[Preliminary and Incomplete. Please Do Not Circulate]: Kids and (or) Career? Family Policies' Effects on Women's Life Cycle Fertility and Labor Supply

Hanna Wang*

University of Pennsylvania

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Abstract

In this paper I investigate the effectiveness of a range of family policies in mitigating the costs of children for women to promote higher fertility and female employment. The policies I consider are paid and unpaid parental leave, childcare subsidies and per-child subsidies. I present reduced-form results on the impact on child-care costs and parental leave pay on employment and fertility and show that wages depend crucially on when the woman returns back to work after childbirth. I develop a dynamic discrete choice model of fertility and full- and part-time work with human capital accumulation. The model is estimated using German household survey data and administrative employment data by simulated method of moments. I use the model to evaluate the effectiveness of existing policy and to explore the design of counterfactual policy combinations based on and their impact on women of different education levels and marital status.

1 Introduction

Despite large improvements in women?s career opportunities, having children still puts women at a significant disadvantage. Childbirth and childcare lead to reductions in women?s

*hannaw@sas.upenn.edu

work hours that result in losses in wages and wage growth, and have been identified as the main contributor to the gender pay gap. Moreover, the cost of children is reflected in the decline in birth rates in many developed countries, which, with a rise in life expectancy, cause population aging and put a strain on social security systems. To address these issues, many countries formulated a range of family policies. Childcare subsidies, paid and unpaid parental leave, and direct per-child subsidies are common policies adopted by most European countries, as well as Japan and Canada. Recently, there has been a global trend to expand the generosity of such policies.[1]

Since fertility and labor supply are inherently of dynamic nature, family policies have important implications for women's choices over the life cycle, e.g. by affecting the timing and number births, the length of maternity leave and part-time work for mothers. Understanding precisely the dynamic incentives determined by women's preferences and the underlying human capital and wage processes is crucial to evaluate their effect, and to design better policies. Progress in the reconciliation of motherhood and career can be important for spurring economic growth, by boosting current and future labor supply. This paper aims to illuminate this issue by estimating a structural model of fertility, female labor supply and human capital and provide a comprehensive analysis of different employment and fertility policies and their interaction. In particular, to capture the differential effects of work hours on women with different educational backgrounds, I allow human capital and wages to depend flexibly on education as well as part-time and full-time work. A common observation is that especially women with college education and those in leadership positions tend to have fewer children. It has also been documented that taking leave and working part-time decreases wages more heavily for higher earning jobs and industries. This suggests that women from different educational backgrounds face very different trade-offs and understanding this is necessary for targeting specific groups. High-education women might wish to resume employment shortly after childbirth because they face larger penalties and hence benefit most from low-cost childcare, while other women with low earnings might prefer direct financial compensation to offset child related costs.

For the estimation I combine survey and administrative data from Germany on women from the cohort 1965-1985. Germany has the policies mentioned above in place and there is substantial variation across time and regions, which I will exploit for identification. In particular, a parental leave reform in 2007 has significantly increased the average amount paid, while also shortening the eligible period from two to one year after childbirth. Fur-

[1]Several US states recently passed laws mandating paid parental leave, including New York and Washington. Canada has passed universal childcare laws. Austria has expanded its parental leave span.

thermore the amount paid was made contingent on previous wages, heavily favoring high income women. Since 2005 Germany has also expanded its public childcare, with a large increase in new childcare spots for small children below the age of three. This effectively lowers (expected) childcare cost and acts as a subsidy for working mothers.

While a growing number of papers attempt to evaluate the effect of different family policies, only a few analyze the joint effects on dynamic fertility and female labor supply. Closely-related is a paper by Gayle and Miller (2012), who estimate a model using CCP and evaluate a range of counterfactual policies including the ones considered here except for unpaid maternity leave (job protection). Using PSID data they find sizeable increases in fertility and modest effects on labor supply. Yamaguchi (2016) examines the effects of paid and unpaid parental leave in the case of Japan and in contrast finds little to no effects on fertility and only small effects on labor supply, perhaps due to low take up rates in Japan. Haan and Wrohlich (2014) employ both a reduced-form and a structural model to study the effects of the recent policy changes in Germany on female labor supply. In line with the financial incentives given by the policy, they find an increase in parental leave take-up in the first year and a decrease for the second year after childbirth. They attribute a large portion of the increase in employment of mothers of small children to the changes of childcare as opposed to parental leave. Adda et al. (2016) and Bronson (2013)[2] estimate models of women's career selection into family-friendly tracks and examine family policies as part of their counterfactual analysis.

A range of reduced-form papers study the effects of policies in Germany. Kluve and Tamm (2013) and Schönberg and Ludsteck (2014) find small employment effects while Raute (2014) and Cygan-Rehm, K. (2013) find positive effects on fertility. Furthermore there are papers studying family policies in various countries, e.g. Lalive and Zweimüller (2009), Lalive et al (2013) for Austria; Lefebvre and Merrigan (2008) for Canada, Laroque and Salanie (2014) for France. Most find significant effects on fertility and labor supply, although results only hold for the short term.

In the following section I give an overview of fertility and female employment in Germany and explain existing family policies in more detail. Section 3 summarizes the data and the model is outlined in Section 4. Section 5 discusses estimation and results are presented in Section 6.

[2]Bronson does not allow for endogenous fertility

2 Background

German families typically depend on a "male breadwinner", so male employment is high at above 90%. Although female employment has steadily increased over the last decades to above 70%, this is predominantly driven by part-time take-up. Nearly half of all women work part-time and it is especially common for mothers with young children.

German women have 1.5 children on average with more highly educated women having fewer children. Roughly 20% of all women remain childless, for women with a college degree the fraction is as high as 28%. Higher education also correlates with older age at first birth, the average is around 29. The low level of employment among mothers and alarmingly low fertility rate are part of the reason of the existence of generous child-related subsidies.

Germany has a publicly funded parental leave system which cost over 5 billion Euro in 2015, roughly 2.5% of total public expenditure. It is roughly comparable to the one in Scandinavian countries and perhaps slightly more generous than the one in other European countries such as France, Italy and Spain. New mothers enjoy job protection for three years after childbirth and are guaranteed 14 weeks of fully paid leave starting 6 weeks prior to the expected delivery date, the cost of which is paid by the employer and health insurance provider. As a matter of fact, women are not allowed to work for 8 weeks following childbirth and almost all women take leave for at least the 14 weeks. On average women are on leave for slightly less than two years and this has only decreased slightly since the reform.

Parents who work less than 30 hours are eligible for paid leave. Prior to 2007 a fixed benefit of 300 Euros per month was granted to all parents for up to two years. The reform shortened the duration of pay to one year and made the amount contingent on pre-birth earnings. The new policy replaces two thirds of net wages with a lower and upper cap of 300 and 1800 Euros per month respectively. The minimum amount applies to parents with low prior wages or who were out of the labor force before the child was born. For these parents the reform only reduced the length of paid leave. However, for the majority of working parents, the amount paid in the first year increased significantly. A parent with monthly earnings of 2000 Euros, which lies just above the mean, is paid 1300 Euros under the new policy, 1000 Euros more than before the reform. For parents working part-time under the new policy only the difference between pre-birth and current earnings is replaced at the rate of 66.7%, while under the old policy the pay would remain unchanged by part-time work.

Parents are free to divide the time among themselves. In practice, however, the take-

up of fathers tends to be modest, until 2007 the rate was below 3%. After the reform the proportion gradually rose to 30%, most likely due to another new feature of the policy designed to encourage paternal involvement in childcare, so-called "daddy-months". Parents are granted two more months of paid leave if each of them takes at least two months. The overall impact is not very large since the vast majority of households responding to this incentive have the father taking exactly two months of leave, oftentimes at the same time as the mother. For the purpose of this paper I ignore paternal leave taking.

Another important development that is relevant to mothers' labor supply is the expansion of childcare since 2005, particularly for small children under the age of three. Prior to this, childcare enrollment has been very low for this age group, especially in West Germany, with many parents staying home longer than intended or working part-time because no free spots were available. Within 7 years, from 2006-2013, enrollment rates have nearly doubled from 16% to 30%.

Childcare policy is determined regionally and there is substantial variation. The majority of childcare services offered are heavily subsidized, so that parents pay an average monthly fee of roughly 100 Euros, whereby fees are progressive in parents' income. The cost to government is substantial, for children under three years each childcare spot is estimated to cost around 1000 Euros.

In addition to the two previous family policies, Germany also offers unpaid parental leave and fixed per-child subsidies to parents. Job protection is offered for up to 3 years after childbirth, so the woman can return to her previous employer at the unchanged conditions if she wishes. Indeed many women return to work before the protection period is over. In particular I observe that many women who do not do so, have to switch employers.

The amount of per-child subsidies is contingent on the child's age and is paid until the child turns 18. The amount is adjusted over time, ranging from 150 to 200 Euros per month. It is interesting to note that the amount is not equal for each child, but is weakly increasing in the order, e.g. the benefit for the third child is higher than for the first.

3 Data and Reduced-Form Analysis

I use household data from the German Socio-Economic Panel (GSOEP), a detailed on-going annual household survey conducted by the German Institute for Economic Research

(DIW). The survey first started in 1984 and comprises responses from over 12,000 households annually. Individual information on education, work experience, employment status including parental leave and wage income is obtained from each adult member. Employment is recorded monthly which makes it possible to precisely determine leave-taking. Furthermore, there is information for the household on the number and age of children in the household, receipt of public transfers and use of child care.

Wage and employment data comes from a large administrative dataset, the Sample of Integrated Labor Market Biographies (SIAB), provided by the Institute for Employment Research (IAB) at the German Federal Employment Agency. This dataset is a 2% random sample from all individuals in Germany who pay into social security, receive unemployment benefits according to the German Social Code or are marginally employed. In other words, individuals are unobserved are when self-employed and out of labor force including parental leave. The data provides precise information to the day on transitions in and out of employment as well as employment interruptions and their causes. Job information includes wage, occupation and whether the position is full-time, part-time or marginal part-time. Worker characteristics are limited to secondary and tertiary education, vocational training and year of birth. In particular, neither marital status nor the number of children are observed. A further complication is that births and maternity leave are not explicitly listed, however using imputation strategies similar to Schnberg (2009) leave be identified with 85%-92% certainty. This method involves imposing a series of restrictions on the woman's age and duration of absence among others before classifying a gap in the data as potential birth or maternity leave.

The Federal Statistical Office and the statistical offices of the individual Länder provide information on the availability and cost of childcare by geographical region. Information on the probability of successfully conceiving a child by mother's age will come from an external source. I furthermore make use of health data on women's fertility by age. Fertility rapidly declines after the age of 35 reaching zero at 45.

In my sample I include married women from the birth cohort 1965 to 1985, between the ages of 22 to 45. I require women to have been married for at least two years and to have had no children prior to the age of 22. I divide the women into three education groups based on years of education obtained (fewer than 11. 5, 11.5 to 13.5 and more than 13.5). The final sample comprises of 300 to 2000 women in each age-education group that have average completed fertility at about 1.5. Summary statistics are given in Table 1 for the SOEP sample.

	Mean	Std. Dev.	Min.	Max.
Years of Obs. Per Woman	15.457	5.760	2	26
No. of Obs per Yr.	3601.542	1308.782	1186	5272
Age	32.314	5.815	22	45
No. of Children at 45	1.544	.919	0	3

No. of Obs.	88798
No. of Women	6942

Table 1: Summary Statistics

Table 2 further shows some characteristics by education and age. Each education group roughly has 2000 women, with the second group, which is approximately equivalent to graduating high school or completing an apprenticeship, being the largest. The higher the education level the longer women delay their fertility, while all three groups have a similar completed fertility. As expected wages increase in education with differences becoming larger for older women. Women in the two higher education groups work about 10% more full-time compare to the lower education group. The part-time share is similar across groups with the most highly educated women working part-time the least.

To get a better understanding of how women's choices depend on their characteristics I estimate logit models for the decision to work full- and part-time as well as to have children. The choice of explanatory variables mirrors the state variables in the dynamic model. The results are shown in Table 3. The presence of children reduce the likelihood of full-time work with the effect decreasing in the order of the child. The first child significantly increases the likelihood of part-time work while the third child decreases it, suggesting that children discourage women from working but also cause them to substitute from full-time to part-time. Higher education and experience levels tend to increase full-time employment, while the effect on part-time is ambiguous. Women tend to have more children when more educated, however fewer children when they have more experience. The latter can be explained by higher opportunity cost, the former could arise due to selecting married women for the sample and marriage being more highly correlated with children for women with higher education. The coefficients for the reform indicator in the full-time and fertility logit regression are significant at the 5% level and are positive and negative in the respective cases.

A second set of logit regressions including indicators for age of the youngest child (see Table 4) and the reform reveals that mothers of young children are less likely to work full-

	e=1	e=2	e=3
No. of Women	1925	2819	2198
Yrs of Education	9.450	11.880	16.021
	(2.238)	(.565)	(1.531)
Age at First Birth	26.203	27.602	30.001
	(3.655)	(3.800)	(4.049)
No. of Children			
Age 25	.690	.542	.322
	(.700)	(0.666)	(.582)
Age 35	1.454	1.368	1.237
	(.925)	(.875)	(.936)
Age 45	1.595	1.502	1.571
	(.941)	(.895)	(.940)
Hourly Wage			
Age 25	8.436	9.784	9.832
	(6.059)	(9.812)	(10.274)
Age 35	10.626	12.934	17.795
	(6.059)	(9.812)	(10.274)
Age 45	12.136	14.104	19.428
	(15.519)	(8.729)	(8.487)
Life-time FT share	.241	.357	.379
	(.427)	(.479)	(.485)
Life-time PT share	.292	.320	.283
	(.455)	(.466)	(.451)
Husband's Earnings	30439.98	35589.36	46813.41
	(22105.66)	(23768.44)	(36049.97)

Table 2: Statistics by Education Group

time with the effect decreasing in the youngest child's age. Note, the reform has a positive effect on full-time employment except for the period in which the child is born, which is consistent with the financial incentives. However, it seems that mothers are not only more likely to work full-time once the parental leave pay period is over, but also for all following periods. The presence of young children decreases the odds of working part-time up to age three. The reform caused a further decrease for children up to one year old.

Table 3: Logit Regression

	(1) ft	(2) pt	(3) fert
main			
k1	−2.290***	0.729***	
	(−61.86)	(20.40)	
k2	−0.921***	0.0970**	
	(−20.51)	(3.23)	
k3	−0.533***	−0.453***	
	(−6.80)	(−10.89)	
age	−0.112***	0.0727***	−0.0747***
	(−26.28)	(22.42)	(−18.48)
refind	0.125*	−0.0393	−0.123*
	(2.44)	(−0.91)	(−2.21)
syear	−0.0334***	0.0443***	0.0137**
	(−8.50)	(11.11)	(3.19)
e2	0.562***	0.0658*	0.147***
	(15.33)	(2.18)	(3.51)
e3	0.982***	−0.222***	0.351***
	(23.58)	(−6.50)	(7.97)
fpexp	0.389***	0.00494	−0.0842***
	(56.83)	(1.42)	(−12.90)
Constant	69.03***	−92.52***	−27.13**
	(8.86)	(−11.66)	(−3.19)
Observations	88026	88026	88798

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The effect of children on employment also has important implications for wages. As can be seen from the wage regression results in Table 5 taking time off following childbirth

Table 4: Logit Regression, Indicators For 5 Years After Birth

	(1) ft	(2) pt
Other State Variables	Yes	Yes
ychind0	−1.038***	−1.937***
	(−14.92)	(−22.92)
ychind0post	−0.473***	−0.661***
	(−4.32)	(−4.89)
ychind1	−1.396***	−0.857***
	(−17.92)	(−13.06)
ychind1post	0.605***	−0.192*
	(5.10)	(−2.19)
ychind2	−1.122***	−0.403***
	(−14.02)	(−6.12)
ychind2post	0.548***	−0.000515
	(4.92)	(−0.01)
ychind3	−0.782***	−0.0766
	(−9.58)	(−1.13)
ychind3post	0.425***	−0.0109
	(3.73)	(−0.12)
ychind4	−0.605***	0.0532
	(−6.81)	(0.73)
ychind4post	0.339**	0.00792
	(2.80)	(0.08)
ychind5	−0.550***	0.109
	(−5.76)	(1.41)
ychind5post	0.363**	0.0145
	(2.68)	(0.14)
Constant	70.95***	−104.0***
	(10.57)	(−14.90)
Observations	88026	88026

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

has significant negative effect on wages. Each additional year of leave decreases wages by approximately 1.6 dollars. Controlling for education and experience decreases the magnitude of the effect slightly.

Table 5: Wage Regression

	(1) hwages2	(2) hwages2
ychildage	-1.648^{***}	-1.534^{***}
	(-9.25)	(-8.53)
per	0.707^{***}	0.596^{***}
	(10.43)	(8.00)
ed		1.705^{***}
		(4.27)
fpexp		0.126
		(1.26)
Constant	9.964^{***}	6.735^{***}
	(9.99)	(5.45)
Observations	1503	1503

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4 Structural Model

4.1 Model Set-up

The model begins when the woman is 22 and in line with biological facts women have positive probability of conception up to the age of 45. Although the analysis focuses on the woman's fertile years, in order to derive obtain realistic terminal values at age 45 that depend on the women's prior choices, I let model run up to age 61 and assume all children leave the household once the youngest turns 24. I allow women to have up to three kids and assume the husband always works. Let t denote the woman's age and i the household.

4.2 Choices

Each period the woman chooses whether to attempt to conceive a child and whether to work full-time, part-time or not at all. I denote choice variables as $q_t^i = \{f_t^i, l_t^i\}$.

If the woman tries to conceive f_t^i takes value equal to 1 with an age-dependent probability. In this case a child is born immediately. The employment choice is denoted by $l_t^i = (l_t^{iF}, l_t^{iP})$, where the first entry stands for full-time and the second for part-time work, the sum of the two can take a maximum value of 1. If the woman worked in the previous period or is under job protection after having given birth, she can returns to her previous employer with certainty. If however, this does not apply, she can only find new employment with probability $P < 1$. This probability is modeled using logit:

$$log(\frac{P}{1-P}) = \theta_0 t + \sum_{e=1}^{3} \theta_2^e edu_e^i$$

Depending on eligibility the woman might receive parental leave payments if she does not work full-time. Furthermore, the woman pays for childcare if she works, whereby the cost is half as large for part-time compared to full-time work. Following not working for at least one period, I assume the women is out of the labor force and can only find a new job with a probability less than one. This probability varies by age and education group. However, if unpaid maternity leave is granted, the women can return to work with certainty.

4.3 Preference

Household utility in period t excluding shocks is given by:

$$u_t^i(l_t^i, c_t^i, \{k_j^i\}_{j=1}^3, a_t^i)$$

$$= \underbrace{\alpha_1 c_t^i + \sum_j \alpha_{2j}^{t_i} k_j^i}_{\text{Utility from consumption and children}} \underbrace{- (l_t^{ifF} + 0.5 l_t^{ifP})(\gamma_1 + \sum_j (\gamma_{2j} + \gamma_3 l_t^{iF}) k_j^i + \gamma_4 a_t^i)}_{\text{Disutility from work}}$$

$\{k_j^i\}_{j=1}^3$ are indicators for the presence of the first to third child. The disutility of work depends on how much the individual works, how many children live in the household and the age of the youngest child a_t^i. Furthermore, γ_3 captures a differential effect of working full-time vs. part-time on utility when there are children in the household. There is preference

heterogeneity for children and productivity as we will see below, this is captured by two types $t_i \in \{0, 1\}$.

There are two fertility shocks $\epsilon_t^{if} = \{\epsilon_t^{if1}, \epsilon_t^{if0}\}$ for whether to try to conceive a child or not and three labor shocks $\epsilon_t^{il} = \{\epsilon^{ilF}, \epsilon^{ilP}, \epsilon^{il0}\}$, one per every employment option. All shocks are type I extreme value. This allows me to partially express expected utility in analytic form.

Define the period utility for labor choice k and fertility choice j including shocks to be:

$$U_t^{ifFP}(f_t^i, l_t^i, c_t^i; n_t^i, a_t^{in}, \epsilon_t^{ilFP}, \epsilon_t^{iff}) = u_t^i(f_t^i, l_t^i, c_t^i; n_t^i, a_t^{in}) + \epsilon_t^{ilFP} + \epsilon_t^{iff}$$

4.4 Budget Constraint

Total consumption expenditure is denoted by C^i and a function of the couple's consumption and the expenditure on each child:

$$C_t^i = c_t^i + \sum_j \chi_j k_j$$

It increases when the household has more children but at a decreasing rate. I assume the couple consumes their full income net of expenses in each period.

The budget constraint in period t is given by:

$$\sum_j s_j k_j^i + y_t^{if} + y_t^{im} + PL_t^i(a_t^{in}, y_t^b) = C_t^i + (1 - l_t^{iF} - 0.5l^{iP})\zeta(n_t^i, \{a_t^{ik}\}, y_t^{if}, y_t^{im}, loc_t^i)$$

where y_t^{if} and y_t^{im} denote the woman and man's income, $\{s_j\}_{j=1}^3$ represents the schedule of per-child subsidies, and ζ represents childcare costs which depends on the number and age of children, family income and geographic location loc_t^i. PL_t^i is the amount of parental leave. If the woman does not work full-time and is eligible for parental leave pay I assume she automatically receives it. Before the reform PL_t^i takes value 300 if the youngest child is less than two years old and the mother does not work full-time. After the reform PL_t^i takes values $max(300, 0.67y_t^b)$ if the youngest child is less than one year old and the mother does not work full-time, where y_t^b denotes the mother's pre-birth wage. y_t^b is equal to y_{t-1}^{if} if the women and was not on maternity leave last period. If she was on maternity leave then $y_t^b = y_{t-1}^b$.

The woman's labor income is $y_t^{if} = w_t^i(l_t^{iF} + 0.5l_t^{iP})$, and the wage w_t^i is given by

$$ln(w_t^i) = \phi_0^{t_i} + \phi_1 exp_t^i + \phi_2 (exp_t^i)^2 + \sum_e (\phi_3^e edu_e^i + \phi_4^e edu_e^i exp_t^i) + \xi_t^{if}$$

Education indicators for group 2 and 3 are $\{edu_e^i\}_{e=1,2,3}$. Human capital is denoted exp_t^i and evolves according to

$$exp_{t+1}^{ig} = exp_t^{ig} + l_t^{igF}(\sum_e \lambda_1^e edu_e^i) + l_t^{igP}(\sum_e \lambda_2^e edu_e^i) - \delta(1 - l_t^{igF} - \lambda_3 l_t^{igP})$$

The last term captures depreciation of human capital. Part-time work has a different effect than full-time work and women of different education levels have different human capital processes.

The husband's income is modeled as function of the woman's age and education:

$$y_t^{im} = \rho_0 + \rho_1 t + \rho_2 t^2 + \rho_3 edu_t^i + \rho_4 edu_t^i t + \xi_t^{im}$$

The woman's wage and the husband's income are subject to jointly normally distributed shocks $\xi_t^i = \xi_t^{if}, \xi_t^{im}$.

4.5 Household Problem

The timing is as follows. Households observe fertility shocks at the beginning of the period and make a decision whether or not to attempt to have a child. If they try to have a child, the couple immediately learns whether the attempt will be successful. The couple then observes labor preference shocks as well as wage and income shocks and chooses whether and how much the woman should work. Given labor income of wife and husband, per-child subsidies and parental leave pay the couple pays for childcare expenses and consumes the rest the budget.

Denote state variables at beginning of period t as $\Omega_t^i = \{n_t^i, \{a_t^{ik}\}_{k\leq 3}, exp_t^i, edu_t^i, loc_t^i, y_t^b\}$ and let $V(\Omega_t)$ and $V'(\Omega_t, f_t^i, \epsilon_t^{if})$ denote life-time utility at the beginning of the period and after the fertility choice was made and the remaining preference, wage and income shocks were realized respectively.

The household, given that the woman can conceive this period, first chooses f_t^i to maximise

$$V(\Omega_t) = E_{\epsilon_t^{il},\xi_t^i} V'(\Omega_t, f_t^i, \epsilon_t^{if})$$

If the woman cannot conceive this period the household gets

$$V(\Omega_t, f_t = 0) = E_{\epsilon_t^{il},\xi_t^i} V'(\Omega_t, 0, \epsilon_t^{if})$$

Once the fertility decision is realized, if the woman can continue her employment or finds a new employer, the woman chooses l_t^i to maximize

$$V'(\Omega_t, f_t^i, \epsilon_t^{if}) = U_t^i(q_t^i; \{k_t^{ij}\}_{j=1}^3, \{a_t^{ik}\}, \epsilon_t^{iff}\epsilon_t^{ilFP} + \beta E_{\epsilon_{t+1}^{if}} V_{t+1}(\Omega_{t+1}|q_t^i, \Omega_t^i)$$

such that the period budget constraint is satisfied, given some discount factor $\beta < 0$.

If the woman didn't work in the previous period, does not have job protection and does not succeed in getting a job offer, she remains unemployed for this period and gets

$$V'(\Omega_t, f_t^i, (l_t^{Fi}, l_t^{Pi} = 0), \epsilon_t^{if}) = U_t^i(f_t^i, (l_t^{Fi}, l_t^{Pi} = 0); \{k_t^{ij}\}_{j=1}^3, \{a_t^{ik}\}, \epsilon_t^{iff}\epsilon_t^{ilFP})$$

$$+\beta E_{\epsilon_{t+1}^{if}} V_{t+1}(\Omega_{t+1}|f_t^i, (l_t^{Fi}, l_t^{Pi} = 0)\Omega_t^i)$$

Next period's state variables will evolve depending on the choices taken in the current period. In particular, the woman's job protection eligibility is determined her status today, her current employment and whether she has young kids. Human capital will either grow or depreciate and the woman and her children will age by one year.

5 Estimation Results

I estimate the model using simulated method of moments (SMM) as first described by McFadden (1989). This allows me to make use of both data sets which is advantageous compared to only using the GSOEP, since the large size of the SIAB will enable me to estimate wage processes and accumulation of experience with part-time and full time work more reliably. Moments concerning employment, such as wage equations and proportion of women in full-time/ part-time employment will primarily come from the SIAB, while the GSOEP will provide moments relating to fertility, such as number and spacing of children.

Compared to estimation using maximum likelihood the results of MSM can be sensitive to the set of moments chosen, hence it will be necessary to carefully choose a sufficient number and run a robustness checks.

For a given set of parameters the model is solved backwards and life-time choices are simulated for a sample of households. Then the moments are formed using the simulated data and compared to the moments calculated from the actual data. Since the state space contains continuous variables y_t^b and exp_t it is necessary to discretize the state space and use interpolation in as described in Keane and Wolpin (1994).

Moments chosen for the current version of the model are the following by education group for the ages 25, 32 and 42: Proportion of women by number of kids, wages, husband's income, part-time and full-time employment rates. Furthermore, the full- and part-time rates for the three education groups one, two and three years after childbirth are matched. Table 6 lists all moments included in the current estimation using only the SOEP. The final estimation will include employment and wage moments from the SIAB, in particular I will run include coefficients from wage regressions as moments. Some moments will be selected that capture the wage penalty depending on the duration of leave and part-time vs full-time.

Another set of moments to be included are differences in employment rates of mothers prior and after the parental leave reform. For this I let different women experience the unanticipated reform at different ages in my simulation.

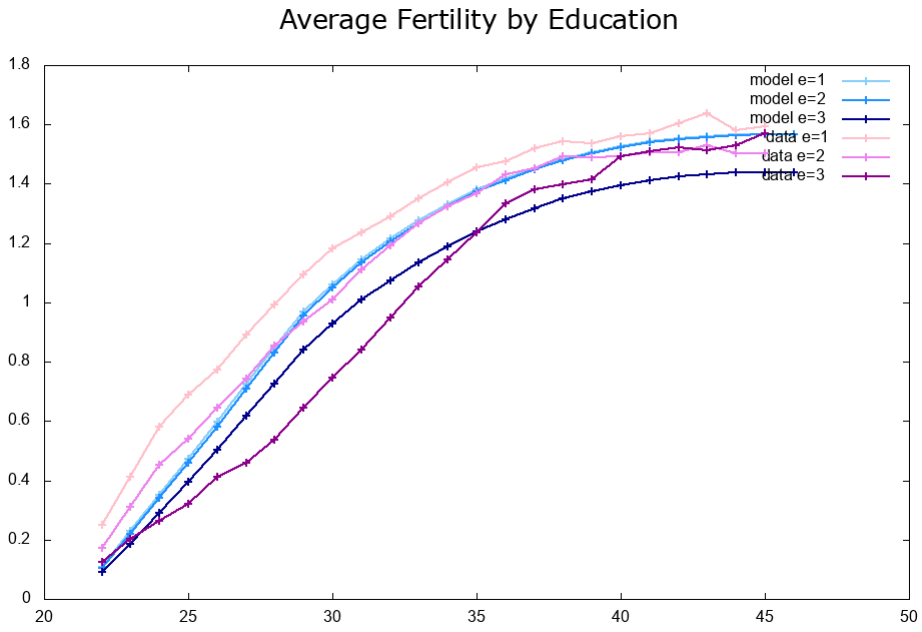
In this section I present graphs illustrating the model fit using parameter specifications from current estimation results using only SOEP data. The model is able to fit most moments relatively accurately.

5.1 Fertility by education

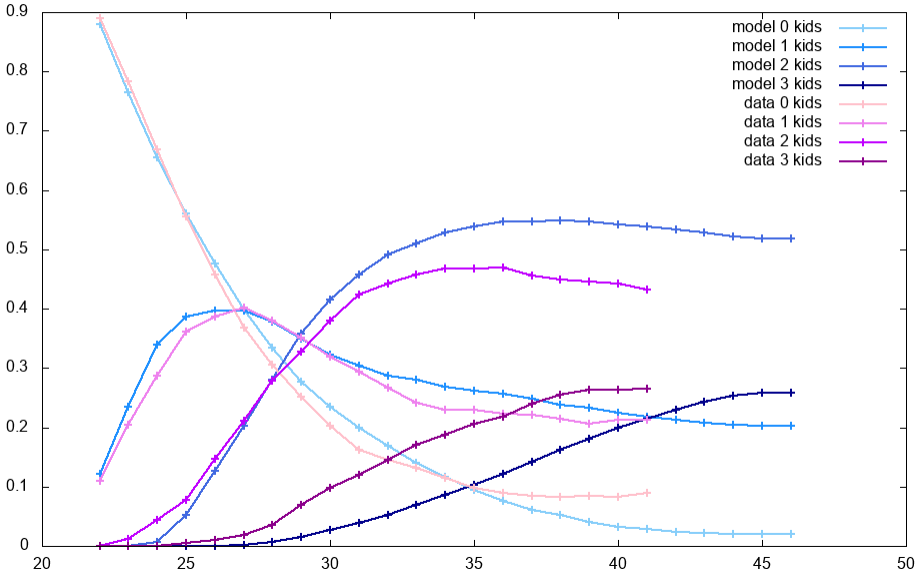
Fertility increases slower with age the higher the education level with only very few women having kids pas the age of 45. The model performs best with the second education group.

	By Education	By Ages	Number
Employment and Wages			
Full-time Rate	Yes	Yes	9
Part-time Rate	Yes	Yes	9
Wages	Yes	Yes	9
Wages Equation	-	-	7
Fertility			
Prop. With One Child	Yes	Yes	9
Prop. With Two Children	Yes	Yes	9
Prop. With Three Children	Yes	Yes	9
Employment after Birth			
Full-time Rate One Year After	Yes	Yes (over/under 32)	6
Full-time Rate Two Years After	Yes	Yes (over/under 32)	6
Full-time Rate Three Years After	Yes	Yes (over/under 32)	6
Part-time Rate One Year After	Yes	Yes (over/under 32)	6
Part-time Rate Two Years After	Yes	Yes (over/under 32)	6
Part-time Rate Three Years After	Yes	Yes (over/under 32)	6
Total			98

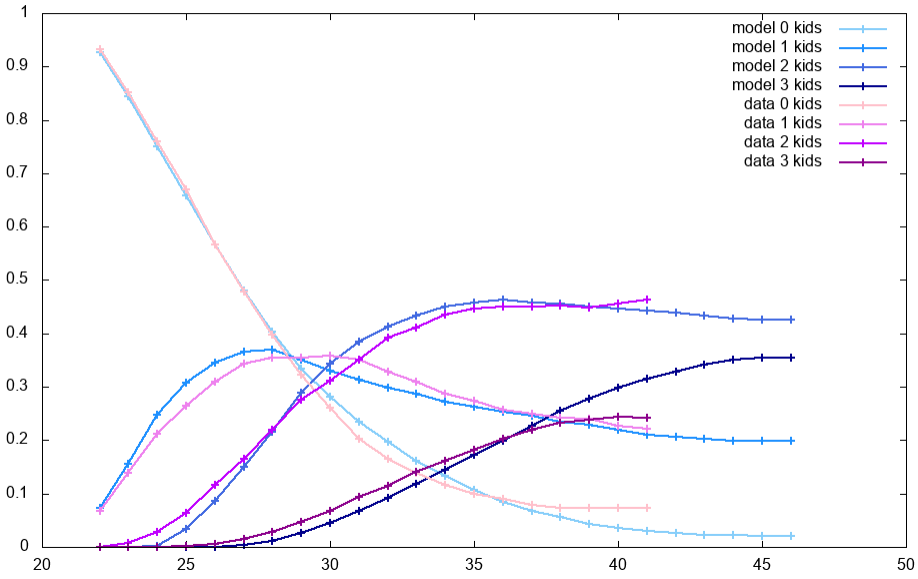
Table 6: Moments

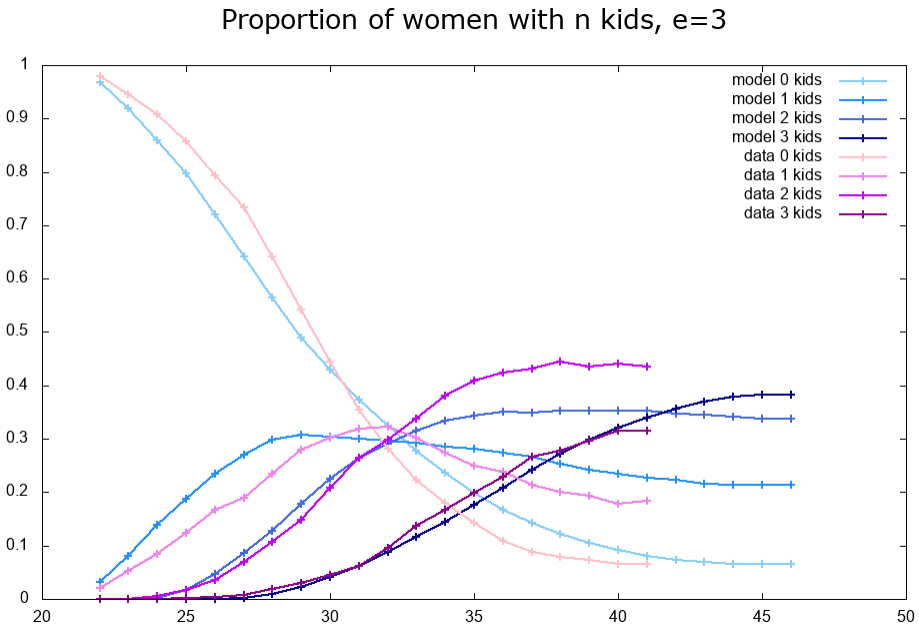


Proportion of women with n kids, e=1



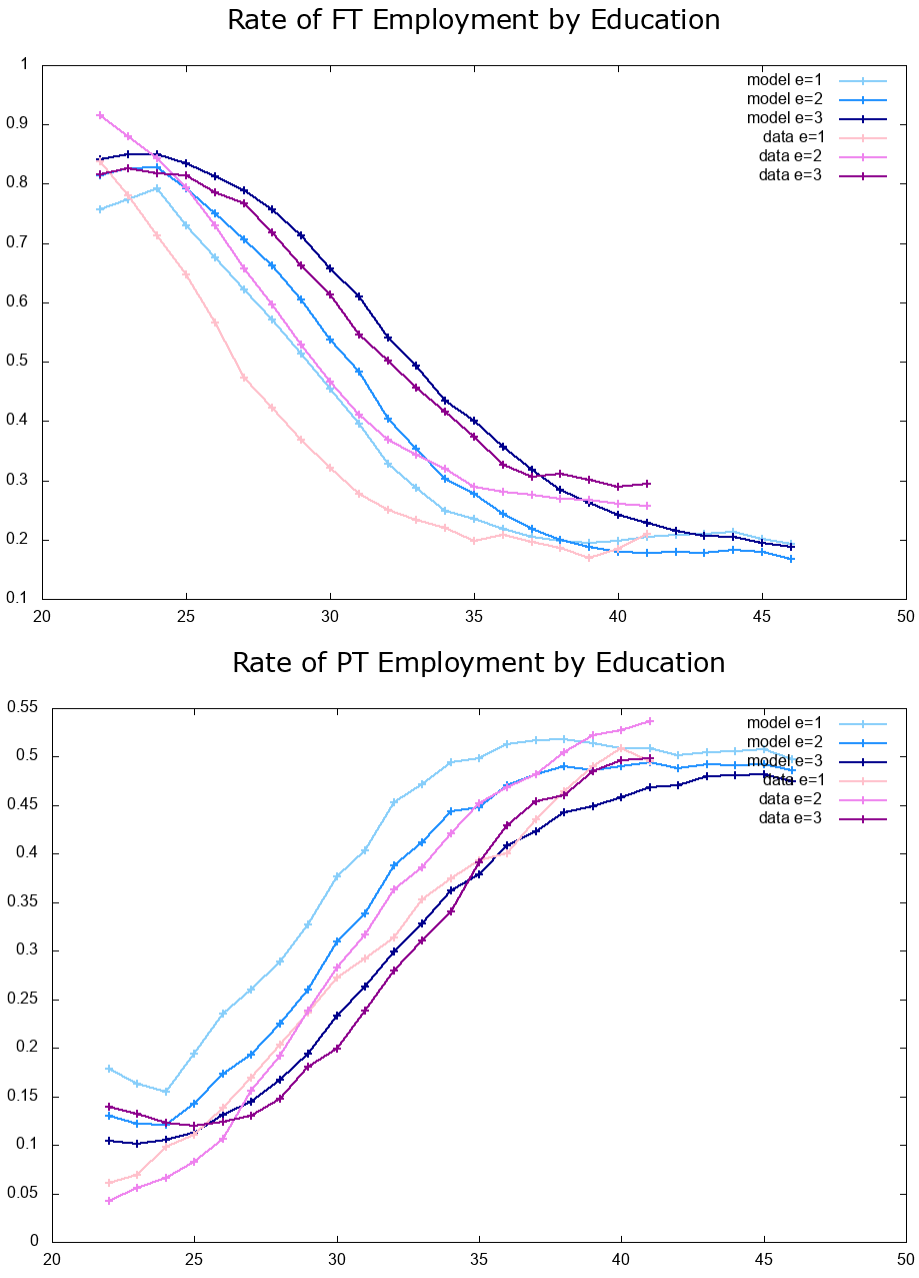
Proportion of women with n kids, e=2





5.2 Employment by Education

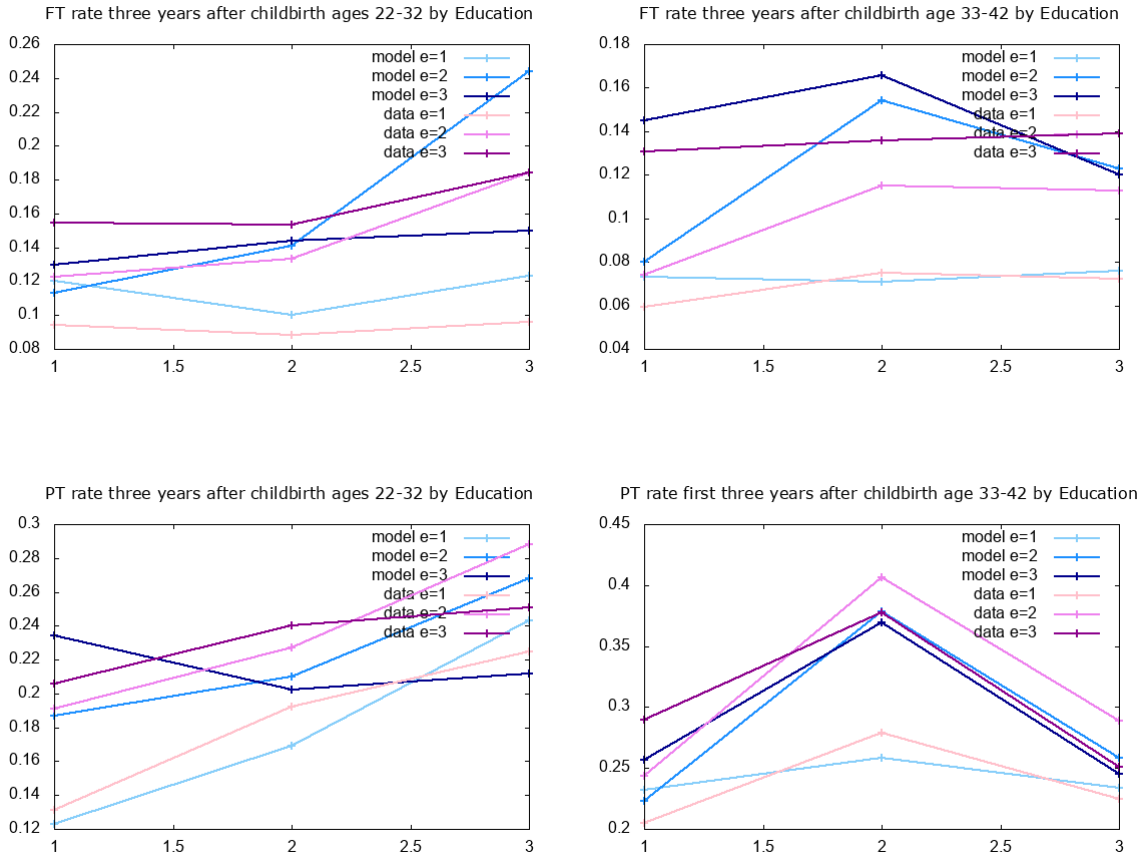
Full-time employment decreases rapidly with age and increases with education. The model replicates this well. The graph for part-time employment is almost a mirror to full-time employment. As women have more children they work more part-time, however the monotonicity in education does not hold, as the second education group has the highest part-time rate at almost all ages. The model fails to capture this.



5.3 Employment Following Childbirth by Education

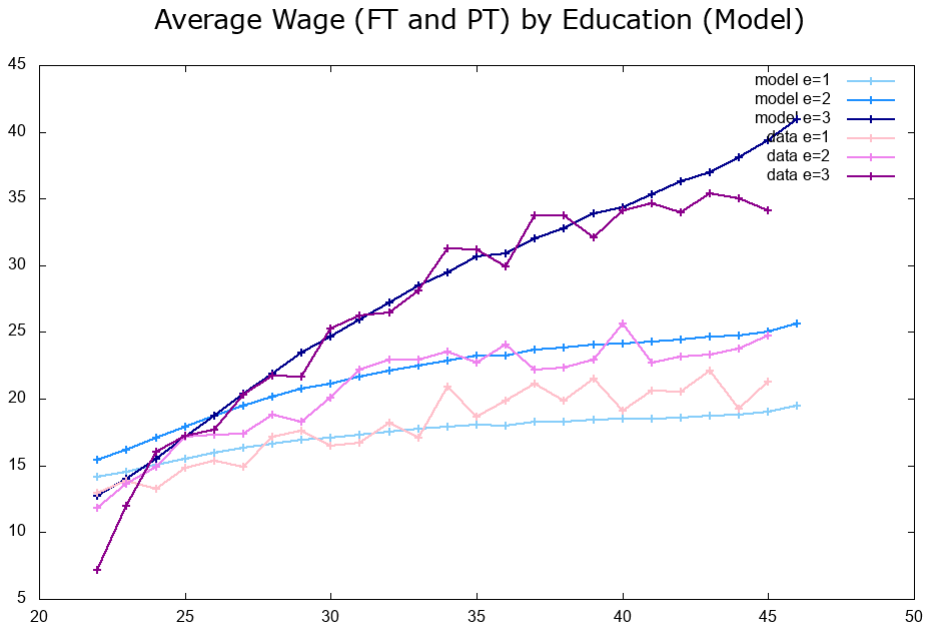
Full-time rates are increasing in education and time following childbirth, while part-time rates seem to increase in time for younger mothers but is hump-shaped for older mothers. Furthermore part-time rates are increasing in education in the first year after birth but the second education group overtakes the third three years after birth. The model estimates are

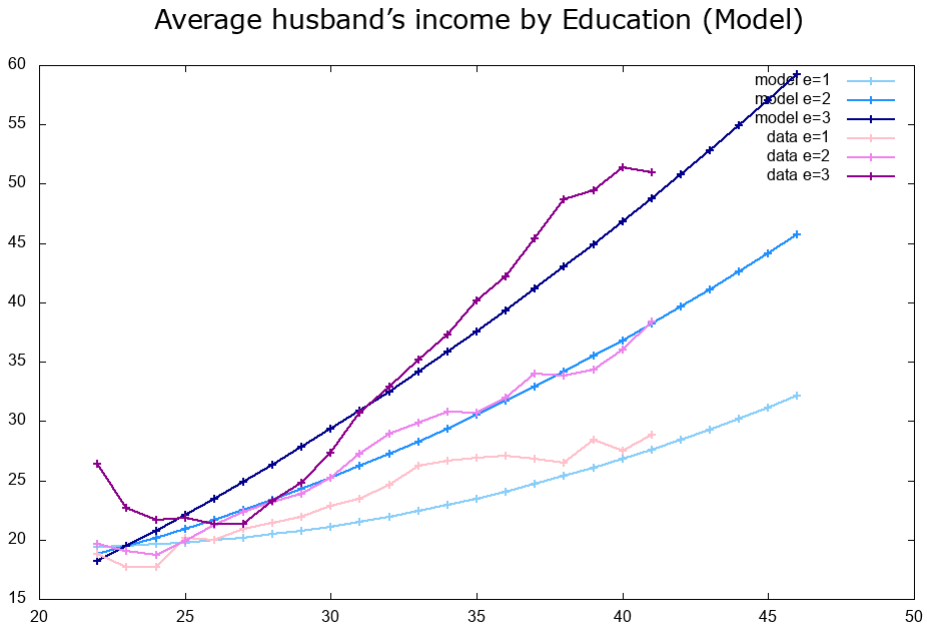
in the right range but does not fit the data very precisely.



5.4 Wages and Husband's income by Education

As expected both wages and the husbands income increase with age and education. Wage growth seems to decline past the age of 35 while the husband's income grows at an increasing across ages. The model fits the data quite well.





5.5 Effects of 2007 Parental Leave Reform

Using the current estimates the change in completed fertility due to the parental leave reform is estimated to be about 2%, with fertility increasing for the two higher education groups

and decreasing for the lowest group.

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