and different family policies, and we analyze how women's decisions regarding residence, fer-

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<sup>6</sup>See Attanasio et al [2010] or Guner and Knowles [2009] among others.

tility, and labor force participation change.<sup>7</sup> The remainder 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 model. 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 on individuals' labor market participation, marital and family status, wages, education, the size of the town they live in etc.<sup>8</sup> 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.<sup>9</sup> 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).

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<sup>7</sup>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.

<sup>8</sup>For more details on the GSOEP and its development, see SOEP [2005].

<sup>9</sup>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.



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 survey 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.<sup>10</sup> 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.

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.<sup>11</sup> 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.

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<sup>10</sup>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.

<sup>11</sup>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.

Child care by relatives might not only influence mothers' labor force participation decision, but at the same time its use might be a function of mothers' labor force participation. Hence, estimates using our direct measure are potentially biased by this endogeneity. The same holds true for child care in nursery. Using our indirect measure solves this problem but poses a different one, given that residence choices might not be independent of mothers' labor force participation decisions. However, given our data set we do not have a way of dealing with this second endogeneity problem. On the other hand, our indirect measure has the advantage of reflecting more than just 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. From both of our samples we exclude individuals with incomplete or inconsistent information.<sup>12</sup> 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. 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.

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<sup>12</sup>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. From 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. From 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 $\leq 3$
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)

For mothers this last percentage is slightly lower, while a larger fraction of mothers has completed secondary education.<sup>13</sup> 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€.<sup>14</sup> 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.

**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

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<sup>13</sup>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.

<sup>14</sup>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]).

to parents or in-laws on women’s fertility is particularly strong for women with university education.<sup>15</sup>

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 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.

### 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.<sup>16</sup> The first column of Table 2.4

<sup>15</sup>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).

<sup>16</sup>This is slightly lower than the range of 4 to 10 percentage points estimated by Compton and Polak [2011] for the US. Note that the positive relation between proximity and labor force participation only holds for mothers. Running the same probit estimation for men and single childless women shows non-significant coefficients for proximity. In addition, for single childless women the coefficient for living in the same house is negative and significant, see Table A.3 of the Appendix.

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.

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.

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 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 of holding a regular part-or fulltime job is given by the difference of 6 percentage points. For this alternative estimation, marginal effects of all other variables on the probability of holding a regular part-or fulltime job are similar, with the exception of the coefficient for spouse's income not being significant.<sup>17</sup>

**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. 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.

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<sup>17</sup>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.4 of the Appendix). Including interaction terms for living close 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.



Table 2.5: Effect of Close Presence of Grandparents on Hourly Wages  
Coefficients of Heckman 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. 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.

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%.<sup>18</sup> Concerning the other variables and controlling for selection effects 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.<sup>19</sup>

<sup>18</sup>Log monthly wages, controlled for by hours worked, show a slightly higher discount for living close (see Table A.5 of the Appendix) as does not controlling for selection (see Table A.6 of the Appendix for an OLS regression of log hourly wages).

<sup>19</sup> 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

**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 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.

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

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.

While having relatives caring for children on a regular basis increases chances of having 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.7 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.

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 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.<sup>20</sup>

**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 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).<sup>21</sup> Marriage and the presence of small children negatively affect mothers’ labor force participation.

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? However, given strong interdependencies among women’s decisions regarding residence, fertility, and labor force participation and despite some adjustments (using proximity as an indirect measure for child care and running indi-

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<sup>20</sup>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.8 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.

<sup>21</sup>The estimated coefficient for “parents or in-laws close” is equal to a marginal effect of 0.28.

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.

vidual fixed effect regressions) our empirical analysis still faces endogeneity problems and we do not claim to have established any causal relationships. Hence, in order to better disentangle women's decision as well as to answer the proposed questions, 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 under distinct scenarios regarding availability of grandparent-provided child care and different family policies.

### 3 The Model

We have a model of fertility and employment choice in which individuals also decide where to live. There are two regions in the economy, 'Home',  $H$  and 'Far',  $F$ . Grandparent-provided child care free of charge is only available in 'Home'. The model economy is inhabited by a continuum of overlapping generations of married women of mass one.<sup>22</sup> 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).<sup>23</sup> Decisions regarding residence are only made when women are fertile young adults. During the two fertile stages of adulthood, young and middle-aged, women can decide how many children to have. In each of the three periods of adult life, women have to decide how much to work, and if they have children, how many resources in term of time and money to spend on educating their children. There is also a government in this economy that taxes labor income at rate  $\tau$ , 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  $\omega$ . Women are born close to their parents so initially they reside in 'Home',  $H$ . Each women's region of residence is denoted by  $j$ , where  $j = H, F$ .

**Life-Course Offers** At the beginning of their life as young fertile adults, women 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, there are  $N \times N$  possible offers for staying 'Home' and  $N \times N$  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  $\Pi(x^H, z^H, x^F, z^F)$ . 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'  $x^F < x^H$ . A woman who receives an offer in 'Home' where the labor productivity is equal to  $x^H$  will receive an offer in 'Far' where the

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<sup>22</sup>Given that only 7% of single women are mothers, while 76% of married women are mothers we only model married women's decisions. And in order to keep the analysis tractable we abstain from modeling a marriage market even though marriage and residence decisions might be related and we simply assign an exogenous income to each woman to represent her husband's income.

<sup>23</sup>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

labor productivity is equal to  $(1 + \kappa x^F)$ . 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. Women are endowed with one unit of productive time.

**Residence Choice** Women's residence choice,  $D$  is a binary variable that takes on value 0 if women reside at 'Home', close to their parents and 1 if their chosen residence is 'Far'.

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

**Working Choice** Women can decide on the extensive and intensive margin of their labor force participation where  $l$  is the fraction of time they allocate to work. Women 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** Women can have children when they are fertile. Children live in the household for two periods. Children receive education each period depending on the resources that the mother decides to spend on the child. We denote by  $b$  the amount of money that a woman 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** Women with young children (0-9 years) who work require child care, hence time spent in child care is equal to the time a mother is at work ( $t_c = l$ ). The price of child care,  $p(D)$  depends on the woman's residence choice in the following way:  $p(0) = 0$  and  $p(1) > 0$ . If a woman lives close to her parents she obtains free child care, else she has to purchase child care at price  $p(1)$ . She might receive a subsidy  $\omega$  from the government, thus actually paying  $(1 - \omega)p(1)$  for each unit of time her child spends in child care.<sup>24</sup>

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<sup>24</sup>We assume that this subsidy is only paid to those women who purchase child care at price  $p(1)$ , i.e. to those living in 'Far'.

Mothers with children older than 9 do not pay for child care, independently of where they reside.<sup>25</sup>

**Utility** Adult women derive utility from consumption, children, and leisure. Let  $k$  be the number of children a woman decides to have. The utility that women 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 women become young fertile adults, they receive 'life-course offers' and they decide which one to realize, i.e. whether to reside close to their parents or not. After residence decisions have been made, women have to decide how many children to have, and how to split their time between working, taking care of children, and leisure. Women 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. Women 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  $\tau$ , pays lump-sum transfers  $T$  conditional on having children and having an income below a certain threshold,  $\bar{T}$ , provides a child care subsidy,  $\omega$  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 to women.

### 3.1 Value functions

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

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<sup>25</sup>Children older than 9, attend free public school during the time their mother works.

**Old adult** In the last period of women's 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

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

subject to the following budget constraint

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

and the education production function

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

If a woman 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 a woman has children. There are economies of scale in consumption,  $\Psi(a, k_m)$ , where  $a$  indicates the number of adults in the household and thus is equal to two for a married couple. The optimal labor decision of an old woman living close is denoted by  $L_o^H(x^H, z^H, k_m)$ . Optimal decisions in terms of money and time devoted to children are denoted by  $B_o^H(x^H, z^H, k_m)$  and  $T_o^H(x^H, z^H, k_m)$  respectively. Given that only older children might be present in the household, old women living far away do not have to purchase child care. The value of being an old woman living far is given by

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

subject to the following budget constraint

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

and the education production function

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

The optimal labor decision of an old woman living further away is denoted by  $L_o^F(x^F, z^F, k_m)$ . Optimal decisions in terms of money and time devoted to children are denoted by  $B_o^F(x^F, z^F, k_m)$  and  $T_o^F(x^F, z^F, k_m)$  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 older ( $k_y$ ) children who were born the previous period. Let  $k$  denote the number of children present in the household,  $k = k_m + k_y$ . The value of being a middle-aged woman living close is given by

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

subject to the following budget constraint

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

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

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

subject to the following budget constraint

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

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 receive child care subsidies,  $\omega$  per unit of time her children spend in child care. The optimal labor decision of a middle-aged woman living further away is denoted by  $L_m^F(x^F, z^F, k_y)$ . The optimal number of small children is given by  $K_m^F(x^F, z^F, k_y)$ , optimal decisions in terms of money and time devoted to all children are denoted by  $B_m^F(x^F, z^F, k_y)$  and  $T_m^F(x^F, z^F, k_y)$  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 women 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

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

subject to the following budget constraint

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

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

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

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.

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

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,  $K_y^j(x^j, z^j)$  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 woman resides. Optimal decisions for fertile middle-aged adults are as follows:  $L_m^j(x^j, z^j, k_y)$  is the labor force participation decision,  $K_m^j(x^j, z^j, k_y)$  denotes the optimal number of small children,  $T_m^j(x^j, z^j, k_y)$  denotes time spent with children,  $B_m^j(x^j, z^j, k_y)$  is the amount of money spent on children, and  $C_m^j(x^j, z^j, k_y)$  is the level of consumption, for  $j = H, F$ . The optimal decision rules for old women are as follows:  $L_o^j(x^j, z^j, k_m)$  is the labor force participation decision and  $C_o^j(x^j, z^j, k_m)$  is the level of consumption,  $T_o^j(x^j, z^j, k_m)$  denotes time spent with children,  $B_o^j(x^j, z^j, k_m)$  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

In this part of the paper we present the explicit functional forms for the utility function and the education production function, and we fix some parameters of the model 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.

### 4.1 Functional Forms

We specify women's utility to be 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  $\phi_e$  and the weighting parameter for leisure in the utility function is  $\phi_l$ . The weighting parameter for consumption is normalized to 1. We thus specify the utility function of a woman as

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

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

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

where  $\lambda$  denotes the share of education for the production of a child's quality.<sup>26</sup>

Education ( $e$ ) in turn 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  $\theta$ . 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. 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

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<sup>26</sup>This specification has been used by others in the literature, see for instance Greenwood et al [2000].

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  $\alpha$ . 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

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

## 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.<sup>27</sup> 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 is 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  $\mu_x$  and  $\sigma_x$  respectively for women and  $\mu_z$  and  $\sigma_z$  for men. We specify ten different productivity types for women and we also have ten different types of exogenous incomes. Men and women match according to a matching

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<sup>27</sup>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)

function,  $\Phi(x, z)$ , 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  $\psi$ . A fraction,  $\Pi(x_i^H, z_j^H, x_i^F, z_j^F)$  of married women receive life-course offers  $(x_i^H, z_j^H)$  for staying 'Home' and  $(x_i^F, z_j^F)$  for moving to 'Far', for  $i$  being any of the  $N$  possible labor productivities of women and  $j$  being any of the  $N$  possible exogenous income. There will thus be a hundred different types of matches between a woman and an exogenous income (spouse).

Parameters related to the productivity distributions for men and women  $\mu_x, \mu_z, \sigma_x, \sigma_z$ , and the assortative matching parameter,  $\psi$  are set a priori based on available evidence. 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  $\sigma_z = 0.45$ . In order to build the matching matrix that assigns an exogenous income to each woman based on information on who marries whom in the German economy, we take the degree of assortative matching, i.e. how likely it is to meet your own productivity type,  $\psi$  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. Also set a priori is the discount factor  $\beta$ . Given that one model period is equivalent to 10 years, the discount factor,  $\beta$  is set to a value of 0.675 in order to match a yearly interest rate of 4%. Table 4.8 displays all parameters set a priori.

Table 4.8: Parameters based on a priori information

Parameter	Explanation	Value
$\mu_x$	mean log productivity of women	2.41
$\sigma_x$	standard deviation of women's log productivity	0.47
$\mu_z$	mean log productivity of spouses	2.66
$\sigma_z$	standard deviation of spouses' log productivity	0.45
$n$	average working time of men	0.4
$\psi$	assortative matching parameter	0.7
$\beta$	Discount Factor	0.675

Parameters to be calibrated are the parameters of the utility function,  $\phi_e, \phi_l$  and the parameters of the education production function for children,  $\lambda, \rho, \alpha, \theta$  as well as the wage premium for working in 'Far',  $\kappa$ . 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,  $\phi_e$  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,  $\phi_l$  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,  $\lambda$  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,  $\rho, \alpha, \theta$  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 25% 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%.<sup>28</sup> Hence parameters  $\rho, \alpha, \theta$  of the education production function are assigned values 0.7, 0.6, and 0.35 respectively. We use the labor force participation rate of married women who live close to their parents or in-laws, 54.54% to match the wage premium  $\kappa$ , which takes on value 0.05. Note that the magnitude of this wage premium is very much in line with our empirical findings (see Table 2.5). Table 4.9 displays the calibrated parameters of the model.

Finally, the model’s policy parameters are the income tax rate,  $\tau$ , and the family policy in terms of child care subsidies and family benefits, i.e.  $\omega, T$ , and the threshold for eligibility of family benefits  $\bar{T}$  respectively. All working individuals pay a proportional tax,  $\tau$  on labor income. We set  $\tau$  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

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<sup>28</sup>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 education in Germany

Table 4.9: Calibrated Parameters

Parameter	Explanation	Value
$\phi_e$	weight of children	1.3
$\phi_l$	weight of leisure	1.15
$\lambda$	share of education in $Q$ function	0.38
$\alpha$	weight of $b$	0.7
$\rho$	elasticity parameter between $b$ and child care	0.6
$\theta$	share of expenditures	0.35
$\kappa$	wage premium in 'Far'	0.05

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 0.522. As all families receive this 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 ( $\omega$ ) 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		
$\omega$	child care subsidy	0
$\bar{T}$	eligibility threshold	$\infty$



## 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.

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	49.00
LFP rate of married women close	58.10	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	25.00	14.77
Child care costs as % of average income	9.10	10.00
Family benefits as % of income	10.00	10.00

Our model is able to capture that women living close to parents or in-laws have on average more children. However, the ratio of average fertility rates of women living close and women living far is 1.02 in the German economy, while in our model this ratio is equal to 1.06. Average fertility rates estimated by our model are lower compared to the data. While the average German fertility rate among women between 20 and 50 is equal to 1.71, in our model economy it is only 1.24. Regarding labor force participation of women, our model replicates well the fact that labor force participation of married women who live close exceeds average labor force participation of married women. Access to free child care provided by grandparents makes it possible for women who live close to participate more. However, given that we underestimate average labor force participation of married women, as well as labor force participation of women living close to parents or in-laws, differences in participation rates in our model are more pronounced than those observed in the data. In Germany, 56.82% of married women participate in the labor market compared to 58.10% of those who live close to their parents or in-laws. In the model economy labor force participation of married women is 49.00%, while 54.52% of those who live close work.

Considering investment in children’s education in terms of time and money, our model overestimates the time educated mothers spend with their children. German mothers with tertiary education spend on average 108 minutes per day taking care of their children, which represents 11.25% of their disposable time. In our model, this percentage is 18.38%. Comparing time spent by non-working and working mothers, according to German data, non-working mothers spend an additional one third of time with their children compared to working mothers. Our model overestimates this difference to be equal to two thirds. We underestimate the fraction of income spent in children. According to German data, the average family spends 25.00% of their income on children while in our model this number is slightly lower and equal to 14.77%. Finally, we also use 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 German data. In Germany, families with children receive benefits equivalent to 10.00% of their average income, while, the cost of child care that they face is equal to 9.10% 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 fairly well, even though it performs better along some dimensions than others. However, model moments in Table 5.11 were targeted explicitly to calibrate certain parameters of the model. In order to assess the model’s validity for carrying out policy analysis, we need to consider the model’s performance in matching moments that have not been used for calibration. To this end we consider the following five statistics related to women’s labor force participation. The first one is the share of women who live far away and who participate in the labor market. The other four statistics refer to labor force participation of mothers of different age groups and according to where they reside. Table 5.12 shows these additional statistics and the corresponding data moments.

In Germany, labor force participation of married women living further away is equal to 55.28%, while in our model this number is equal to 43.90%. Thus the model slightly underestimates participation rates of married women living further away. However, it replicates well the fact that participation of married women living further away is lower compared to labor force participation of women living close. The model also generates statistics on the participation rates of different groups 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. In the data, the participation rate of young mothers (between 20 and 29) with small children who live close is equal to 31.01%, while the participation rate of young mothers who live further away is equal to 24.54%. The model overestimates both statistics, but does generate 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, 46.08% for those who live close and 39.50% 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 have had a child from the previous period, thus it is more expensive to have more children which means that in order to pay for child expenses they need to work more compared to when they were young and had fewer children. 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 very well the share of women who move away from parents or in-laws. While in the data, around 45% of women live far away from their parents, 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	55.28	43.90
LFP rate of married young mothers with small children, close	31.01	50.68
LFP rate of married young mothers with small children, far	24.54	31.71
LFP rate of married middle-aged mothers with small children, close	46.08	54.68
LFP rate of married middle-aged mothers with small children, far	39.50	43.90
share of female married population moving away	45.42	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  $\kappa$  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 more thoroughly who moves and who does not move in our model economy, we identify four subgroups of women: (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 in the data by these four sub-groups. In our model, low productivity individuals are identified as the six lowest types in the productivity distribution while the high productivity individuals are the four highest types.<sup>29</sup> The model does quite a good job in matching how many women remain close according to the subgroups mentioned above.<sup>30</sup> 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%.

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

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<sup>29</sup>The six lowest types represent 70% of the total population. This is equivalent to the share of individuals without tertiary education in Germany.

<sup>30</sup>By ‘Far’ we mean the same as in the empirical part of the paper. Those living an hour away or further from their parents or in-laws are considered to live in ‘Far’.

Table 6.13: % of women living 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%

to high educated women, and low productivity women. And in both regions there are women who are married to high productivity type men and others who are married to low productivity type men. Those who belong to the low-low productivity group are less mobile as child care costs constitute an important barrier for them. Meanwhile, those who belong to the high-high productivity group 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 enables in particular mothers of low productivity to work.<sup>31</sup> In absence of grandparents, income of low productivity women 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 their children, and enjoy more leisure.

## 7 Counterfactual Experiments

In this section we consider two distinct scenarios regarding availability of grandparent-provided child care and different family policies, and we simulate our model to analyze how women’s decisions on residence, fertility, and labor force participation change. In our first counterfactual experiment we analyze a situation where grandparents are not available to take care of their grandchildren and everyone has to pay for child care, while our second counterfactual experiment considers an increase in subsidies for paid child care. The purpose of our first experiment is to quantify the importance of grandparent-provided child care. There are several reasons why the provision of child care by grandparents might be reduced in the future. Women’s age at first child birth has been increasing over the last decades. In 2009, German mothers were on average 30 years old when giving birth to their first child, while in 1970 average age at first child’s birth was 24 (OECD [2008]). As

<sup>31</sup>Similarly, Arpino et al [2010] find that grandparent-provided child care increases, in particular labor force participation of low educated mothers of young children.

successive generations of women delay birth, grandparents may be too old or too sick to take care of their grandchildren. On the other hand, women’s labor force participation and individuals’ retirement age has been and is increasing in many countries and hence situations where both generations of women, grandmothers and adult daughters, are of working age when grandchildren come along are going to be even more likely to occur in the future.<sup>32</sup> Regarding our second experiment, we consider a subsidy for child care as a policy instrument given the positive relationship found in the literature between availability of child care and female labor force participation.<sup>33</sup> We set the subsidy to 50 per cent of child care costs as this is the amount of subsidy needed to reduce the cost of child care in our Benchmark model such as to be equal to the cost that families in Sweden face. In Sweden, child care costs are among the lowest in the OECD countries and they amount to 4.6 per cent of the Swedish average wage (OECD [2008]).

Table 7.14 provides moments from our first counterfactual experiment when there is no grandparent-provided child care available, together with the corresponding moments from our benchmark economy. In the benchmark economy, women face high child care costs in Far and the main reason for not moving away is the access to free child care in Home. When women no longer have access to free child care, the incentive to remain close disappears and thus we observe an increase of 2 percentage points in the share of women moving away with respect to the benchmark economy. Women who remain close either received better ‘life-course offer’ in ‘Home’ or they cannot afford to pay for child care and thus do not participate in the labor market. Hence, labor force participation of mothers who remain close decreases and only 9% of young mothers with small children and 31% of middle-aged mothers with small children work. Meanwhile, the percentage of mothers living away who participate in the labor market increases with respect to our benchmark economy. Around 38% of young mothers living far away work, while the fraction of working middle-aged mothers is 48%. This rise in labor force participation rates in Far is due to more working mothers moving away in order to obtain higher wage rates given that they face the same child care costs in both regions. Hence, as grandparent-provided child care becomes unavailable labor force participation rates of mothers who remain close drop while rates for those far away increase. On the aggregate, labor market participation by women drops by 9 percentage points compared to our benchmark economy. Moreover, having no access to grandparent-provided child care also affects women’s fertility decisions. We observe a slight decrease in the average fertility rate, 1.18 compared to the benchmark economy, 1.24.

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<sup>32</sup>Individuals’ increasing life expectancy and better health might counteract the problem of late first child birth. However, this increased life expectancy is again likely to lead to successive increases in retirement age.

<sup>33</sup>See the Introduction 1 for a review of this literature.

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	49.00
LFP rate of young mothers with small children, close	9.00	50.68
LFP rate of young mothers with small children, far	38.00	31.71
LFP rate of middle mothers with small children, close	31.01	54.68
LFP rate of middle mothers with small children, far	48.00	43.90
share of population moving away	48.62	46.82

In our second counterfactual experiment we consider an increase in child care subsidies that is government consumption neutral. Hence, the amount of tax revenues collected used for government consumption remains the same as in our benchmark economy and as child care subsidies are financed via labor income taxes, this policy might imply higher tax rates. In particular we consider a policy that subsidizes 50% of child care costs, the policy parameter  $\omega$  is set equal to 0.5. Table 7.15 displays moments from this counterfactual experiment, next to moments of our benchmark economy where child care subsidies are zero. As more women can now afford child care costs in 'Far', more decide to move. Compared to our benchmark economy, the percentage of women moving away increases by 5 percentage points. As a result of the increased labor mobility, 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 result 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	49.00	49.00
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	53.00	43.90
share of population moving away	51.36	46.82

## 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 along other dimensions related to time spent with children and expenditures made on children. We then perform two counterfactual experiments to analyze how women’s decisions on residence, fertility, and labor force participation change under distinct scenarios regarding availability of grandparent-provided child care and different family policies. We find that if there is no grandparent-provided child care, there are fewer women participating in the labor market and fertility decreases. 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 5 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.

In absence of child care subsidies, grandparent-provided child care plays an important role by allowing women to work. However, grandparent-provided child care imposes spatial restrictions that limit labor mobility. Women who remain close have access to a smaller labor market which in turn, might imply worse labor market opportunities and thus lower



wages. Hence, when designing policies aimed at increasing labor force participation of mothers policy makers should take into account the wide-spread presence of grandparent-provided child care as well as the spatial restrictions it implies. For instance, a policy that subsidizes grandparents' time does not only affect labor force participation by mothers but it also has an impact on mothers' labor mobility and hence their wages.

In this paper we simply assumed that being close to one's grandparents' implies that grandparents take care of their grandchildren and we did 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.<sup>34</sup> We believe that a further analysis of how late first birth and improved health after retirement might interact with these aspects is 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.

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<sup>34</sup>See Fernandez et al [2004] 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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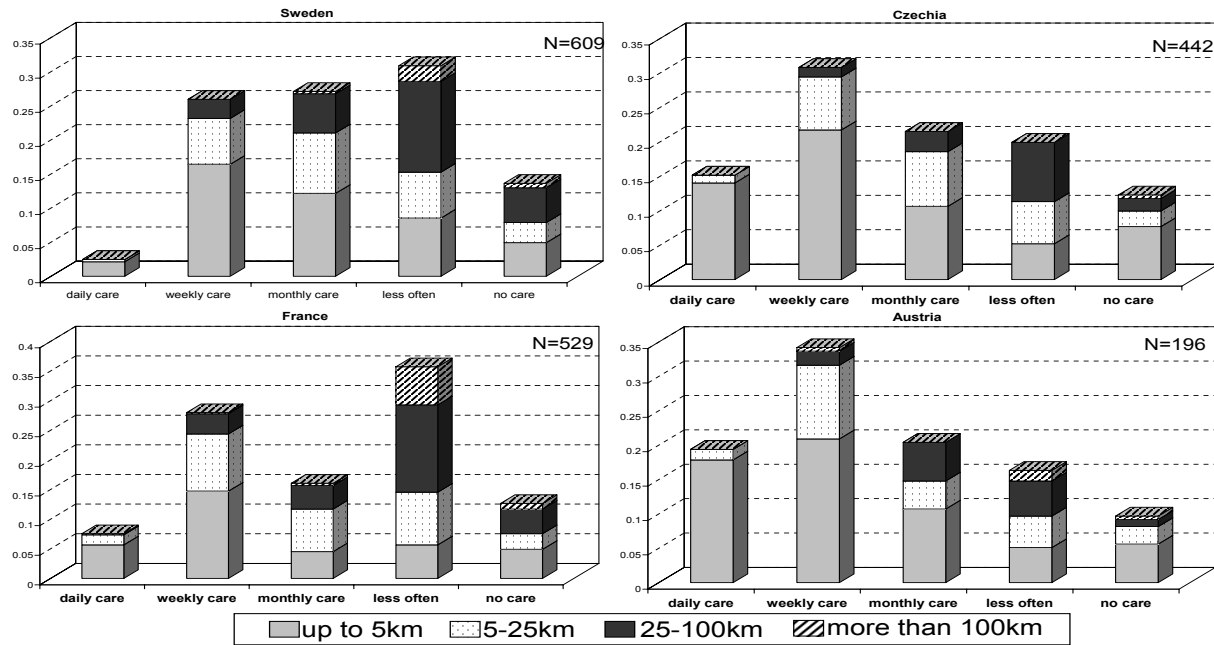
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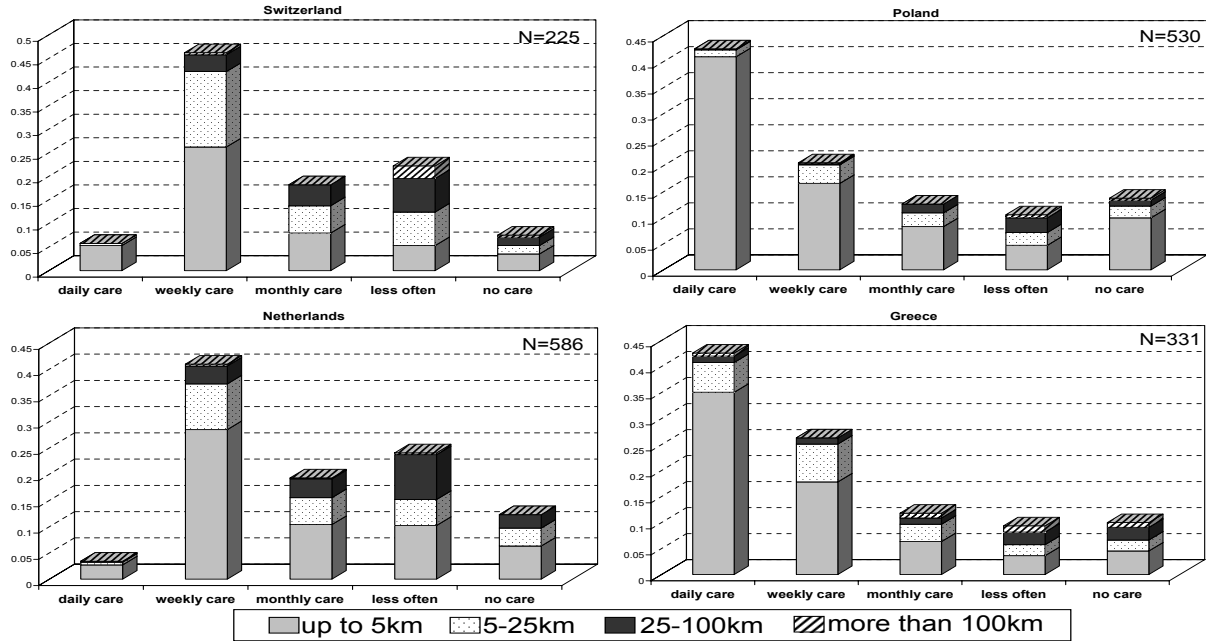
## A Appendix

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



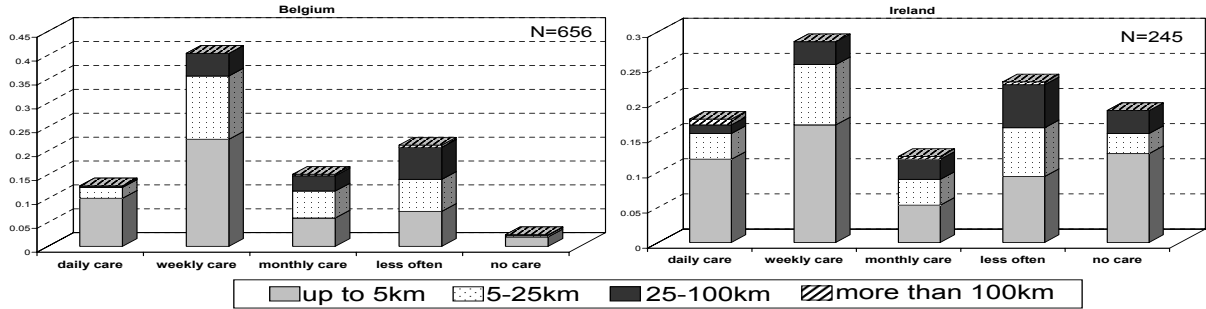
Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2<sup>nd</sup> wave.

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<sup>nd</sup> 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<sup>nd</sup> 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

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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	

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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: Proximity of Adult Parents and Effects on Participation by Non-Mothers  
 Marginal Effects from Probit Estimation for Labor Force Participation of (1) Men and  
 (2) Single Childless Women

	Regular Part or Fulltime Job		Regular Part or Fulltime Job	
	(1)		(2)	
Married, living together	0.106***	(0.008)		
Other than German nationality in East Germany	-0.088***	(0.032)	-0.099	(0.070)
Tertiary education (ISCED: 5,6)	-0.095***	(0.009)	-0.045	(0.036)
Parents or in-laws close	0.090***	(0.006)	0.122***	(0.024)
Parents or in-laws in same house	0.007	(0.007)	0.029	(0.027)
Small community	-0.007	(0.010)	-0.094***	(0.036)
Large community	0.011	(0.008)	-0.030	(0.035)
	-0.014	(-0.009)	-0.106***	(0.031)
Observations	8,653		1,191	

Standard errors in parentheses;\*\*\* p<0.01,\*\* p<0.05, \* p<0.1; Data: GSOEP unbalanced panel 1) 91,96,01,06; Men 25-50.

Reference group: unmarried men 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 2)91,96,01,06; single childless women (25-50). Reference group: single childless women age 25-29 in 1991, with education level 1 or 2 (ISCED: 0-4), in a medium-sized town in West Germany.

All regressions include year dummies and age group dummies.

Table A.4: 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)	(0.015)	(2)	(0.020)
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.5: Effect of Close Presence of Grandparents on Monthly Wages  
Coefficients of Heckman 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. 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.6: Effect of Close Presence of Grandparents on Hourly Wages  
Coefficients of OLS Estimation of Mothers' Log Hourly Wages

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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	

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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.7: Effect of Close Presence of Grandparents on Hourly Wages  
Coefficients of Heckman 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.8: 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

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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  $\leq 3$ . 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.

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