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With Strings Attached: Grandparent-Provided Child Care and Female Labor Market Outcomes*

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Abstract

Grandparents are regular providers of free child care. Similar to other forms of child care, availability of grandparent-provided child care affects fertility and labor force participation of women positively. However, grandparent-provided child care requires residing close to parents or in-laws which may imply costly spatial restrictions. We find that mothers residing close to parents or in-laws have lower wages and that the probability of having to commute increases if relatives provide child care. We build a model of residence choice, fertility, and female labor force participation that can account for the observed relationships. We simulate our model to analyze how women's decisions would change if the availability of grandparent-provided child care or family policies were altered. We find that if child care subsidies were raised to the Swedish level, fertility and mothers' labor force participation would increase, while mobility would remain unchanged. The absence of grandparents, on the other hand, would increase mobility, while it would only have limited negative effects on aggregate fertility and labor force participation.

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

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1 Introduction

Grandparents are an important source of child care. According to data from the 2^{nd} wave of the Survey of Health, Ageing and Retirement in Europe (SHARE), between 18% (Denmark) and 49% (Italy) of grandparents take care of their grandchildren age six or younger on a daily or weekly basis. More than 30% of grandparents in the Netherlands, Belgium, and Switzerland provide weekly care, whereas in Italy, Greece, and Poland almost 30% look after their grandchildren each day (see Figure A-1 of the Appendix A).[1] The availability of child care and especially cheap or even costless child care has important effects on fertility and mothers' labor force participation.[2] 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 Vuri [2007] point out that most studies find that high child care costs deter female labor supply, while availability of child care is found to have positive effects on mothers' labor force participation. These findings suggest that the main barrier that mothers face at the time of working is to obtain affordable child care.[3]

Free grandparent-provided child care seems to be the perfect solution for working mothers. However, in order to enjoy grandparent-provided child care on a regular basis, residence choices of adult children and elderly parents have to coincide. Data from the 2^{nd} wave of SHARE show that the frequency of grandparent-provided child care is clearly related to the geographical distance between parents and their adult children. Figure 1.1 displays the frequency of grandparent-provided child care, together with the geographical distance between grandparents and their grandchildren (age six and younger) for Germany, Denmark, Italy, and Spain. Across the four selected countries the frequency of care varies strongly, but common to all countries those who provide care more frequently tend to live close by.[4]

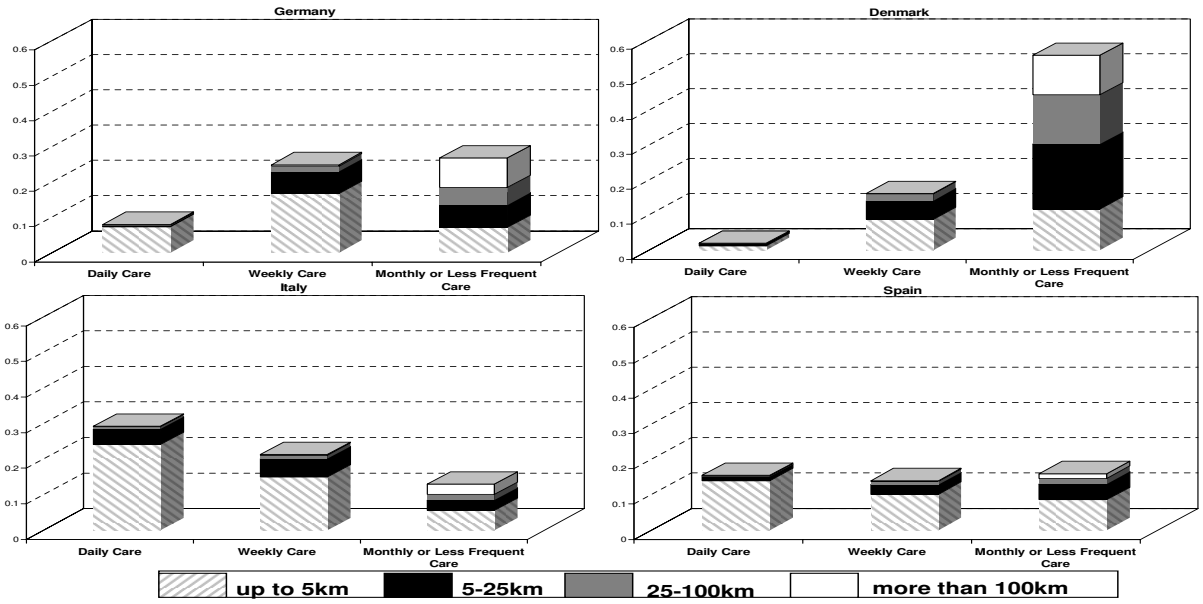
[1] In the US, 22.7% of children under 5 are regularly cared for by their grandparents (Overturf Johnson [2005]).

[2] While female labor force participation has increased tremendously over the past decades, mothers are still participating significantly less. Across 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].

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

[4] The same pattern can be observed across the rest of the countries included in SHARE; see Figures A-3-A-2 of the Appendix A.

Figure 1.1: Frequency of care for and distance to grandchild, ≤ 6



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

Grandparent-provided child care – similar to other types of child care – may have positive effects on fertility and mothers' labor force participation. However, – different from other types of child care – it imposes spatial restrictions which may affect female labor market outcomes negatively. Looking at German data we find that women residing close to parents or in-laws have lower hourly and monthly wages. Furthermore we find that mothers are more likely to incur in commutes if their children are regularly cared for by relatives. Similar to other studies, we also find that women residing close to parents or in-laws are more likely to have children, and that as mothers they are more likely to hold a regular full or part time job. Given strong interdependencies of decisions regarding residence, fertility, child care arrangements, and female labor force participation, our empirical analysis faces problems of endogeneity and reversed causality. While our findings can thus not be interpreted as causal, the observed relationships provide the motivation for our theoretical model.

We build a model of residence choice, fertility decisions, and female labor force participation. In our model there are two regions. Both regions are characterized by the same distribution of wage offers. Women who decide to work need to purchase child care. In one of the two regions free grandparent-provided child care is available. A woman decides

where to reside upon observing her potential wage-were she to work- and her spouse's income in each region. Both her wage and her spouse's income are independent across regions. So when deciding where to reside women might accept lower wages in turn for free grandparent-provided child care. This mechanism generates the observed relationship between lower wages and living close to parents or in-laws. Given that women are more likely to have children and to work if child care is free, our model also replicates the positive relationships between fertility, labor force participation, and living close to parents or in-laws. In our model, the simultaneous interaction of child care costs with two important determinants of family migration decisions – husbands' and wives' wages – generates the observed relationships.[5] We then simulate the model to analyze how women's decisions would change if the availability of grandparent-provided child care or family policies were altered. We find that if child care subsidies were raised to the Swedish level, fertility and mothers' labor force participation would increase, while mobility would remain unaltered. The absence of grandparents, on the other hand, would increase mobility, while it would only have limited negative effects on aggregate fertility and labor force participation.

To the best of our knowledge the current paper is the first one that explicitly incorporates spatial restrictions imposed by grandparent-provided child care into a model of fertility and labor force participation decisions. There is a strand of the literature analysing fertility and labor force participation in general equilibrium models as for instance Attanasio et al [2010], Erosa et al [2010], García-Morán [2010], Greenwood et al [2000], or Guner and Knowles [2009]. Closely related is Cardia and Ng [2003] who – different from the current paper – explicitly incorporate grandparents' decisions into a general equilibrium model of grandparent-provided child care. The authors suggest that subsidizing grandparents' time is the most effective child care policy in terms of output and capital accumulation. However, they do not consider the spatial restrictions and potential costs in terms of labor market outcomes implied by grandparent-provided child care. 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 the spatial restrictions that it imposes. The paper by Mendez [2008] attempts to account for differences in geographical mobility and female labor force participation across European countries. His model of residence choice, fertility, and female labor force participation is similar to ours, but the author does not provide any evidence for individual costs associated with living close to parents or in-laws.

[5] Mincer [1978] finds husbands' wage offers to be determinant for family migration decisions, but to a lesser extent if the wife is working and if her work is permanent and well paid. Hence, husbands' and wives' wages jointly determine migration decisions.

Thus, our paper is also - to the best of our knowledge - the first one to document possible costs related to the geographical proximity between parents and adult children. The existing literature, on the contrary, has highlighted its positive aspects. 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. Holdswoth and Dale [2009] study labor force participation decisions of mothers in Spain and Britain. They estimate that the probability of being in employment is 1.24 times higher for Spanish women whose parents live in the same town. 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. The studies by Dimova and Wolff [2011] and Zamarro [2011] use SHARE data and estimate simultaneous equation models of labor supply and grandparent-provided child care. Zamarro [2011] only finds a positive effect of grandparent-provided child care on mothers' labor force participation for Greece and the Netherlands. For ten European countries Dimova and Wolff [2011], who also include financial transfers into their model, find a positive effect of grandparent-provided child care on the extensive margin of female labor force participation but no effect along the intensive margin. Arpino et al [2010] and Posadas and Vidal-Fernández [2012] for Italy and the US respectively, 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 related to a broader literature on intergenerational time transfers. Most of this literature focuses on time transfers 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. Alesina and Giuliano [2010] argue that the extent of intergenerational time transfers within the family – care of children or the elderly – is strongly determined by the value of family ties in a society. The authors find that across countries a higher value of family ties is associated with lower geographical mobility, higher fertility, but also with more traditional gender roles and thus lower female labor force participation. In the current paper – on the contrary – we find that within a country grandparent-provided child care is related to higher female labor force participation.

The remainder of this paper is organized as follows: the next section presents our empirical analysis, Section 3 presents the model, Section 4 describes our calibration strategy, Section 5 presents the results of the model, and in Section 6 we discuss the model's mechanisms in detail. In Section 7 we perform two counterfactual experiments and Section 8 concludes.

2 Empirical Analysis

2.1 Data

For our empirical analysis, we consider data from the German Socio-Economic Panel (GSOEP), an annual household survey. The GSOEP provides extensive information on individuals' labor market participation, marital and family status, wages, education, etc.[6] It also includes variables of particular interest for our analysis: child care provided by relatives and geographical distance to parents. In four waves (1991, 1996, 2001, and 2006) survey participants were 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. 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. 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." This particular form of co-residence mostly 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. Only in two of the four waves considered (2001 and 2006) did the survey also include questions about relative-provided child care. We construct a dummy variable "child care by relatives" that takes on value one for all mothers with children age six or younger if relatives regularly take care of this child and a dummy variable "child care non-relatives" that takes on value one if the child age six or younger attends a nursery or is being cared for by others than relatives. We report these variables for two different age groups, for children up to the age of three and those between the ages of three and six. In Germany, for children younger than three very few spots in public or publicly subsidized nurseries are available, whereas for children between the ages of 3 and 6, those spots are almost guaranteed.[7]

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

[7] In 2011 only 25.2% of children younger than three attended some form of private day care (85%) or public or publicly subsidized nurseries (15%), compared to 93.4% of children between three and six (less than 1% of them in private day care) (Statistische Ämter des Bundes und der Länder [2011]). However,

Given pronounced 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.[8] To account for possible cultural differences, we also distinguish between individuals of German and other nationalities. We define three levels of education following the International Standard Classification of Education (ISCED 1997) designed by the UNESCO[1997]: (i) primary education (ISCED levels 0 and 1), (ii) secondary education (ISCED levels 2, 3, and 4), (iii) tertiary education (ISCED levels 5 and 6).[9] Town sizes are grouped into small communities (up to 20.000 inhabitants), medium-sized communities (20.000-100.000 inhabitants), and large communities (more than 100.000 inhabitants). We also construct dummy variables for each federal state.

Sample For our analysis we pool the data from the available four waves. We only consider women age 25 to 50.[10] We exclude those born outside of Germany, because 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. Our sample consists of 10,732 women and 8,129 mothers.[11]

Descriptive Statistics Table A.1 of the Appendix A provides descriptive statistics for our sample. Individuals are on average between 37 and 39 years old. Approximately 76% of women between 25 and 50 have children and 10-13% are mothers of small children (age 0-2) and 14-19% have children age 3-6. Around 36% of women have a regular fulltime

most of these nurseries (for over 60% of children) provide only part-time arrangements, see European Commission [2009]. Compulsory schooling for German children starts at age 6-7, reducing the need for child care drastically. 'Regular child care by relatives' includes child care by any relative but it is mostly grandparents who provide child care. Similar spatial restrictions would apply for child care by other relatives.

[8] Labor force participation rates of 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 sample, labor force participation rates of mothers are 67% and 48% in East and West Germany respectively.

[9] For our regression analysis we only differentiate between individuals with and without tertiary education.

[10] We exclude individuals living in East Germany from the 1991 wave, because for this wave information for most labor market variables (participation, wages) are missing for East Germans.

[11] We also exclude individuals who report to have worked regular full-or part time jobs but who also report to have worked fewer than twenty hours a month as well as those 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.

job and 24% hold a regular part time job. Mothers are more prone to hold part time jobs (29%) compared to fulltime jobs (25%).[12] Around 42-44% of women and mothers live in the same neighborhood or town as their parents or in-laws and 43-44% live at least one hour away. Approximately 13-14% of individuals live in the same house or household with parents or in-laws. Only 14% of mothers of children younger than age three, but 84% of mothers of children between the ages of three and six use nursery care, sitters or other types of paid child care. Around one third has their children cared for by relatives on a regular basis.[13] Hourly wages of women and mothers are around 12€.[14] Around 50% of individuals commute to their place of work.

Proximity to Grandparents and Relative-Provided Child Care Child care by relatives is not only likely to influence mothers' labor force participation decision, but at the same time its use might be determined by mothers' decision to work. This reversed causality introduces a potential bias into a direct measure of grandparent-provided child care. Using geographical proximity to grandparents as an indirect measure of grandparent-provided child care solves this problem. However, as residence choices might not be independent of mothers' labor force participation decisions, a caveat remains. Descriptives statistics show that geographical proximity to grandparents and child care provided by relatives are very much related (see Table A.2 of the Appendix A). The clear relationship displayed in Figure 1.1 regarding child care by relatives and proximity to grandparents hence also holds for our data set. We thus feel confident to use geographical proximity as an indirect measure of grandparent-provided child care. Furthermore, geographical proximity reflects more than just currently provided child care by grandparents. It might also reflect child care provided by "potential" grandparents if living close to parents or in-laws affects fertility decisions. Thus, geographical proximity proves particularly useful to test effects on fertility. In addition, geographical proximity might also reflect "child care provided in the past" if individuals continue to live close to parents or in-laws after children have grown beyond the child care age. In this case the indirect measure can also

[12] These figures correspond to 1991-2006 and are thus lower compared to more recent data. While in 1996, 75.7% of women and 58.5% of mothers age 25 to 54 participated in the German labor market, by 2004 these rates had increased to 77.0% and 63.1% respectively. This increase was almost exclusively due to an increase in labor force participation rates of mothers in West Germany from 54.4% in 1996 to 61.6% in 2004 (Bundesministerium für Familie, Senioren, Frauen und Jugend [2005]). Regarding labor force participation of mothers with children under 6, those increased from 51.4% in 1991 (OECD [2001]) to 66.3% by 2009 (OECD [2008]).

[13] Those two options are not exclusive. For children ages (0-2) and (3-6), 36% and 35% of mothers who use private care also have relatives looking after their children on a regular basis, and 15% and 86% respectively of those who use relative-provided care also use private care for their children.

[14] 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 2001 and 2006 (see Figure 1 in DIW [2009]).

be used to test long-lasting effects of on wages.

However, geographical proximity is only a necessary condition for grandparent-provided child care. Other aspects such as employment status, age, or health status of grandparents may determine if grandparents actually provide care for their grandchildren. Mothers of around 20% of women in our sample also participated in the GSOEP during the four waves considered. The number of observations for these mother-daughter pairs is extremely limited and thus not suited for regression analysis. However, considering descriptive statistics we observe that grandmothers who live close to their daughters who in turn report to use relative-provided child care are younger, and they are also less likely to work (see Table A.3 of the Appendix A). Surprisingly, these grandmothers also report worse health conditions. This might be explained by the fact that grandmothers' status of health does not only determine if they provide child care, but caring for grandchildren may have a negative effect on grandmothers' health.[15]

2.2 Benefits of Grandparent-Provided Child Care

In line with findings in the literature discussed before, we find geographical proximity to ("potential") grandparents to affect fertility and labor force participation of mothers positively. Women living in the same neighborhood or town as their parents or in-laws have a 4 percentage points higher probability to have children (see Table A.4 of the Appendix A). We find this positive effect to be particularly strong for women with university education.[16] Regarding participation, we find that mothers residing close to their parents or in-laws have a 3 percentage points higher probability to hold a regular part-or fulltime job (see Table A.6 of the Appendix A).[17] This last number is close to the 4 percentage

[15] According to Hughes et al [2011], a " growing literature suggests that for many people, the net health effects of grandchild care are negative"(p.111).

[16] See Table A.5 of the Appendix A for the regressions with interaction terms. 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.

[17] 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. 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. Results are robust to the exclusion of the variables marital status and spouse's income. Including interaction terms of living close to parents or in-laws and educational attainment seems to indicate that the positive effect of living close to parents or in-laws on mothers' labor force participation is driven by individuals with tertiary education. However, coefficients are only (negatively)

points lower bound of estimates for the US in Compton and Pollak [2011]. The latter argue that geographical proximity is a good instrument for child care arrangements because its positive effect on labor force participation does not extend to groups for which grandparent-provided child care is not a determinant for labor supply. Similarly, in our data the effect does not extend neither to men nor to single childless women (see Table A.7 of the Appendix A).

2.3 Costs of Grandparent-Provided Child Care

Lower wages Controlling for selection effects, we find that mothers living close to their parents or in-laws earn lower hourly wages.[18] The first column of Table 2.1 displays the coefficients for the Heckman selection model for log hourly wages for mothers in Germany age 25 to 50. Living close to parents or in-laws or in the same house increases the probability of holding a regular part-or fulltime job, but it reduces hourly wages by almost 5%.[19] Other control variables show the expected signs. Wages are higher for those living in larger communities, they increase with firm tenure, and tertiary education. On the other hand, having more children, living in small communities, not being German, and living in East Germany are all aspects that affect hourly wages negatively.[20] We also check if our results are driven by low-educated individuals. Running the regression separately for individuals with and those without tertiary education shows that this is not the case. On the contrary, the penalty in hourly wages for staying close to parents or in-laws turns out to be higher – more than 6% – for the group of highly educated individuals (see Tables A.11 and A.12 of the Appendix A).

The two exclusion restrictions that we use are: (i) having a child younger than age three and (ii) spouse's income. Both variables affect mothers' labor force participation (see Table A.6 of the Appendix A). However, none is directly related to mothers' hourly wage rates. Given that we only consider mothers, differences in a child's age are mostly ex-

significant for individuals with primary or secondary education.

[18] For this analysis, we only consider wage incomes of dependent workers of regular full-or part time jobs.

[19] Using log monthly wages, controlled for by hours worked, leads to slightly more negative coefficients for living close (see Table A.8 of the Appendix A), as does not controlling for selection effects (see Table A.9 of the Appendix A for an OLS regression of log hourly wages).

[20] 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. We also check the robustness of our results to the exclusion of the variables marital status and spouse's income (see Table A.10 of the Appendix A).

Table 2.1: Proximity to grandparents and hourly wages
Coefficients of Heckman Selection Model for mothers' log hourly wages

	Log hourly wage		Selection Equation	
	(1)		(2)	
Married, living together	-0.009	(0.016)	-0.324***	(0.044)
Number of children	-0.037***	(0.010)	-0.286***	(0.017)
Other than German nationality	-0.134*	(0.077)	-0.312**	(0.140)
Tertiary education (ISCED: 5,6)	0.293***	(0.015)	0.441***	(0.036)
Parents or in-laws close	-0.049***	(0.014)	0.073**	(0.033)
Parents or in-laws in same house	-0.050**	(0.020)	0.056	(0.048)
Small community	-0.040**	(0.017)	-0.006	(0.039)
Large community	0.046**	(0.019)	0.045	(0.044)
in East Germany	-0.069	(0.044)	0.294**	(0.119)
Log (Spouse's income)†			0.015***	(0.005)
Children 0-2			-1.114***	(0.056)
Tenure in firm	0.016***	(0.001)		
Constant	1.905***	(0.046)	0.188**	(0.087)
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 age 3 or older living in West Germany, with education level 1 or 2 (ISCED:0-4) in 1991, in a medium-sized West German town in North Rhine-Westphalia, far from parents or in-laws. All regressions include year dummies, age group dummies and state dummies.

plained for by the mother's own age and her years of education. We control for both variables in the wage estimation. The second exclusion restriction might be invalid if assortative matching leads to similar incomes of wife and spouse. As long as these similarities are mostly explained for by a common level of education or the size of the community they live in – both variables that we include as controls – the use of this exclusion restriction is justified.

More Commuting Costs of spatial restrictions may also arise from commutes. Rupert et al [2009], looking at French data find that mothers with small children, who have a lower bargaining power as workers incur in longer commutes. We find that for working mothers of children of age six or younger the probability of having to commute is almost 9 percentage points higher if their children are regularly cared for by relatives. Table 2.2 dis-

plays marginal effects from the probit estimation for the probability of having to commute for mothers in Germany age 25 to 50.[21]

Table 2.2: Grandparent-provided child care and commutes
Marginal effects from Probit estimation for mothers

Married, living together	0.005	(0.055)
Number of children	0.053	(0.033)
Other than German nationality	-0.278**	(0.127)
Children 0-2	-0.026	(0.063)
Log (Spouse's income)†	-0.003	(0.011)
Tertiary education (ISCED: 5,6)	0.127**	(0.051)
Tenure in firm	0.004	(0.004)
Children cared for by relatives	0.087*	(0.048)
Children in non-relative care	-0.010	(0.072)
Small community	0.262***	(0.056)
Large community	-0.213***	(0.065)
in East Germany	-0.227*	(0.136)
Observations	537	

†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, 01,06; mothers 25-50 of children <= 6 years with regular full or part time job. Reference Group: unmarried mothers of age 25-29 in 2001 with education level 1 or 2 (ISCED: 0-4) in a medium-sized West German town in North Rhine-Westphalia, whose children are not in nursery, nor cared for by relatives. All regressions include dummies for age groups, states, and years.

Having children in a nursery or with a sitter, on the other hand, does not affect the likelihood of being a commuter. Other control variables show the expected sign. The probability of having to commute is lower for those of other nationalities and for individuals living in large communities in East Germany. It is higher for mothers in small communities.[22]

[21] We only consider waves 2001 and 2006 that include a question on commutes.

[22] Again results are consistent to the way the variables 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.13 of the Appendix A). When running separate regressions for individuals with and without tertiary education, coefficients loose significance. However, coefficients for relative-provided child care for both groups of individuals with and without tertiary education are similar (see Table A.14 of the Appendix A).

Given strong interdependencies of decisions regarding residence, fertility, child care arrangements, and female labor force participation, our empirical analysis faces problems of endogeneity and reversed causality. By using geographical proximity between adult children and their parents as an indirect measure of grandparent-provided child care, we addressed the interdependency of child care arrangements and female labor force participation. However, certain caveats remain because we cannot dismiss a reversed causality between geographical proximity and labor market outcomes or fertility. Nevertheless, from the observed relationships between labor force participation, fertility, commuting, and wages with grandparent-provided child care a set of interesting questions arise: How valuable is grandparent-provided child care in terms of fertility and employment? How do family policies compare to grandparent-provided child care with respect to effects on aggregate employment, mobility, and fertility? In order to answer these questions and to better disentangle women's decision, we build a model economy that incorporates the spatial restrictions imposed by grandparent-provided child care.

3 The Model

In our model economy there are two regions where individuals can reside, 'Home' denoted by 'H' and 'Far', denoted by 'F'. The only ex-ante difference between the two regions is that grandparent-provided child care is only available in 'H'. The economy is populated by a continuum of married women of mass one.[23] Women in our economy live for two periods, each of three years. Essentially we want to capture mothers' decisions during the time when child care is most important, i.e. during early childhood.

At the beginning of the first period, women receive two 'life-course offers', one associated with living in 'H' and the other associated with living in 'F'. Each offer consists of: i) a realization of her labor productivity x and ii) an exogenous source of income, z representing a spouse's income, where $x \in x_1, x_2, ..., x_N$ and $z \in z_1, z_2, ..., z_N$, with N denoting the number of different labor productivities and spouses' incomes in the economy. Offers are independent of the region and independent of each other. Upon observing these two

[23] In our GSOEP sample only 2.4% of single women (heads of household, not living with another adult) are mothers, while 86% of married women who live together with their spouses are mothers. Hence, we only model married women's decisions. Even though marriage and residence decisions might be related, in order to keep the analysis tractable we abstain from modeling a marriage market and we simply assign an exogenous income to each woman to represent her husband's income.

offers, women have to decide where to reside. We assume that residence choices are only taken once during a woman's life time and cannot be reconsidered. Let D denote the residence choice that takes on value 1 if a woman decides to reside in 'F.' If she decides to reside in 'H', D is equal to 0. Women also have to decide whether to have children and how much to work. In the first period, women decide whether or not to have children, $k = 1$ or $k = 0$. Children remain with their mother during the two periods. Each period a woman is endowed with one unit of productive time and she has to decide how much to work.

Working mothers need child care. The price of child care per unit of time, $p^i(D)$ depends on the woman's residence choice and on the age of her child, with $i \in 1, 2$. Mothers with small children – from age 0 to 3 – who have no access to free child care pay $p^1(1)$. Mothers with older children – ages 3 to 6 – pay $p^2(1)$. Living in 'H' potentially provides access to free child care by grandparents, $p^i(0) = 0$. However, with a certain probability grandparents fall sick, are not alive, still work, or are otherwise unable to take care of their grandchildren. In the first period, only a share $p(g)$ of women who live in 'H' obtain free child care. The remaining $(1 - p(g))$ have to purchase child care at price $p^1(1)$. In the second period, only a share $p(g)$ of those who had access to free child care continue to do so. The remaining $(1-p(g)p(g))$ face child care costs equal to $p^2(1)$. Women might receive a subsidy for child care ω from the government. In this case they pay $(1-\omega)p^i(1)$ for each unit of time their children spend in child care.[24] Women might also receive family benefits T conditional on having children.

Women with children ($k = 1$) care about the quality of their children, e and about consumption, c. Hence, they enjoy the following utility

$$U(c, e, k) = \frac{c^{1-\sigma}}{1-\sigma} + \left(\sigma^e e - \sigma^k\right) k,$$

where σ^k are fixed costs per child. Childless women ($k = 0$) only care about consumption. The quality of children, e is a function of the time a mother spends with her children, t_m and the time her children spend in child care t_c,

$$e = \phi_m t_m + \phi_c t_c.$$

Time spent in child care is assumed to be equal to the time the mother is at work. A mother spends her remaining time taking care of her children,

$$t_c + t_m = 1.$$

[24] We assume that this subsidy is only paid to women who purchase child care at price $p^i(1)$, i.e. to those living in 'F' and those living in 'H' who have no access to free grandparent-provided child care.

How a mother divides her time between working and taking care of her children crucially depends on how decisive her time is for her children's quality. This is captured by the two weights, ϕ_m for time spent with the mother and ϕ_c for time spent in child care or with grandparents. We assume time in child care and time spent with grandparents to be of equal importance for children's quality.[25]

3.1 Value functions

We solve our model backwards by first presenting the value functions for women in the second period.

Value functions in the second period For childless women with labor productivity x and spouse's income z, the value of residing in 'H' is

$$H^2(x,z) = \frac{c^{1-\sigma}}{1-\sigma},$$

subject to the budget constraint

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

where τ denotes an income tax rate. Childless women only care about consumption, they work all their disposable time, $l = 1$ and they consume all disposable income. The value of residing in 'F' for a childless woman of type x and spouse's income z is equal to the value for living in 'H', $F^2(x,z) = H^2(x,z)$.

When deciding how much to work, mothers, on the other hand take into account that their children's quality depends on how much time they spend taking care of them. Thus

[25] Formal child care and grandparent-provided child might be very different. For the first nine months, Hansen and Hawkes [2009] find that formal child care is associated with higher school readiness scores, while grandparent-provided child care is associated with a higher vocabulary test score; both measured at the age of three. Hence, it is not clear whether one of them is of higher quality than the other. Bernal and Keane [2011] find that informal child care has negative effects on children's test scores while center-based care does not. However, the authors study single mothers only. This clearly introduces a bias towards more disadvantaged backgrounds of mothers and as well as towards informal care providers. In another study, Bernal [2008] finds that non-maternal child care is detrimental for children's scores. Hence if grandparent-provided child care is similar to the type of care a mother provides, then grandparents might be the second best option. Moreover, children in informal care might receive more individual attention, see Clarke-Stewart et al. [1994] and grandparents tend to guarantee a stable provider-child relationship, something found to be determinant for the quality of child care (see Walker [1991]).

the value function for a mother living in 'H' who has access to free child care during the second period is given by

$$H^2(x,z,k) = \max_l \left(\frac{c^{1-\sigma}}{1-\sigma} + (\sigma^e e - \sigma^k)k \right),$$

subject to the budget constraint

$$c = (1-\tau)(xl+z) + T,$$

and given the children's quality production function

$$e = \phi_m t_m + \phi_c t_c.$$

Women only decide to have children during the first period. At the beginning of the second period all children are three years old. Mothers who work and who have no access to free child care –those living in 'F' and those living in 'H' but without access to grandparent-provided child care– will have to purchase child care at price $p^2(1)$ per unit of time worked. The value function for a mother without access to free child care in the second period is given by

$$F^2(x,z,k) = \max_l \left(\frac{c^{1-\sigma}}{1-\sigma} + (\sigma^e e - \sigma^k)k \right),$$

subject to the budget constraint

$$c = (1-\tau)(xl+z) + T - (1-\omega)p^2(1)l,$$

and given the children's quality production function

$$e = \phi_m t_m + \phi_c t_c.$$

Value functions in the first period A woman who resides in 'H' has to decide whether to have children and how much to work. Only a share of working women $p(g)$ has access to free child care provided by grandparents. If a woman has access to free child care, her value function is given by

$$H^1(x,z) = \max_{l,k} \left(\frac{c^{1-\sigma}}{1-\sigma} + (\sigma^e e - \sigma^k)k + \beta(p(g)H^2(x,z,k) + (1-p(g))F^2(x,z,k) \right),$$

subject to the budget constraint

$$c = (1-\tau)(xl+z) + T,$$

and given the children's quality production function

$$e = \phi_m t_m + \phi_c t_c.$$

Given that residence choices are only made at the beginning of the first period, the continuation value for a woman living in 'H' is equal to the discounted value of living in 'H' in the second period. In the second period, with probability $p(g)$, she continues to have access to grandparent-provided child care. On the other hand, a share $(1 - p(g))$ of mothers who live in 'H' and who work, have to pay for child care. Their problem is the same as that of working mothers living in 'F'.

If a woman resides in 'F', she has to decide whether to have children and how much to work, taking into account that if she has children and works, she has to purchase child care at price $p^1(1)$. Child care services might be subsidized at a rate ω. The value function in the first period for a woman living in 'F' or living in 'H' but without access to free child care is given by

$$F^1(x,z) = \max_{l,k}\left(\frac{c^{1-\sigma}}{1-\sigma} + (\sigma^e e - \sigma^k)k + \beta F^2(x,z,k)\right)$$

subject to the budget constraint

$$c = (1-\tau)(xl + z) + T - (1-\omega)p^1(1)l$$

and given the children's quality production function

$$e = \phi_m t_m + \phi_c t_c.$$

Residence Decisions When deciding where to reside, women do not know for sure if they will have access to grandparent-provided child care in 'H'. They thus consider the expected value of living in 'H' which is given by

$$EH^{1*} = p(g)H^{1*}(x,z) + (1-p(g))F^{1*}(x,z)),$$

where $F^{1*}(x,z)$ and $H^{1*}(x,z)$ denote the value functions evaluated at the optimal decisions of labor supply and number of children. Women decide where to reside by comparing the expected value of living in 'H' to the value of living in 'F'. They will decide to live in 'F' if the expected value of living in 'H' is strictly higher than the value of living in 'F'.[26]

[26]Individuals who are indifferent are distributed equally across the two regions.

If child care were free in both regions there would only be two reasons why women would decide to reside in 'F': (i) a higher labor productivity and/or (ii) a higher spouse's income. However, once child care is costly women's residence choices depend on the life-course offers for each of the two regions, the price of child care in 'F' and the availability of free child care in 'H'. A woman who receives the same life-course offer in both regions– the same productivity x and the same spouse's income z – will always decide to live in 'H' because this is where she may obtain free child care. However, life-course offers can differ. Assume that a woman receives an offer $(x, z)^H$ associated with living in 'H' and an offer $(x, z)^F$ associated with living in 'F'. Her offer could include a higher labor productivity in 'F', $(x^F > x^H)$, a lower labor productivity in 'F' , $(x^F < x^H)$ or labor productivities could be the same, $(x^F = x^H)$. Moreover, spouses' incomes might also be different. In this case, residence choices become non-trivial. A higher offer might not be enough to compensate for the cost of child care and a woman might decide to reside in 'H' even if the life-course offer in 'F' is higher. In the following subsection we analyze the closed form solution for labor supply in our model and we discuss how changes in the price of child care and life-course offers affect women's labor supply decision.

3.2 Labor Supply

For our relatively simple model of grandparent-provided child care and women's labor market outcomes, we are able to obtain a closed-form solution for the optimal labor supply. Childless women work all their disposable time, $l^* = 1$. For mothers on the other hand, the optimal labor supply is given by

$$l^* = \left(\frac{1}{\sigma^e(\phi_m - \phi_c)}\right)^{\frac{1}{\sigma}} (x(1-\tau) - (1-\omega)p^i(1))^{\frac{1-\sigma}{\sigma}} - \frac{(1-\tau)z + T}{(1-\tau)x - (1-\omega)p^i(1)},$$

subject to

$$0 \leq l^* \leq 1, \text{for } i = 1, 2.$$

Mothers' optimal labor supply depends crucially on how important time spent with their mother is for children's quality, compared to the time spent in child care or with grandparents. We assume that time with mothers is at least as important as time in child care $(\phi_m \geq \phi_c)$. Mothers' labor supply also depends on the relationship between mothers' labor productivity and the cost of child care, as well as on the relative value of the spouse's income compared to mothers' labor productivity. Women whose marginal benefit from working – their labor productivity x – is lower than the marginal cost of working – the cost of child care, $p^i(1)$ for $i \in 1, 2$ – will decide to stay home. On the other hand, if the mothers' time for children's quality were of equal importance as time spent in child care,

$\phi_m = \phi_c$, women whose labor productivity is high enough would work all their disposable time

$$l^* = \begin{cases} 0 & \text{for} \quad (1-\tau)x < (1-\omega)p^i(1) \quad \text{and} \quad \phi_m \geq \phi_c \\ 1 & \text{for} \quad (1-\tau)x > (1-\omega)p^i(1) \quad \text{and} \quad \phi_m = \phi_c. \end{cases}$$

In case $\phi_m > \phi_c$, women whose labor productivity suffices to pay for child care will work, $0 \leq l^* \leq 1$. Even though, a mother's time has a higher weight for children's quality, working increases disposable income and consequently consumption. The effect of other parameters on the optimal labor supply is as expected. A higher weight of consumption for utility (σ), increases labor supply. An increase in the importance of time spent in child care for children's quality and an increase in labor productivity have similar effects. On the other hand, an increase in the weight of a mother's time for children's quality reduces labor supply. Similarly an increase in the cost of child care and an increase in the spouse's income decrease labor supply. In particular mothers supply no labor if their spouse's income is large enough,

$$l^* = \{ \ 0 \quad \text{if} \quad z > \frac{1}{1-\tau}[\left(\frac{x(1-\tau)-(1-\omega)p^j(1)}{\sigma^e(\phi_m-\phi_c)}\right)^{1/\sigma} - T].$$

4 Calibration Strategy

In order to be able to quantify the importance of grandparent-provided child care and the effect of family policies for women's decisions on residence, labor supply, and fertility, we calibrate our model. Some parameters of the model are fixed based on available evidence. The remaining parameters are calibrated to match the model to several labor market statistics and fertility data from Germany. Most statistics used for calibration come from pooled waves 1991, 1996, 2001, and 2006 of the German Socio-Economic Panel (GSOEP). We consider weighted statistics for married women in West Germany ages 20 to 48 for whom information on parents' residence is available.[27] Finally, we set policy parameters to represent German family policies.

In our model economy, individuals are distributed over different life-course offers. This distribution is denoted by $\Pi(x^h, z^h, x^f, z^f)$, chosen such as to be consistent with the existence of an initial distribution of women over labor productivities, $\Omega(x)$ and an initial distribution of men over labor productivities, $\Theta(z)$. Hence $\Omega(x_i)$ denotes the mass of women who are of productivity type x_i, for $i = 1...N$. Labor productivities x and z follow a log normal distribution. We discretize the distribution of men's observed wages to

[27] We chose ages 20 to 48 because this is the age range of women with children 0-6. We only consider individuals who report if they have children, and if and how they participate in the labor market. For men, we use wage data for married working individuals older than 20.

obtain twenty different types of spouses' incomes. Mean and standard deviation of men's productivity distribution are denoted by μ_z and σ_z. The distribution of women's observed wages, on the other hand, is much more likely to be effected by selection into employment. We assume the standard deviation of men and women's wages to be the same and we calibrate the mean of women's underlying productivity distribution to match the observed mean wage for women. Estimates for these parameters $(\mu_z, \sigma_z, \sigma_x)$ and calibration targets (μ_x) are taken from the distribution of hourly wage rates observed in our GSOEP sample. They are $\mu_z = 2.74$ and $\sigma_z = 0.41$ for men and $\mu_x = 2.46$ and $\sigma_x = \sigma_z = 0.41$ for women.

A life-course offer is a labor productivity and a spouse's income. It can be interpreted as a couple formed by a woman of productivity, x and a man of income z. Thus, the probability of an offer is equivalent to a matching probability between a woman and a man. The probability that an offer $(x_i, z_j)^d$ for $d = H, F$ is realized, or that a woman of type x_i matches with a man of type z_j is denoted by $\Phi(x, z)$. If a man and a woman are of the same type, $i = j$, this probability is equal to ψ. Otherwise the probability is given by $\frac{1-\psi}{N-1}$ for $i \in 1, ..., N$ and $j \in 1, ..., N$. To assign a value to ψ, we use the degree of assortative matching indicating how likely it is to meet your own productivity type. Fernández et al. [2005] estimate this value to be 0.7 for Germany, i.e. 70% of women in Germany match with men of the same type. The remaining 30% are equally likely to match with men of types different from their own.

In order to determine the distribution of life-course offers, $\Pi[(x, z)^H, (x, z)^F]$, we need to know how many individuals receive an offer $(x_i, z_j)^H$ in 'H' and an offer $(x_r, z_p)^F$ in 'F', for $i, j, r, p \in 1, ..., N$. For instance, how many women receive a particular offer $(x_1, z_3)^H$ in 'H' and an offer $(x_3, z_5)^F$ in 'F'? The number of individuals receiving the offer $(x_1, z_3)^H$ depends on the number of individuals of type x_1 – given by $\Omega(x_1)$ – and on the number of individuals of type z_3, – given by $\Theta(z_3)$ – and on the probability of this match happening, $\Phi(x_1, z_3)$. Thus the number of women receiving an offer $(x_1, z_3)^H$ is equal to the product of the three elements, $\Omega(x_1)\Theta(z_3)\Phi(x_1, z_3)$. It is thus equal to the probability of a woman being of type x_1 and the probability of a man having income z_3 and the probability for this match to happen. Likewise, the number of individuals receiving an offer $(x_3, z_5)^F$ is given by $\Omega(x_3)\Theta(z_5)\Phi(x_3, z_5)$. Hence the number of individuals receiving the two offers detailed above is equal to the probability of individuals receiving an offer $(x_1, z_3)^H$ times the probability of individuals receiving an offer $(x_3, z_5)^F$, normalized by the probability of receiving any offer. Given that there is a mass one of individuals, the number of individuals of a certain type is given by the probability of being an individual of that type. Each element of $\Pi[(x, z)^h, (x, z)^f]$ is calculated in the same fashion. The distribution of life-course offers is key to our analysis, as it determines how individuals are distributed across different offers, which will have implications for the model's aggregate statistics.

According to SHARE around 16.8% of German grandparents who live close to their small grandchildren [0-3), take care of them on a daily basis. Mothers of around 89% of women in our GSOEP sample are still alive. Hence we assign value 0.14 to the parameter $p(g)$ that denotes the share of women who live in 'H' and who have access to grandparent-provided child care. Given that one model period is equivalent to 3 years, the discount factor, β is set to a value of 0.889 in order to match a yearly interest rate of 4%. Table 4.3 displays all parameters set a priori.

Table 4.3: Parameters based on a priori information

Parameter	Explanation	Value
σ_x	standard deviation of women's log productivity	0.41
μ_z	mean log productivity of spouses	2.74
σ_z	standard deviation of spouses' log productivity	0.41
$p(g)$	% of women with access to free care in 'H'	0.14
ψ	assortative matching parameter	0.7
β	discount factor	0.889

We calibrate the parameters of the utility function, $(\sigma, \sigma_e, \sigma_k)$, the cost of child care in both periods, $p^1(1)$ and $p^2(1)$, women's mean log hourly wage rate μ_x, as well as the parameters of the children's quality function, (ϕ_m, ϕ_c). Note that we impose $\phi_m + \phi_c = 1$, and hence we only need to calibrate one of the two parameters. We now relate the calibrated parameters to the data moments that they are most likely to affect.

We set the mean of the distribution of women's underlying productivities $\bar{x}$ to 2.31 in order to match working women's observed mean log hourly wage rate, μ_x of 2.46. The weight of consumption in the utility function, σ is set to 0.976, to match the percentage of working women in 'H'.[28] Given that on average these women face lower child care costs, their participation decision is very much determined by the value of consumption. We use two moments related to fertility and participation to match the fixed utility cost of children, σ_k and the weight of children's quality, σ_e in the utility function. The weight of children's quality affects the decision of whether to participate in the labor market or not. Thus, to match this parameters we use the participation rate of mothers with older

[28]We join variables "parents or in-laws in same house" and "parents or in-laws close." Hence those in 'H' are individuals who live in the same house, neighborhood, or town as their parents or in-laws.

children [3-6) in 'H' who face lower child care costs. Whether a woman wants to become a mother or not is related to the fixed cost of children. Hence we use the percentage of women who are mothers in 'H' to match the fixed cost σ_k. We set σ_k and σ_e to 0.35 and 1.2 respectively.

The weight of mothers' time for children's quality, ϕ_m determines how much a mother works depending on her child's age. We calibrate this parameter to match the percentage of working mothers with small children [0-3) in 'H'. This parameter takes on value 0.672. The OECD [2008] estimates that child care costs for a two-year-old in Germany amount to 9.1% of average income. We set the first period child care cost for small children [0,3) $p^1(1)$ to 1 to match this number.[29] The price of child care in the second period is calibrated to match the participation rate of mothers with older children [3-6) in 'F'. This parameter takes on value 0.75. Table 4.4 displays the calibrated parameters of the model.

Table 4.4: Calibrated parameters

Parameter	Explanation	Value
$\bar{x}$	mean underlying productivity of women	2.31
σ	weight of consumption	0.976
σ_e	weight of children quality	1.2
σ_k	fixed cost of children	0.35
ϕ_m	weight of mother's time	0.672
$p^1(1)$	cost of child care, period 1	1
$p^2(1)$	cost of child care, period 2	0.75

Finally, the model's policy parameters are the income tax rate, τ, child care subsidies, ω and family benefits, T. We set τ to 37% which is equivalent to the income tax revenue collected by the German government as a fraction of GDP (OECD [2010]). According to the OECD [2009], all German families receive some family benefits for each child up to the age of eighteen (*Kindergeld*). In particular, they receive 184 Euros per month for the first child, 190 for the second and 205 for the third, fourth, fifth child etc. We set the amount of family benefits in our economy, T such as to match that for the average German family (in terms of income and number of children), *Kindergeld* is equivalent to

[29]Note that in our model men and women who are not taking care of their children work all their disposable time. Given that we targeted hourly wage rates, the resulting average income in the model is too high compared to the data. In order to calculate child care costs as a fraction of average income we impose a maximum work day equal to 40% of disposable time, i.e. 40 hours per week of 98 hours disposable time after subtracting 10 hours per day for sleeping, eating, personal care.

around 5% of family income. Hence, T is set to 0.522. According to the same source, child care subsidies for small children [0-3) are negligible in Germany. Therefore, we set child care subsidies (ω) to zero. All policy parameters are displayed in Table 4.5.

Table 4.5: Policy parameters

Parameter	Explanation	Value
τ	income tax	0.37
T	Family Benefits	0.522
ω	child care subsidy	0

5 Results-Benchmark Economy

Table 5.6 presents model moments from our benchmark economy together with the corresponding data moments from our GSOEP sample.

Table 5.6: Data and model moments

	Data	Model
LFP of mothers, children [0-3) in 'H'	26.75	28.68
LFP of mothers, children [3-6) in 'H'	46.22	51.09
LFP of mothers, children [3-6) in 'F'	44.10	49.17
LFP of women in 'H'	50.36	57.86
Mean log hourly wage rate of working women	2.46	2.46
% of women being mothers in 'H'	72.34	70.09
Child care costs as % of average income	9.10	9.88

Our model matches labor force participation of mothers with small children [0-3) who live close to parents or in-laws, particularly well. This rate is equal to 26.75% in the data while the model estimates it to be 28.68%. On the other hand, the model slightly overestimates labor force participation of mothers with children between the ages of 3 and 6. While in the data this rate is 46.22% in 'H', the model estimates a rate of 51.09%.

In 'F', this rate is 44.10% in the data while the model predicts that 49.17% of mothers with children between 3 and 6 who live far from parents or in-laws work. We slightly overestimate the labor force participation of all women who live close to parents or in-laws. This rate is 50.36 in the data, while the model estimates a rate of 57.74. This is partly due to overestimating labor force participation of mothers with older children in 'H'. In addition, all childless women work all their disposable time because leisure has no value for utility in our model set-up. The model predicts an average log hourly wage rate for working women of 2.46, matching perfectly the wage rate observed in the data. The model also performs fairly well in terms of matching data on fertility. In our model, women can only decide whether to become mothers or not. Thus we cannot say anything about the average number of children per woman. However, the model matches closely the percentage of married women who are mothers, 70.09% in the model compared to 72.34% in the data. In Germany, the cost of child care for small children [0-3), is equal to 9.10% of average income while the model predicts this cost to be 9.88%. Thus the model also matches child care costs well.

Model moments in Table 5.6 were targeted explicitly to calibrate certain parameters. 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. Table 5.7 shows these un-targeted moments of the model and the corresponding data moments.

Table 5.7: Data and model moments: not used for calibration

	Data	Model
% of women being mothers, 'F'	66.75	64.28
Aggregate LFP rate of women	48.90	57.74
LFP rate of women, 'F'	47.62	57.61
LFP rate of mothers children [0-3), 'F'	20.55	19.00
Share of female married population living in 'H'	43.43	52.62
Average time spent with child, all mothers, as % of total time	64.37	57.14
Average time spent with child, working mothers, as % of total time	(35.33-57.24)	37.64

The model produces particularly good estimates of the percentage of women who are mothers in 'F' as well as of the labor force participation of mothers with small children

in 'F'. These statistics are key to our analysis of the relationship between mothers' labor force participation and the availability of child care. On the other hand, as expected our model without leisure in the utility function overestimates aggregate female labor force participation. Moreover, the model predicts that 52.62 per cent of women live in 'H', while in the data, 43 per cent of women live close to parents or in-laws. The model somewhat overestimates this statistic. However, taking into account that we did not target this number in the calibration the model does fairly well.

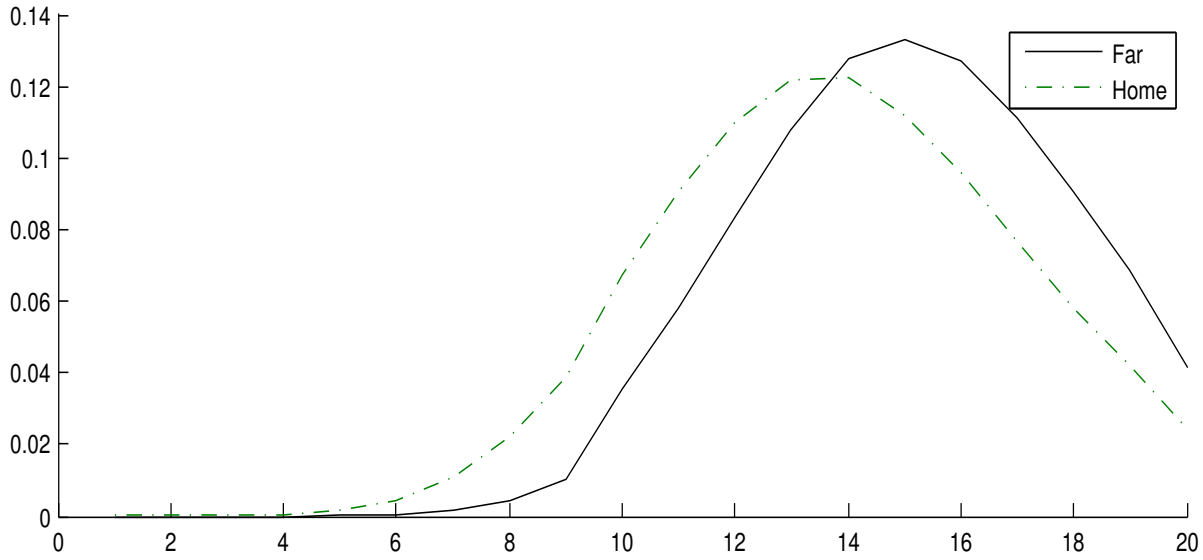
We also report the percentage of time mothers devote to taking care of their children. In our model, individuals do not value leisure and hence when a mother is not working, she is taking care of her children. Hence, time spent taking care of children is a residual. However, in the data we observe women spending their non work-related time on other activities besides child care. Hence, we cannot reproduce actual time spent on child care, but we want to show how our model performs in terms of mother's time spent on child care relative to work-related activities. In order to do so, we make the data comparable to our model by assuming that the sum of time women spend on child care and time for work-related activities is equal to their total disposable time. Our data comes from an OECD report on time use, OECD [2011]. It contains the time women in a couple with at least one child of preschool age devote to various activities. We are interested in how much time women spend on child care–both as primary or secondary activity- as a percentage of total time– child care plus work-related time. For Germany, all mothers spend 63.37 per cent of their time on child care, while our model predicts that all mothers spend 57.17 per cent of their time on child care. For working women, the data differentiates between those working part time and those who work full time. We report both values and we take them to be lower and upper bounds for time spent taking care of children by working mothers in our model. In the data, mothers who work full time spend 35.33 per cent of their time caring for their children. Meanwhile those who work part time spend a larger share of their time taking care of their children, 57.24%. In our model, working mothers spend 37.64% of their time on child care. This percentage of time spent on child care is relatively close to that of full time working mothers in the data. Despite the lack of leisure in the model and if it were to be the case that women spend time only at work or taking care of children, the model produces sensible moments on mothers' time taking care of children.

6 Discussion

6.1 Cost in terms of wages

In the empirical analysis of the paper we showed that there exists a negative relationship for mothers between living close to parents or in-laws and hourly wages. In our model, where residence is a choice and depends on life-course offers received and on child care costs, the same relationship arises. Figure 6.2 shows the wage distributions of working mothers in both regions. We obverse that the mean of the wage distribution in 'F' (15.5) is higher than in 'H' (13.5). The model thus generates endogenous differences in wage rates of working mothers. In our model differences in child care costs generate these differences in wage rates. In 'F', there is no access to grandparent-provided child care, and women who work have to pay for child care. This leads to a selection of high productivity type working women into residing in 'F'.

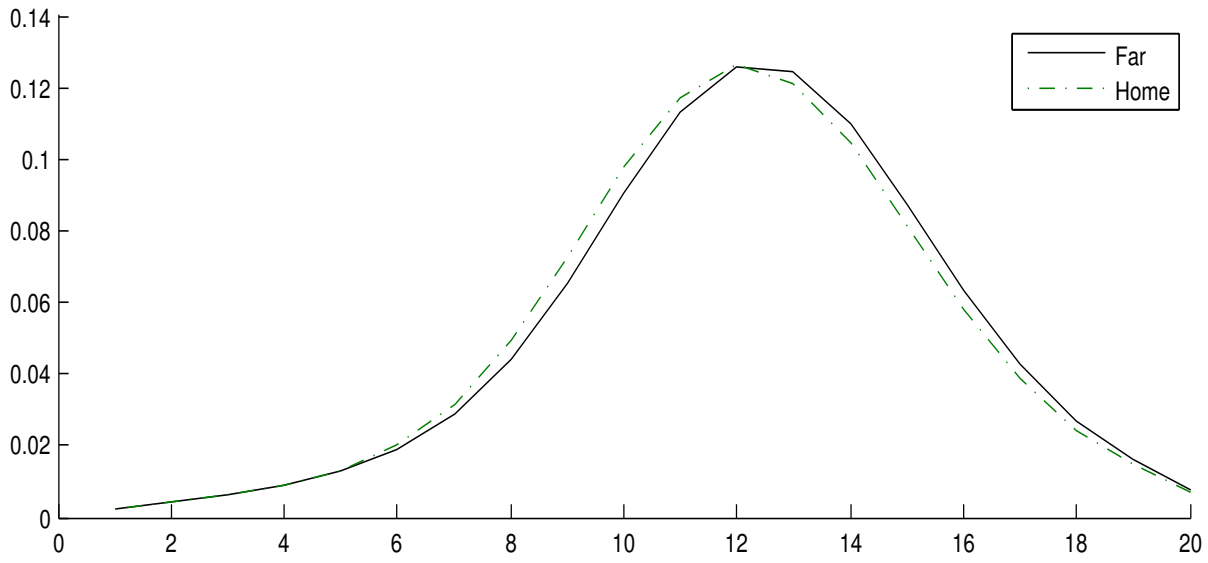
Figure 6.2: Working mothers' wage distribution



In our empirical analysis, we used a Heckman selection model to control for the fact that observed wages might be biased upward by a selection of women into employment. However, we were not able to control for a selection into residing close or far from parents or in-laws. In the model on the other hand, we are able to also control for this additional selection effect. Figure 6.3 displays the underlying or potential wage distributions for

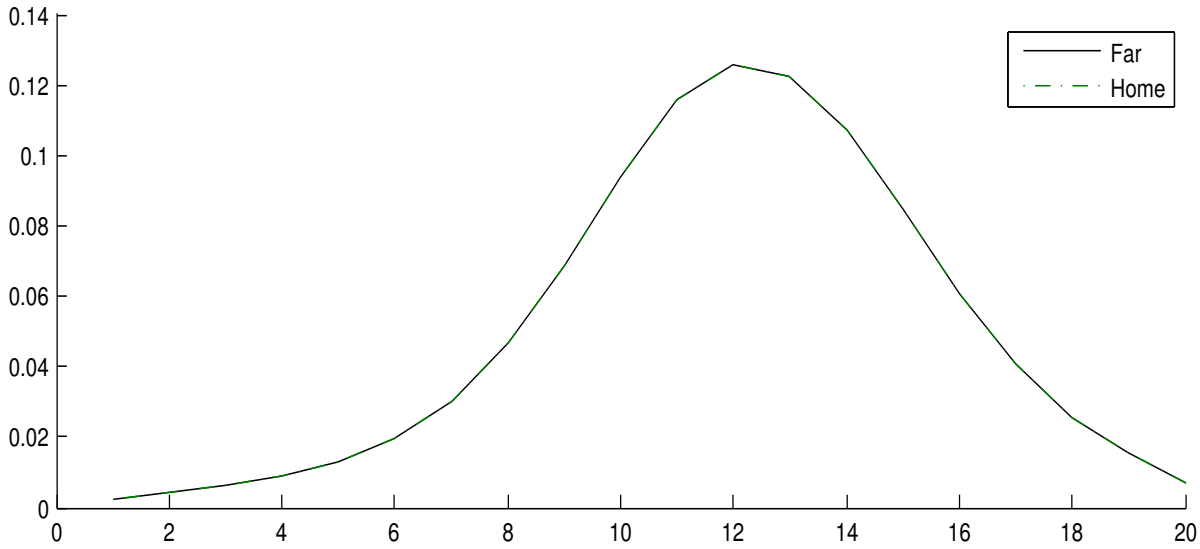
women in both regions, before employment decisions. Women reside in 'F' to take advantage of higher wages. Thus we observe that the potential wage distribution of women in 'F' lies to the right of the one in 'H'. To analyze whether those who reside in 'H' despite lower average wages do so because of grandparent-provided child care, we consider the underlying wage distributions in both regions when there are no grandparents. Figure 6.4 shows that in this case, wage distributions are the same in both regions. In addition to the effect of selection into employment, residence choices also contribute to the differences in the wage distributions of women in 'H' and in 'F'. While these differences are small they clearly depend on how wide-spread grandparent-provided child care is.

Figure 6.3: Women's potential wage distribution



In our model, women decide where to reside, based on the life-course offers they receive and taking into account the higher costs of child care in 'F'. Life-course offers consist of different wages and different spouses' incomes in both regions. In order to better analyze the role of life-course offers for women's decisions, we consider life-course offers that only differ in one of the two dimensions. First we analyze the role of women's wages by only allowing offers to differ across women's wages in each region. In this case, a life-course offer consists of a wage and spouse's income in 'H' and a different wage and the same spouse's income in 'F'. In a second step we maintain wage offers fixed and only vary spouses' incomes across regions.

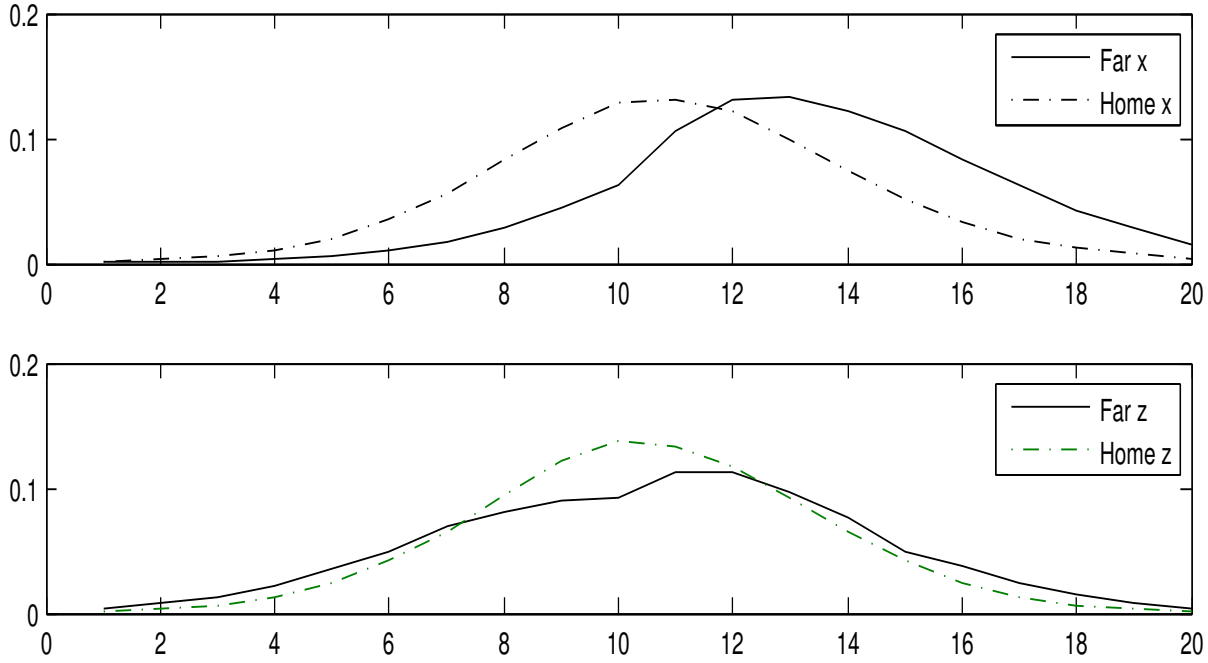
Figure 6.4: Women's potential wage distribution, no grandparents



6.2 Effect of women's wages on decisions

To study the importance of women's wages for residence choices, we shut down the spouse's income channel. In this case, the only reason to move to 'F' is a higher wage rate. The wage distribution of women in 'F' is thus skewed to the right (see Figure 6.5). The distribution of spouses' incomes in 'F', on the other hand is fairly symmetric. Only 22% of women live in 'F' compared to 48% in the benchmark economy. Without any variation in spouse's income 58% fewer women reside in 'F'. In our benchmark economy with a certain probability – as specified in the calibration section – a woman could receive life-course offers $(x_1, z_3)^H$ and $(x_1, z_5)^F$. Given certain parameters she would be likely to choose the second option. In the observed distribution of spouse's incomes only z_5 would be registered. When shutting down the spouse's income channel the aforementioned life-course offer will not be available. Instead a women might receive offers $(x_1, z_3)^H$ and $(x_1, z_3)^F$ or $(x_1, z_5)^H$ and $(x_1, z_5)^F$. In one case z_3 and in the other z_5 will become observations in the spouse's income distribution. This is why on the aggregate compared to our benchmark economy women receive lower spouses' incomes and they thus participate more. In particular, in 'F' 70% of mothers with small children participate. These women can afford to pay for child care but would decide not to work if their spouse had a higher income.

Figure 6.5: Women's potential wage distribution and spouses' income distribution

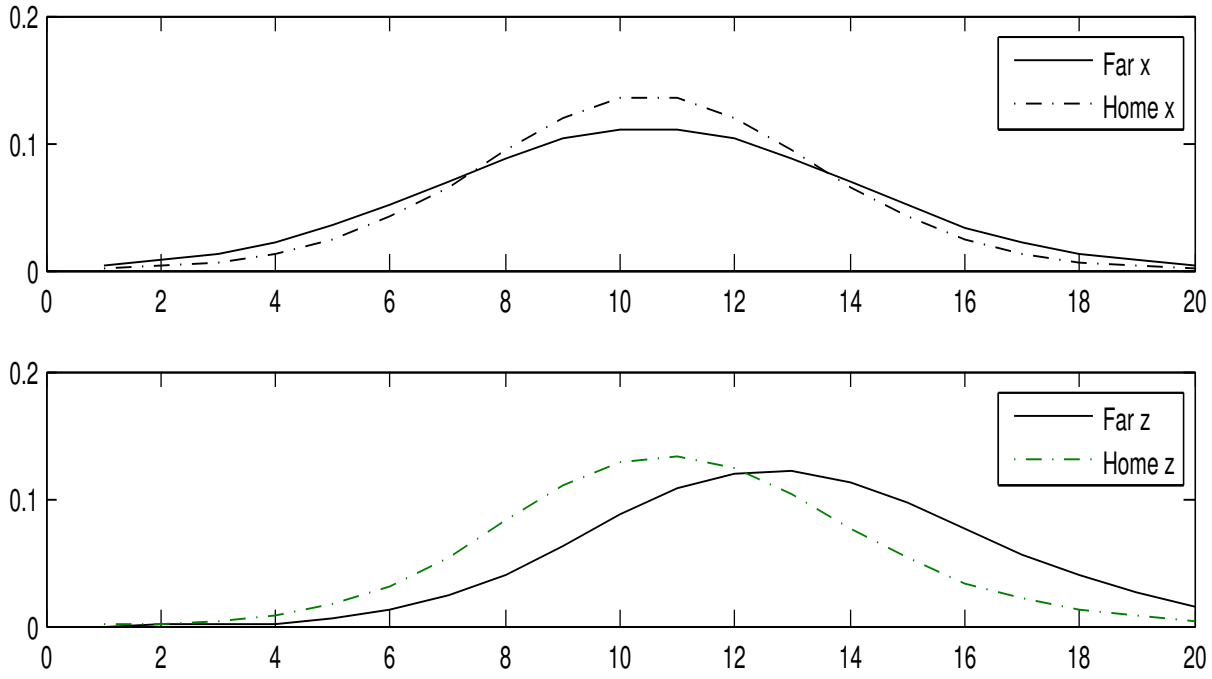


6.3 Effect of spouse's income on decisions

If on the other hand we shut down the wage channel, women receive the same labor productivity offer in both regions, but different offers for spouses' income. In this case, the main reason for moving to 'F' lies in a higher spouse's income and women with relatively higher spouse's income reside in 'F'. The distribution of productivity types in 'F' displays a larger variance than the distribution in 'H' and the distribution of spouses' incomes in 'F' is skewed to the right (see Figure 6.6). Again, fewer women reside in 'F' compared to the benchmark economy, 21% versus 48%. For the same reason that women receive lower spouses' incomes when we shut down the spouse's income channel, they receive lower productivity offers when we shut down the wage channel. We thus also observe a decrease in female labor force participation as women face lower wages on average.

Both channels - women's wages and their spouses' income - are important for understanding women's residence choices as well as their decisions regarding labor force participation. If we shut down both channels and women received the same life-course offers in 'F' and 'H' all women would reside in 'H'. Given a positive probability for grandparent-provided

Figure 6.6: Women's potential wage distribution and spouses' income distribution



child care, the value function for living in 'H' would always be larger than the one for living in 'F'.

7 Counterfactual Experiments

In our first counterfactual experiment we analyze a situation in which grandparents are not available to take care of their grandchildren and in which everyone has to pay for child care. Our second counterfactual experiment considers 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 increased 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 birth was 24 (OECD [2008]). As successive generations of women delay birth, grandparents may be to be too old or too sick to take of their grandchildren. On the other hand, women's labor force participation and individuals' retirement age has increased in many countries. 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 in the future.[30] Regarding our second experiment, we consider a subsidy for child care. Given the positive relationship found in the literature between availability and low cost of child care and female labor force participation, we would expect such a policy to lead to an increase in mothers' labor force participation. We set the subsidy to 53 per cent of child care costs. 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 Swedish families face. In Sweden, child care costs are among the lowest compared to other OECD countries, and they amount to 4.6 per cent of average income (OECD [2008]).

No grandparent-provided child care Table 7.8 provides moments from our first counterfactual experiment together with the corresponding moments from our benchmark economy.

Table 7.8: No grandparent-provided child care

	No grandparents	Benchmark economy
Aggregate LFP rate of women	56.40	57.74
% of women being mothers, 'H'	65.21	70.09
% of women being mothers, 'F'	65.21	64.28
LFP rate of mothers children [0-3), 'H'	17.85	28.68
LFP rate of mothers children [3-6), 'H'	48.40	51.09
LFP rate of mothers children [0-3), 'F'	17.85	19.00
LFP rate of mothers children [3-6), 'F'	48.40	49.17
share of women living in 'H'	50.00	52.62

In the benchmark economy, women in 'F' and those women in 'H' who have no access to grandparent-provided child care face high child care costs. Without the availability of grandparents, the incentive to remain close disappears. We thus observe that the share of women living in 'F' is 2.56 percentage points higher compared to the benchmark economy.

[30] 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.

We observe that half the population chooses to live in 'F' and the other half chooses to live in 'H'.[31] In both regions 65.21 per cent of women are mothers. Labor force participation of mothers with small children [0-3) decreases in both regions to 17.85 per cent. The fact that grandparent-provided child care is not available in 'H' alters incentives to move to 'F'. This changes the composition of productivity types in 'F' which in turn affects the labor force participation rate of women in 'F'. Given that without grandparents, child care for older children [3-6) is more costly, too we also observe a decrease in labor force participation of mothers with older children.

On the aggregate, labor force participation by women drops 1 percentage point compared to our benchmark economy. Finally, we observe a drop in fertility. In 'H' the number of women who become mothers is reduced by almost 5 percentage points. Women who would decide to reside in 'H' if there was grandparent-provided child care, react by moving more, participating less, and having fewer children. However, given that in our benchmark economy only 14% of grandparents are readily available for child care, effects of a loss in availability of grandparents are small on the aggregate.

Child Care Subsidies In our second counterfactual experiment we consider an increase in child care subsidies. In particular, we consider a policy that subsidizes 53% of child care costs in both periods, i.e. the policy parameter ω is set to 0.53. Table 7.9 displays moments from this counterfactual experiment, next to moments from our benchmark economy, with $\omega = 0$.

Under this policy, every woman can afford to become a mother and around 84 per cent of women work. A child care subsidy not only affects women who live in 'F', but also those who live in 'H' and who do not have access to grandparent-provided child care. It thus increases labor force participation of mothers in 'H' as well as of mothers in 'F'. Some women still have access to free grandparent-provided child care, leading to a slightly higher participation rate of mothers in 'H'. It is for the same reason that we do not observe any change in the share of women living in 'F'. The significant increases in both the aggregate number of mothers and mothers' labor force participation rates, indicate that subsidizing child care costs can lead to higher fertility and higher labor force participation by mothers.

[31] The fact that the population splits into half has to do with how the offers are set up and that we equally divide those who are indifferent.

Table 7.9: Child care subsidy, $\omega = 0.53$

	$\omega = 0.53$	Benchmark economy
Aggregate LFP rate of women	82.91	57.74
% of women being mothers, 'H'	100.00	70.09
% of women being mothers, 'F'	100.00	64.28
LFP rate of mothers children [0-3), 'H'	82.70	28.68
LFP rate of mothers children [3-6), 'H'	84.22	51.09
LFP rate of mothers children [0-3), 'F'	81.51	19.00
LFP rate of mothers children [3-6), 'F'	83.10	49.17
share of women living in 'H'	52.46	52.62

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 that as mothers they are more likely to hold a regular full-or part time job. However, we find that their wages are lower and that they are more likely to incur in commutes. We build a 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 and female labor force participation. 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 was no grandparent-provided child care, fewer women would participate in the labor market and fewer would become mothers. We also observe that mobility increases. Hence, grandparent-provided child care imposes a geographical restriction. One way to remove this restriction would be to subsidize child care. However, we find no effect on mobility when we subsidize 53% of child care costs. Though this subsidy leads to increases in both, aggregate female labor force participation and fertility.

In absence of child care subsidies, grandparent-provided child care plays an important role for mothers' labor force participation. However, women who remain close to their parents or in-laws only access a confined labor market, which might imply worse labor market opportunities and thus lower wages. Hence, when designing policies aimed at in-

creasing 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 may not only affect mothers' labor force participation but it may also have an impact on their wages and/or commutes.

In this paper we simply assume that being close to one's grandparents' implies that with a certain probability grandparents take care of their grandchildren, and we do not consider grandparents' decisions to provide care. However, this decision might be very much related to individuals' retirement age and especially in the case of grandmothers to previous decisions about labor force participation. In this sense, opposing cohort effects of female labor force participation could arise. On the one hand, having a working mother increases the likelihood for her daughters to also become working mothers.[32] On the other hand, a grandmother who is actively participating in the labor market might be less likely to provide child care for her grandchild, something that is found to increase mother's labor force participation rates. We believe that a very interesting road for future research could be an analysis of how late first birth and improved health after retirement interact with these forces.

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[32] See Fernández 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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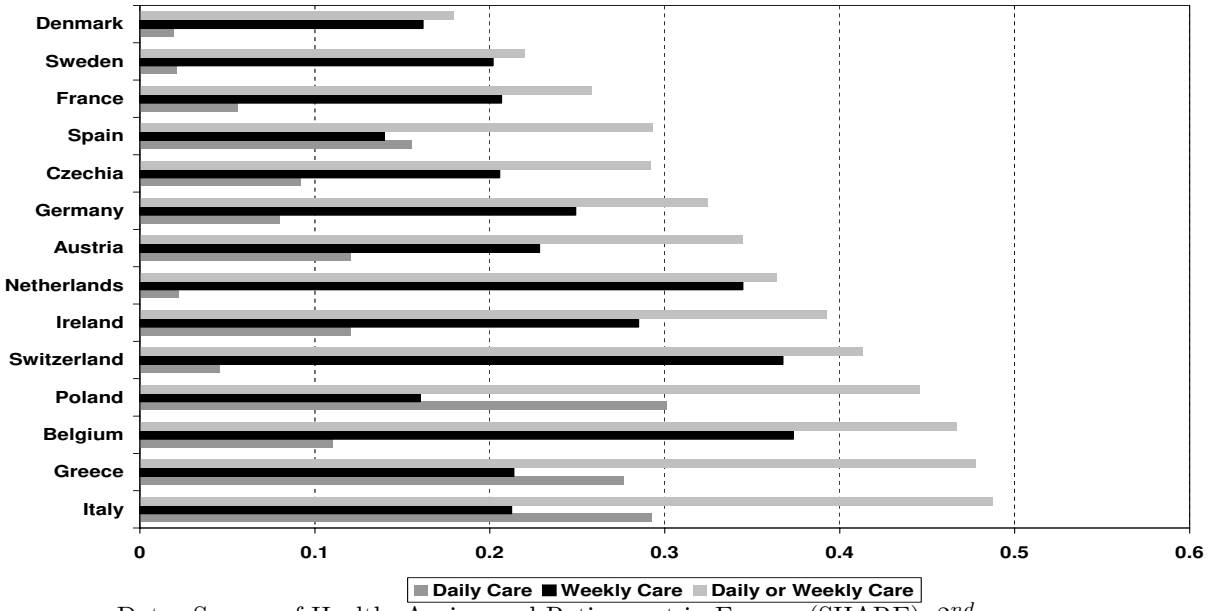
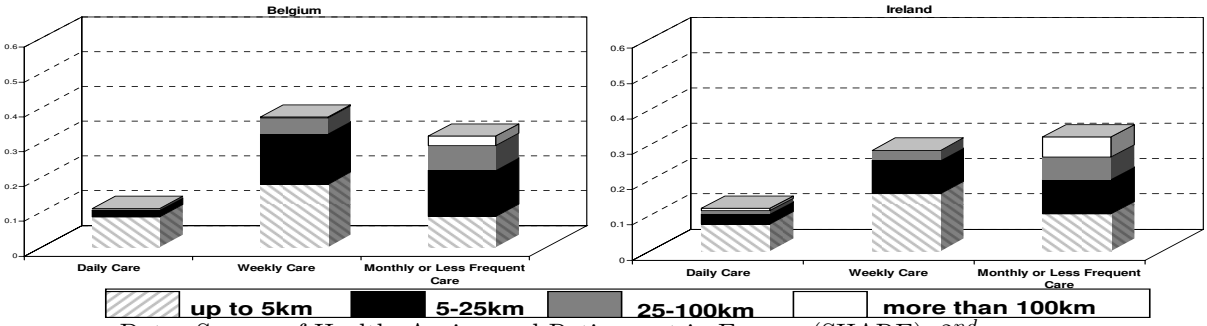
A Appendix

Figure A-1: Grandparent-provided Care for grandchildren, ≤ 6



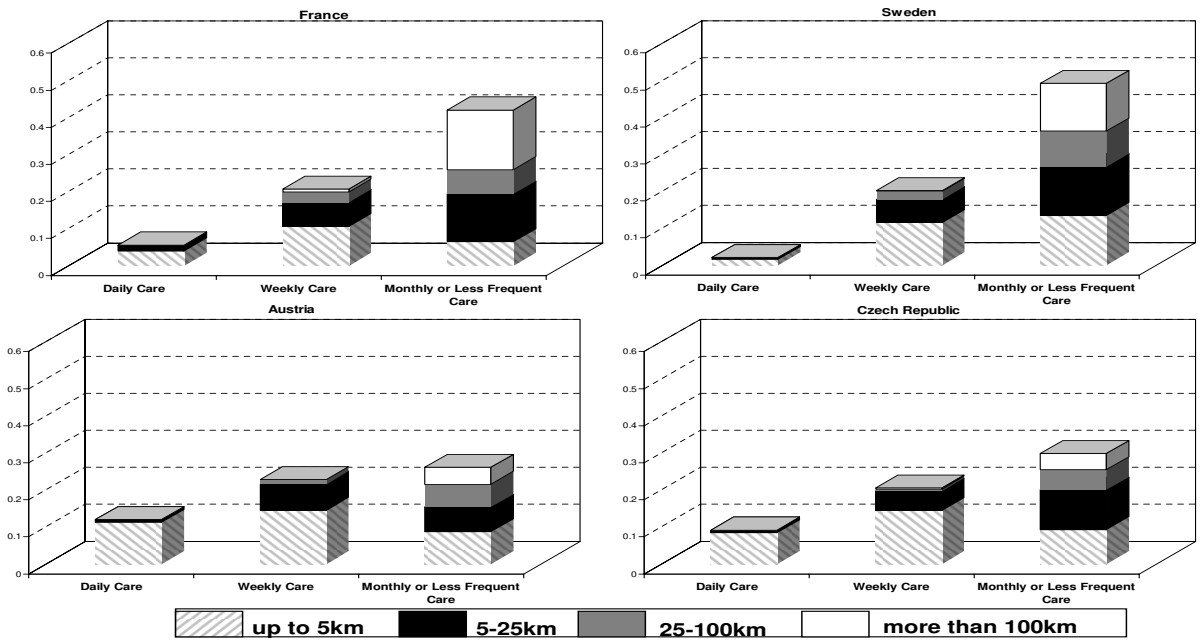
Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2^{nd} wave.

Figure A-2: Frequency of care for and distance to grandchild, ≤ 6



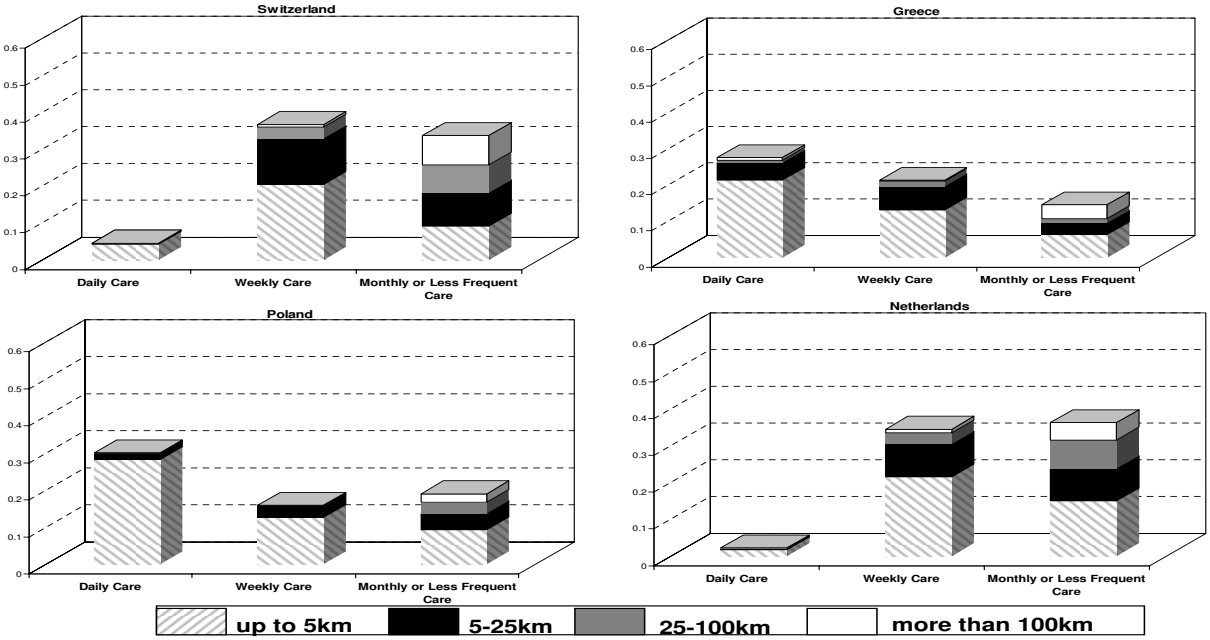
Data: Survey of Health, Ageing and Retirement in Europe (SHARE), 2^{nd} wave.

Figure A-3: Frequency of care for and distance to grandchild, ≤ 6



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

Figure A-4: Frequency of care for and distance to grandchild, ≤ 6



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

Table A.1: Means (Std.) - GSOEP pooled sample-
- 1991, 1996, 2001, 2006-

	Women	Mothers
	25-50	25-50
Age	37.4 (7.1)	38.8 (6.6)
30-34	0.20	0.18
35-39	0.22	0.24
40-44	0.21	0.25
45-50	0.20	0.23
Married, living together	0.68	0.79
Other than German nationality	0.02	0.01
Children	0.76	1
Children 0-2	0.10	0.13
Children 3-6	0.14	0.19
Number of Children	1.5(1.2)	2.0(0.9)
Primary education	0.01	0.01
Tertiary education	0.27	0.26
Regular fulltime job	0.36	0.25
Regular part time job	0.24	0.29
Small community	0.45	0.48
Large community	0.29	0.26
in East Germany	0.25	0.28
Parents or in-laws in same house	0.14	0.13
Parents or in-laws close	0.42	0.44
- Parents or in-laws in same neighborhood	0.19	0.21
- Parents or in-laws in same town	0.23	0.24
Parents or in-laws far away	0.44	0.43
- Parents or in-laws one hour away	0.29	0.29
- Parents or in-laws further away	0.15	0.13
Parents or in-laws in foreign country	0.01	0.01
Children in non-relative care (nursery, sitter, paid care etc.)***	-	0.65
- Children (< 3)	-	0.14
- Children ($3 - 6$)	-	0.84
Children cared for by relatives***	-	0.34
- Children (> 3)	-	0.33
- Children ($3 - 6$)	-	0.34
Spouse's income*	2844.5 (2362.0)	2865.0 (2159.0)
Hourly wage**	12.4 (6.2)	12.1 (6.2)
Tenure in firm**	8.4 (7.3)	8.9 (7.6)
Commuter****	0.50	0.49
N	10,732	8,129

*** Only available for 2001 and 2006 ($N = 761$ for < 3, $N1296$ for $3 - 6$.) *Only taking into account strictly positive income ($N = 7,323$, $N = 6,083$ for women, mothers) **Among those working regular part-or fulltime jobs ($N = 6,471$,$N = 4,348$)**** Only available for 2001 and 2006 ($N = 4363$, $N = 2913$).

Table A.2: Use of relative-provided child care by proximity to parents or in-laws (number of observations)

	Mothers with children <= 6	Working Mothers with children <= 6	Mothers with children < 3	Working Mothers with children < 3
All	34.9% ($n = 2148$)	44.4% ($n = 786$)	33.3% ($n = 901$)	46.6% ($n = 176$)
Parents or in-laws in same house	49.8% ($n = 265$)	64.6% ($n = 99$)	48.6% ($n = 111$)	77.8% ($n = 18$)
Parents or in-laws close	45.1% ($n = 990$)	53.8% ($n = 379$)	43.7% ($n = 398$)	57.6% ($n = 85$)
- Parents or in-laws in same neighborhood	50.7% ($n = 489$)	56.8% ($n = 190$)	49.5% ($n = 204$)	60.5% ($n = 43$)
- Parents or in-laws in same town	39.5% ($n = 501$)	50.8% ($n = 189$)	37.6% ($n = 194$)	54.8% ($n = 42$)
Parents or in-laws far away	19.1% ($n = 893$)	26.3% ($n = 308$)	18.4% ($n = 392$)	26.0% ($n = 73$)
- Parents or in-laws one hour away	24.7% ($n = 635$)	32.1% ($n = 224$)	24.6% ($n = 280$)	32.7% ($n = 52$)
- Parents or in-laws further away	5.4% ($n = 241$)	11.3% ($n = 80$)	2.8% ($n = 107$)	10.0%($n = 20$)
Parents or in-laws in foreign country	5.9% ($n = 17$)	0 ($n = 4$)	0 ($n = 5$)	0 ($n = 1$)

Women 25-50, pooled waves 2001 and 2006.

Table A.3: Use of relative-provided child care, age, health status and labor force participation of grandmothers (number of observations)

	All		Close to own parents and using relative-provided care	
	Mothers with children <= 6	Working Mothers with children <= 6	Mothers with children <= 6	Working Mothers with children <= 6
Age grandmother	58.0 (7.8) ($n = 503$)	57.9 (7.7)($n = 151$)	57.3 (7.7)($n = 81$)	55.4(7.4) ($n = 33$)
Grandmother not employed	51.5% ($n = 410$)	45.2% ($n = 126$)	64.2% ($n = 67$)	61.5% ($n = 26$)
Grandmother works full time	25.8% ($n = 410$)	32.5% ($n = 126$)	17.9% ($n = 67$)	30.8% ($n = 26$)
Grandmother works part time	18.0% ($n = 410$)	15.9% ($n = 126$)	13.4% ($n = 67$)	7.7% ($n = 26$)
Grandmother very good or good health	30.2% ($n = 410$)	21.4% ($n = 126$)	28.4% ($n = 67$)	26.9% ($n = 26$)
Grandmother not good or bad health	23.7%($n = 410$)	23.0%($n = 126$)	28.4% ($n = 67$)	26.9% ($n = 26$)

Women 25-50, pooled waves 2001 and 2006.

Table A.4: Marginal effects from Probit estimation for having children

Married, living together	0.286***	(0.012)
Other than German nationality	0.008	(0.027)
Log (Spouse's income)†	0.004***	(0.001)
in East Germany	0.177***	(0.023)
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	0.036***	(0.011)
Large community	-0.065***	(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. Regression includes year, state, and age group dummies. Reference group: unmarried women age 25-29, with education level 1 or 2(ISCED:0-4), living in West Germany in North Rhine-Westphalia in 1991, in a medium-sized town, far from parents or in-laws.

Table A.5: Marginal effects from Probit estimation for having children with interaction terms

Married, living together	0.286***	(0.012)	0.286***	(0.012)
Other than German nationality	0.008	(0.027)	0.008	(0.027)
Log (Spouse's income)†	0.004***	(0.001)	0.004***	(0.001)
in East Germany	0.178***	(0.023)	0.178***	(0.023)
Tertiary education (ISCED: 5,6)	-0.102***	(0.013)		
Primary/Secondary edu (ISCED: 0-4)			0.102***	(0.013)
Parents or in-laws close	0.032***	(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	0.036***	(0.011)	0.036***	(0.011)
Large community	-0.065***	(0.012)	-0.065***	(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. Regressions include year, state, and age group dummies. Reference group: unmarried women age 25-29 with education level 3 (ISCED 5,6) and education level 1 or 2(ISCED:0-4) respectively living in West Germany in North Rhine-Westphalia in 1991, in a medium-sized town, far from parents or in-laws.

Table A.6: Marginal effects from Probit estimation for mothers' labor force participation

	Regular Part or Fulltime Job	
Number of children	-0.114***	(0.007)
Children 0-2	-0.398***	(0.016)
Married, living together	-0.128***	(0.017)
Other than German nationality	-0.123**	(0.054)
Log (Spouse's income)†	0.006***	(0.002)
in East Germany	0.116**	(0.046)
Tertiary education (ISCED: 5,6)	0.171***	(0.014)
Parents or in-laws close	0.029**	(0.013)
Parents or in-laws in same house	0.022	(0.019)
Small community	-0.003	(0.015)
Large community	0.018	(0.017)
Observations	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 age 25-29 with education level 1 or 2(ISCED:0-4) in 1991, in a medium-sized town in West Germany North Rhine-Westphalia , far from parents or in-laws, with children age 3 or older. Regression includes year, state, and age group dummies.

Table A.7: 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	-0.096***	(0.032)	-0.097	(0.071)
in East Germany	-0.067**	(0.027)	-0.299**	(0.136)
Tertiary education (ISCED: 5,6)	0.088***	(0.006)	0.135***	(0.024)
Parents or in-laws close	0.009	(0.007)	0.033	(0.028)
Parents or in-laws in same house	-0.008	(0.010)	-0.100***	(0.037)
Small community	0.003	(0.009)	-0.034	(0.036)
Large community	-0.013	(0.010)	-0.125***	(0.033)
Observations	8,653		1,176	

1) 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 in North Rhine-Westphalia, far from parents or in-laws 2) single childless women (25-50). Reference group: women age 25-29 in 1991, with education level 1 or 2 (ISCED: 0-4), in a medium-sized town in West Germany in North Rhine-Westphalia. Regressions include year, state, and age group dummies.

Table A.8: Coefficients of Heckman Selection Model for mothers' log monthly wages

	Log monthly wage		Selection Equation	
	(1)		(2)	
Married, living together	-0.035**	(0.017)	-0.326***	(0.044)
Number of children	-0.047***	(0.010)	-0.287***	(0.017)
Other than German nationality	-0.116	(0.083)	-0.311**	(0.140)
Tertiary education (ISCED: 5,6)	0.282***	(0.016)	0.441***	(0.036)
Parents or in-laws close	-0.056***	(0.015)	0.073**	(0.033)
Parents or in-laws in same house	-0.059***	(0.022)	0.056	(0.048)
Small community	-0.038**	(0.018)	-0.007	(0.039)
Large community	0.053***	(0.020)	0.046	(0.044)
in East Germany	-0.081*	(0.042)	0.296***	(0.119)
Log (Spouse's income)†			0.016***	(0.005)
Children 0-2			-1.105***	(0.056)
Tenure in firm	0.017***	(0.001)		
Monthly hours worked	0.007***	(0.000)		
Constant	5.787***	(0.055)	0.186**	(0.087)
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 age 3 or older with education level 1 or 2 (ISCED: 0-4) in 1991, in a medium-sized West German town in North Rhine-Westphalia , far from parents or in-laws. Regressions include age group, state, and year dummies.

Table A.9: Proximity to grandparents and hourly wages
Coefficients of OLS estimation of mothers' log hourly wages

Married, living together	0.000	(0.015)
Number of children	-0.026***	(0.008)
Other than German nationality	-0.121	(0.077)
Tertiary education (ISCED: 5,6)	0.280***	(0.014)
Tenure in firm	0.016***	(0.001)
Parents or in-laws close	-0.052***	(0.014)
Parents or in-laws in same house	-0.052**	(0.020)
Small community	-0.040**	(0.017)
Large community	0.045**	(0.019)
in East Germany	-0.081*	(0.044)
Constant	1.955***	(0.041)
Observations	4,348	
R-squared	0.262	

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. Regression includes age group, state, and year dummies. Reference group: unmarried mothers age 25-29 living in West Germany in North Rhine-Westphalia , with education level 1 or 2 (ISCED: 0-4), in 1991, in a medium-sized town, far from parents or in-laws.

Table A.10: Proximity to grandparents and hourly wages
Coefficients of Heckman Selection Model for mothers' log hourly wages without variables posing a possible endogeneity problem: marital status and spouse's income

	Log hourly wage		Selection Equation	
	(1)		(2)	
Number of children	-0.038***	(0.010)	-0.292***	(0.017)
Other than German nationality	-0.135*	(0.077)	-0.340**	(0.139)
Tertiary education (ISCED: 5,6)	0.293***	(0.015)	0.433***	(0.036)
Parents or in-laws close	-0.049***	(0.014)	0.061*	(0.033)
Parents or in-laws in same house	-0.051**	(0.020)	0.037	(0.047)
Small community	-0.040**	(0.016)	-0.014	(0.038)
Large community	0.046**	(0.019)	0.056	(0.044)
in East Germany	-0.067	(0.044)	0.314***	(0.119)
Children 0-2			-1.117***	(0.056)
Tenure in firm	0.016***	(0.001)		
Constant	1.897***	(0.047)	0.061	(0.083)
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 age 3 and older living in West Germany, with education level 1 or 2 (ISCED: 0-4) in 1991, in a medium-sized West German town in North Rhine-Westphalia , far from parents or in-laws. Regressions include age group, state, and year dummies.

Table A.11: Proximity to grandparents and hourly wages
Coefficients of Heckman Selection Model for low educated mothers' log hourly wages

	Log hourly wage		Selection Equation	
	(1)		(2)	
Married, living together	-0.002	(0.019)	-0.341***	(0.051)
Other than German nationality	-0.207**	(0.090)	-0.435***	(0.155)
Number of children	-0.038***	(0.012)	-0.290***	(0.020)
Parents or in-laws close	-0.042**	(0.017)	0.059	(0.038)
Parents or in-laws in same house	-0.038	(0.024)	0.035	(0.054)
Small community	-0.043**	(0.020)	-0.013	(0.044)
Large community	0.042*	(0.022)	0.048	(0.050)
in East Germany	-0.135***	(0.048)	0.477***	(0.117)
Children 0-2			-1.102***	(0.070)
Log (Spouse's income)†			0.018***	(0.006)
Tenure in firm	0.017***	(0.001)		
Constant	1.895***	(0.055)	0.190*	(0.097)
Observations	6,035		6,035	

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 with primary pr secondary education. Reference group: mothers of age 25-29 of children age 3 and older living in West Germany, with education level 1 or 2 (ISCED: 0-4) in 1991, in a medium-sized West German town in North Rhine-Westphalia , far from parents or in-laws. Regressions include dummies for age groups, states and years.

Table A.12: Proximity to grandparents and hourly wages
Coefficients of Heckman Selection Model for high educated mothers' log hourly wages

	Log hourly wage		Selection Equation	
	(1)		(2)	
Married, living together	-0.015	(0.028)	-0.286***	(0.095)
Number of children	-0.026	(0.016)	-0.265***	(0.038)
Other than German nationality	0.089	(0.148)	0.220	(0.353)
Parents or in-laws close	-0.066***	(0.024)	0.090	(0.068)
Parents or in-laws in same house	-0.069*	(0.038)	0.159	(0.107)
Small community	-0.038	(0.030)	-0.029	(0.084)
Large community	0.047	(0.033)	0.042	(0.091)
in East Germany	-0.146**	(0.064)	0.307*	(0.174)
Children 0-2			-1.095***	(0.098)
Log (Spouse's income)†			0.007	(0.011)
Tenure in firm	0.013***	(0.002)		
Constant	2.266***	(0.088)	0.679***	(0.208)
Observations	2,094		2,094	

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, with tertiary education. Reference group: mothers of age 25-29 with children age 3 and older living in West Germany, with education level 3 (ISCED: 5-6) in 1991, in a medium-sized West German town in North Rhine-Westphalia, far from parents or in-laws. Regressions include age group, state, and year dummies.

Table A.13: Grandparent-provided child care and commutes
Marginal effects from Probit Estimation for mothers without variable posing a possible endogeneity problem: Children in non-relative care

	Commuter	
Married, living together	0.006	(0.055)
Number of children	0.053	(0.033)
Other than German nationality	-0.278**	(0.127)
Children 0-2	-0.024	(0.060)
Log (Spouse's income)†	-0.003	(0.011)
Tertiary education (ISCED: 5,6)	0.126**	(0.051)
Tenure in firm	0.004	(0.004)
Children cared for by relatives	0.088*	(0.048)
Small community	0.263***	(0.055)
Large community	-0.213***	(0.065)
in East Germany	-0.228*	(0.135)
Observations	537	

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Data: GSOEP unbalanced panel 01, 06; mothers 25-50 of children <= 6 with regular full or part time job. Regression includes year, state, and age group dummies. Reference group: unmarried mothers age 25-29 in 1997 living in West Germany, in North Rhine-Westphalia with education level 1 or 2 (ISCED:0-4) in 1991, in a medium-sized town in 2001, far from parents or in-laws, with children who are not cared for by relatives.

Table A.14: Grandparent-provided child care and commutes
Marginal effects from Probit Estimation for
(1) low educated and (2) high educated mothers

	Commuter		Commuter	
	(1)		(2)	
Married, living together	0.003	(0.071)	0.015	(0.095)
Number of children	0.057	(0.042)	0.022	(0.056)
Other than German nationality	-0.438***	(0.108)	-0.016	(0.217)
Children 0-2	-0.148*	(0.086)	0.125	(0.093)
Log (Spouse's income)†	-0.019	(0.015)	0.019	(0.018)
Tenure in firm	0.008	(0.005)	-0.000	(0.008)
Children cared for by relatives	0.097	(0.061)	0.106	(0.088)
Children in non-relative care	0.017	(0.086)	-0.098	(0.133)
Small community	0.268***	(0.068)	0.260**	(0.106)
Large community	-0.222***	(0.082)	-0.264**	(0.119)
in East Germany	-0.280*	(0.156)	0.125	(0.232)
Observations	352		183	

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Data: GSOEP unbalanced panel 01, 06; mothers 25-50 of children <= 6 with regular full or part time job. Regressions include year, state, and age group dummies. Reference group: unmarried mothers age 25-29 in 2001 living in West Germany, in North Rhine-Westphalia 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.