Female Employment and Child Care

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Abstract

I develop a dynamic model of labour supply, fertility, marriage, and child care decisions of women and men to estimate the degree of substitutability between paid child care and housework hours. I estimate the model using 1968-1996 waves of PSID. My estimates suggest that paid hours of child care are close substitutes to housework hours. I then use the estimated model to evaluate the impact of a free child care policy for working mothers. The results indicate that such polices increase part-time employment of women and also affect marital decisions. On the positive side, child care subsidies increase employment rates, however, towards the end of the life-cycle, due to state dependence in part-time employment, there are movements from full-time to part-time employment. Since the returns to part-time employment are lower than full-time employment, the free child care subsidies, which do not depend on the intensive margins of labour supply, can decrease life-cycle income of employed women.

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1 Introduction

Evidence collected from the Panel Study of Income Dynamics (PSID) suggests that many women drop out of the labour market or start to work part-time after having children. Part-time employment, provides women with the flexibility that they need in order to be able to participate in the labour market. Especially women who already have or who are planning to have children value this kind of flexibility, since it enables them to participate in the labour market while still leaving them with sufficient time to allocate to their children. On the other hand, the impact of part-time work on human capital accumulation is possibly lower than that of full-time work and this may result in lower future wage opportunities. Indeed, Goldin (2014) argues that the nonlinearity in earnings with respect to hours of work is one of the main contributors to the existing gender pay gap between men and women in the US labour market.

A policy which can help women to balance family and work life, is provision of affordable child care. Child care subsidies can increase female labour supply by decreasing costs of employment. On the other hand, a reduction in the cost of child care increases net labour income of mothers to the extent that mothers can afford to work less to have the same level of income. Therefore, if it is the wish of mothers to work less and spend more time with the child at home, such policies can indirectly decrease hours of work. Since these two effects work in opposite directions the impact of child care subsidies on labour supply remains ambiguous. Studies estimating the impact of child care costs on female labour supply report a wide range of elasticities of mother's employment with respect to child care cost and there is no consensus in the literature on how responsive mother' s employment decisions are to variation in child care costs [1].

To understand the issues related to employment and child care decisions of women I develop a discrete choice dynamic programming model of employment and child care decisions. In the model, wages, employment, child care usage, fertility, and marital decisions are endogenously determined and part-time and full-time human capital affect wages differently. Household decisions are modeled using a Nash bargaining framework, where outside options are specified as spouses' value of making decisions as single individuals. I use the 1968-1996 waves of the PSID to structurally estimate the parameters of the model using Simulated Method of Moments. This framework allows me to study the long-term impacts of child care subsidy programs on wages and various life-cycle outcomes of women and men.

This paper therefore contributes to the literature on child care and female labour supply in three ways: first, I empirically document that the hourly returns to full-time and

[1] These estimates range from 0.06 to -3.6 (See Blau and Currie (2006) for a survey).

part-time experiences are different and this difference remains even after controlling for education. This result is obtained by accounting for different processes of part-time and full-time human capital accumulation. My estimates suggest that the return to part-time experience is lower than the return to full-time experience and there is a strong state dependence in both part-time and full-time employment. The second contribution of this paper is to estimate the degree of substitutability between paid hours of child care and housework hours. Taking into account wages, employment, fertility, and marital decisions in the households, I show that housework hours and hours of child care are close substitutes. This result indicates that changes in the cost of childcare should have significant effects on female labor supply decisions.

The third contribution of this paper is to study the implications of free child care policy programs on wages, employment, fertility, and marital decisions. To study the precise nature of the impact of changes in childcare costs I conduct a policy experiment of a child care policy conditional on employment of mothers. The first observation from this experiment is that women move from not working to part-time employment indicating an increase in female labour supply, however, towards the end of the life-cycle women move from full-time to part-time employment. This pattern can be explained by the state dependence in part-time employment. As human capital in part-time sector increases, the return to employment in that sector exceeds the return to employment in the full-time sector. Consequently, part-time employment towards the end of the life-cycle increases. Lastly, I exploit the implications of the policy experiment mentioned above on the marriage market. Following the adoption of this policy, the fraction of divorcees increases and subsequently the fraction of married individuals decreases. In the absence of this policy women with a lower stock of human capital within marriage cannot afford to pay for child care if they get divorced. The free child care subsidy allows working women to substitute housework hours with child care at no cost. Therefore, the policy decreases the costs of divorce and leads to an increase in divorce rates.

In the following, I review the existing literature related to my approach and discuss the new features of my model that allow me to to shed new light on female labor market participation in ways that go beyond the existing literature. The first study to develop a full solution to a model of female labour force participation in a discrete choice dynamic programming framework treating experience as an endogenous process is Eckstein and Wolpin (1989) [2]. Francesconi (2002) extends Eckstein and Wolpin (1989) model in two ways: first, by including fertility as a choice and second by differentiating between part-time and full-time employment. This paper is similar to Francesconi (2002) in differentiating

[2]For a survey on Discrete Choice Dynamic Programming literature, see Keane et al. (2011).

between full-time and part-time processes of human capital accumulation and incorporating fertility as a choice. However, it varies from his model in a number of ways.

First of all, Francesconi (2002) models the decisions of individuals in a unitary framework. By contrast, I model the labour supply decisions of both husbands and wives through a collective model with no commitment. Modeling marital decisions together with part-time employment has important implications on allocation of resources within the household. Working part-time might affect the process of human capital accumulation and result in lower wages in the future. The lower income upon divorce, which is the outside option to marriage can change the allocation of resources in the household to the extent that the agent with a lower outside option has to transfer more resources to the partner to make marriage a feasible option. In solving the bargaining problem, this paper is similar to (Manser and Brown, 1980; McElroy and Horney, 1990), since the bargaining problem is solved as a solution to a Nash bargaining problem.

In any dynamic bargaining model the issue of commitment to future transfers becomes important. Can couples commit to the future allocation of resources in the household? Mazzocco (2007) tests the full-commitment versus no commitment model in a dynamic framework and rejects the full-commitment against the no commitment model. The most recent papers estimating a collective model with no commitment are (Gemici, 2007), (Gemici and Laufer, 2011), (Mazzocco and Yamaguchi, 2006), and (Eckstein et al., 2016). However, these papers do not differentiate between part-time and full-time human capital accumulation processes. Moreover, they do not model the choice of market hours of child care together with hours of work. Modeling these two choices simultaneously, allows me to estimate the degree of substitutability between housework hours and market hours of child care.

Secondly, in Francesconi (2002) the household gains direct utility from having a child. In my model, however, mother and father gain utility from the time spent with children through production of a public good that can be enjoyed by both parents. In my model, children are equivalent to a household good produced by the out of labour market time of parents as well as child care. By modelling the child care decisions together with market hours decisions of women and men, I intend to understand: first, whether the time spent by the parents in producing the household good (children) and child care are substitutable. Second, if the different returns to part-time and full-time employment affects the affordability and therefore use of child care.

Ribar (1995) develops a static model of child care and employment decisions of married women and shows that female labor supply is sensitive to wages but insensitive to child care costs. Haan and Wrohlich (2011) develop a model of employment, fertility and child

care decisions and show that increasing child care subsidies, conditional on employment, increases the labor supply of all women. Del Boca (2002) models employment decisions and child care usage of women, however, she has a unitary setting in which wages do not depend on hours of work. The papers modeling the child care decisions mostly focus on the outcome of these policies on children rather than female labour market outcomes. Bernal (2008) models the employment and child care decisions of women evaluating the impact of employment decisions on cognitive child development. Del Boca et al. (2014) use a human capital production function and also model the role of the father in the child's cognitive development. This paper is different from the above studies due to differentiating between part-time and full-time human capital and modeling employment, fertility, child care usage, and marital decisions simultaneously.

2 Data

The data used in this study are taken from 30 waves (1968 to 1997) of the Panel Study of Income Dynamics (PSID). PSID starts collecting labour market information of individuals for the previous year from 1969 onwards. Therefore, the effective years of data are 29 periods (1968 - 1996). Following year 1997, individuals have been interviewed biennially. Since in my model each period is defined as a year, I do not use the collected data from 1997 onwards.

2.1 Sample

PSID consists of a core sample, a sample of low income households known as SEO (Survey of Economic Opportunity sample), a Latino sample (first interviewed in 1990 or 1992), and an immigrant sample (first interviewed in 1997). These samples are endogenously selected based on their income, ethnicity or immigration status. I drop these oversampled individuals to overcome any potential biases resulting from sample selection. My sample is restricted to household residents who are either head or wife and have been interviewed at least 3 times between 1968 and 1997. Since I model individuals aged 18 to 50, all the descriptive statistics and subsequent analyses are only reported for a sample of 18 to 50 years old. The unit of observation, therefore, are 18 to 50 years old men and women.

To obtain data on child care, I use Child Development Supplement (CDS) of the PSID. PSID collected information on a sample of children aged 0-12 in 1997, surveying 2,394 families which provides information on 3,563 children. CDS reports the child care arrangements and programs used since birth of the child up to kindergarten. Mothers could have used up to 9 different arrangements since the birth of the child. Therefore, hours and costs of child

care can be constructed retrospectively since the child's birth. Only a few mothers use more than four types of arrangements, therefore, I construct the child care cost and hours using the first 4 types of arrangements. The children in CDS were born between 1984-1997. Figure B.1 shows the distribution of year of birth of CDS children. The CDS sample is matched to the main sample of the PSID, using the Family Identification Mapping System (FIMS). FIMS maps the parents of the children interviewed in 1997 to the core sample of PSID.

My unbalanced sample of PSID consists of 8,931 men and women. 52 percent of sample are women and the remaining 48 percent are men. I can match 1,094 mothers and 1,008 fathers with the CDS sample. Table B shows how the descriptive statistics on different child care arrangements used by the caregiver in the original sample and the matched sample differ. Table B.2 and B.3 show the differences in the number of periods individuals in the entire sample and CDS sample have been observed. Table B.4 compares the proportion of college graduates in the CDS and Non-CDS sample. CDS sample has about 50% more college graduates compared to the non-CDS sample. This difference is because women in the CDS sample are from a younger cohort, who have children aged 0 to 12 years old. Women in younger cohorts are more likely to attend college.

2.2 Part-time Employment - definition and prevalence

Figure 1 shows the Kernel density estimates of hours of work of men and women. The graph shows that hours of work are clustered around certain hours and women are more likely to work less hours and to stay out of labour market. The left tail of the density of hours of work for women is thicker and many women tend to work between 10 to 35 hours. Based on this figure, I define part-time employment as those working more than 10 but less than 35 hours per week. Those working between 0 to 10 hours are considered as out of labour market. The remaining women work more than 35 hours and are classified as full-time employed. Note that PSID is collected annually, therefore data on annual hours of work might not necessarily reflect part-time employment. This is because the beginning and end of an spell cannot be identified in the data. Therefore, those not working for half a year and being full-time employed in the second half of the year are considered as part-time workers. In addition, a person needs to be out of the labour force for a year to be considered as not working. The same argument holds for full-time employed individuals [3].

[3]Note that in labour supply models there is no distinction between not working and unemployed individuals. It is a common assumption in modelling labour supply that everyone who seeks jobs finds a job immediately.

Figure 1: Kernel density estimates of hours of work, men vs women

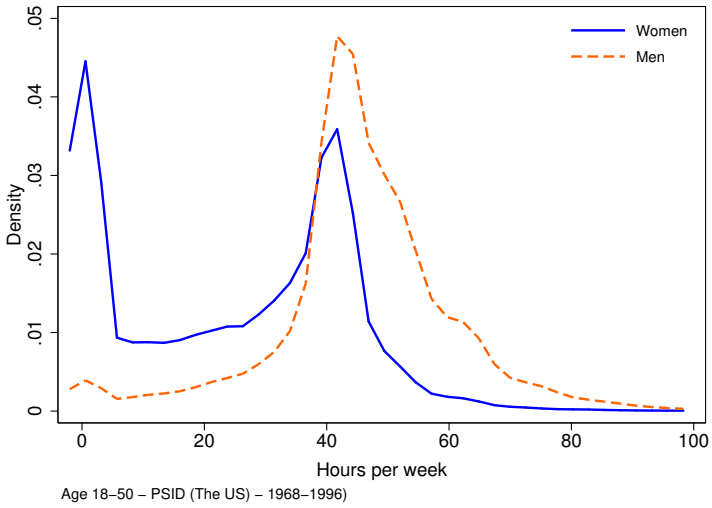
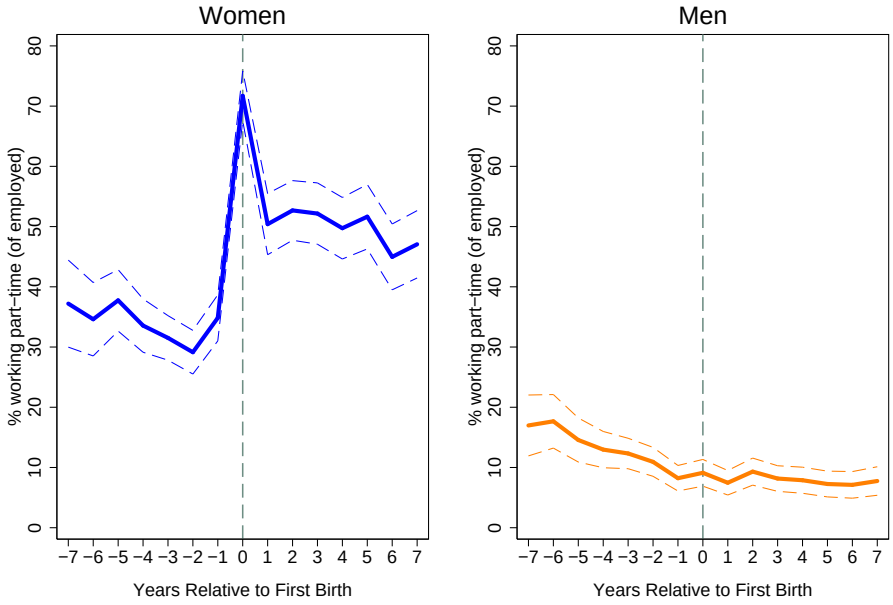


Figure B.3 shows the trend in the share of part-time employment of men and women from 1968 to 1996 in the total labour force. It shows that part-time employment has been an important type of employment during these years and that the fraction of women working part-time has remained relatively constant over the course of these years. On the other hand the share of part-time employed among employed women has decreased (Figure B.3). These graphs together show that women have moved more into full-time rather part-time employment over this time period. Male's part-time employment has been rather stable during these years and about 10 percent of men (in labour force or employed) worked part-time throughout this time period.

Knowing that part-time employment is more prevalent among women, it is important to understand what determines the decision of a women to work part-time. Figure 2 illustrates the trend in part-time employment of married women and men around the time of first birth. It shows that the share of women working part-time before birth is about 30 per cent and reaches to its peak at the time of the birth [4]. Thereafter, some women return to full-time employment and the share of part-time workers decreases to about 40 per cent but does not reach to its previous figure. It is clear from this figure that men start to work more hours in anticipation of the birth. While anticipation of birth could be an explanation for observing an increase in labour market hours of men, marriage could be another explanation. It is hard to disentangle these two patterns using graphs. Therefore in the next section I develop a model of marriage, fertility, labour supply and child care to

[4]Note that the 70 percent part-time employed women at the time of birth is an indication of the problem with my data that those who were on maternity leave for half a year are considered as part-time employed. Therefore, the share of part-time employed mothers at the time of birth should be interpreted with caution.

Figure 2: Part-time Employment Around the Time of Birth



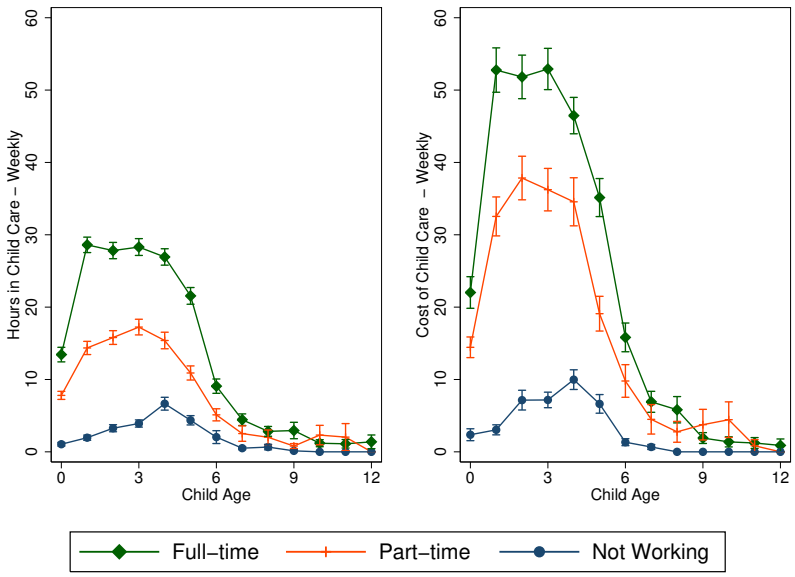
384 men and 328 women for whom data at least 3 years before and after birth are available, PSID (1968−1996)

explain these patterns in the data.

Figure B.4 and B.7 show the proportion of employed around the time of birth. It is clear that before birth around 90 percent of women were employed (this is a sample of 328 women and does not necessarily represent the population nor my sample of PSID). One year after birth this proportion decreases to around 60 percent and remains relatively constant 7 years after birth. Figure B.7 shows that in the sample of 384 men , whose employment status 3 years before and after birth were observed, nearly all of them were and remained employed around the birth of the first child. Figure B.6 and B.8 show the share of part-time employed in the total labour force. For women this share is relatively constant before and after the birth. This is because the proportion of out of labour force increases significantly after birth and brings down the proportion of part-time employed individuals.

Part-time employment becomes particularly prevalent around the birth of the first child and not all women return to full-time employment subsequently. There might be various reasons for observing such patterns in persistence of part-time employment. One explanation could be the preferences of women to spend more time with the child. Another possibility is that those who work part-time, do not have the option or cannot afford to pay for the full-time child care cost. The left panel of Figure 3 shows the weekly hours of child care used by mothers conditional on their employment status. Both part-time and full-time working mothers use about 10 hours of child care when the child is less than

Figure 3: Weekly Hours and Cost of Child Care of Mothers - by employmnet status and child's age



one year old. As the child gets older, part-time working mothers use about 15 hours of child care, while full-time working mothers on average use double the child care hours of part-time working mothers. The hours that the child spends in child care decreases significantly when the child passes 6 years old. By the age of 6, most of the children are already in kindergarten and CDS collects data only on pre-kindergarten child care [5]. The right panel of figure 3 reports the costs of child care by employment status of mothers. Full-time working mothers spend about 50 dollars on child care while part-time working mothers' weekly cost of child care is about 35 dollars. Hourly cost of child care however does not statistically significantly differ between part-time and full-time working mothers (Figure B.9).

Table B.5 shows weekly hours and cost of child care used by married mothers are different than those used by single mothers. Married mothers use more hours of child care and subsequently spend more on child care. We can see in Figure B.10 that the difference in the cost of care is not only due to hours of care used by mothers but also single mothers pay less per hour on child care. This difference can be explained by policies already in place in the United States that grant single low-income mothers child care benefits. The second explanation could be due to the lower income of single mothers as compared to married mothers who can rely on the income of fathers to pay for child care. We can see in table

[5]The age that a child must be in kindergarten in the united states varies across states. In 1998, the must entry age was between 5 to 8 years old. See Table 3 in (Datar, 2006).

B.6 that employment status of married fathers is not a good predictor of hours of child care used in the household compared to employment status of mothers. Patterns of child care usage seem to be more dependent on employment status of the mother.

Part-time employment is an important type of employment for women and becomes prevalent after the birth of the first child. However, part-time employment might or might not be used as a temporary type of employment. Table B.7 shows two-step transitions matrix between different labour market states. We can see that about 73 per cent of women remain in the same employment status as in the previous period (sum up the numbers on diagonal). While 80 per cent of women working full-time in the first period continue to work full-time in the next period, only 26 per cent of part-time employed women move to full-time employment in the next period. On the other hand, 17 per cent of part-time employed women move out of the labour force. We can conclude from this table that some women use part-time employment as a transitory type of employment. However, 55 percent of part-time employed women remain part-time employed in the next period, which gives some evidence on state dependence of part-time employment.

When we look at the three step transition patterns in table B.10 only about 48 percent of part-time employed women in the first period continue to work part-time in the third period (9.8+1.3+1.9 out of 27). However, 64 percent of women, who were employed part-time for two consecutive years, continue to work part-time in the third period. The persistence in part-time employment become more apparent in this table, which indicates that part-time jobs or the type of human capital associated with part-time jobs might be systematically different than full-time employment. Consequently when part-time employed for a few periods, it is more difficult to move to full-time sector jobs. The three step transition patterns also show that 59 per cent of women stay in the same labour market status over 3 years which is an indication of a dynamic labour supply patterns of women.

In the bottom part of table B.7, we can see that men's labour market transitions is extremely stable and about 87 per cent remain in the same employment status over two years. About 10 per cent of men work part-time and 57 percent of them move to full-time employment in the second period which is substantially higher than the 26 percent part-time employed women moving to full-time employment. In table B.11, we can see that among all men who were part-time employed in the first period, only 28 percent remain in part-time employment in the third period (1.5+.23+1 out of 9.7). Tables B.8 and B.9 report the two step transition patterns but with different part-time specifications. We can see that the stickiness in part-time employment pertains even with different specifications of part-time employment.

2.3 Part-time Employment and Wages

Because of either preferences or availability of child care, women tend to change their working hours around the birth of the child. one explanation could be that women who work part-time select into occupations that are more likely to employ part-time workers. The human capital accumulated on such jobs cannot be easily transferred to full-time jobs in sectors and occupations which need other types of skills. Therefore, by choosing to spend more time at home and with children there might be some long-term consequences on future employability of women. In what follows, I further explain the dynamics and movements across full-time and part-time employment sectors.

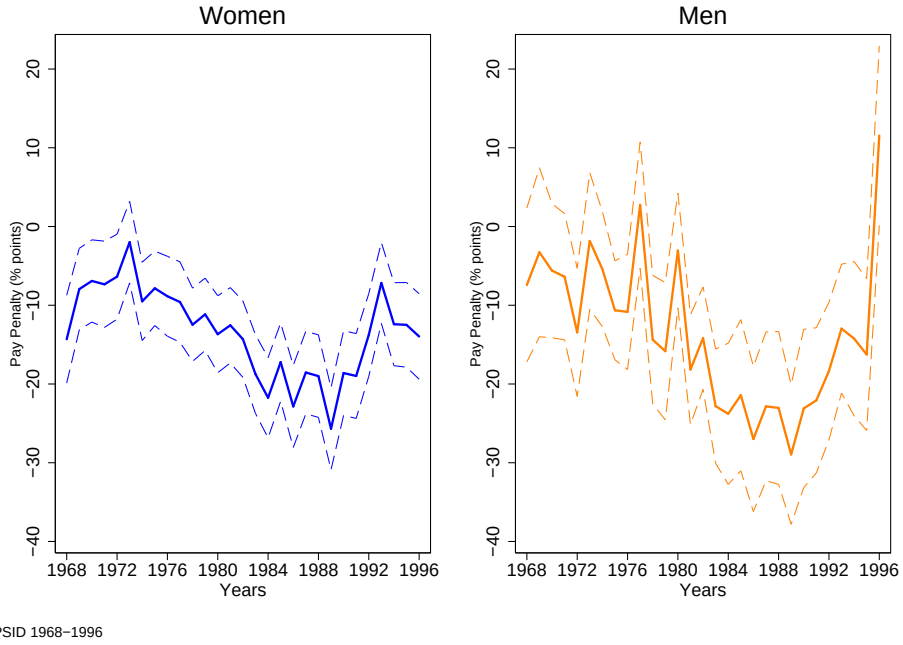
Figure 4 shows the difference between median log hourly wages of part-time and full-time workers between 1968 and 1996. I have taken into account the impact of inflation, and all wages are deflated using Consumer Price Index to 1984 US dollars. The pay penalty in women's hourly wages is of a higher significance than for men. This can be due to the fact that men work less part-time and it is harder to get a precise estimate in their pay penalty. The difference between hourly wages of part-time and full-time workers is known as part-time pay penalty in the literature. Different studies have not reached to a consensus on whether there is a pay penalty associated with part-time employment. Some argue that the pay penalty vanishes after controlling for workers and job characteristics of part-time workers (in the US: Hirsch (2005) and in the UK: Manning and Petrongolo (2008)). Some find that this pay penalty does not vanish controlling for these factors (Spanish data: Fernández-Kranz and Rodríguez-Planas (2011)) [6].

Figure B.11 reports the coefficients on the differential hourly returns to different working hours compared to working less than 10 hours. We can see that the hourly returns to working more than 30 hours is considerably higher. Figure B.12 shows the differential returns by gender. The differential returns between part-time and full-time employment exists can be seen for both genders but for women is considerably higher (figure B.11).

Motivated by these graphs, table B.12 - B.14 show the results for regression of a Mincer wage equation, in which I allow for the differential impact of part-time experience. The coefficient on return to hourly experience is positive for all specifications showing that experience has a positive impact on hourly wages. However, the coefficient on hourly part-time experience is negative indicating that the return to hourly part-time experience is statistically significantly different from full-time experience. While there is a clear decreasing return to total experience, the coefficient on part-time experienced squared is positive showing that the return to part-time experience is relatively less concave than that of

[6] I would like to thank Alan Manning and Barbara Petrongolo for sharing their Stata code so that I could plot graphs similar to the Part-time Penalty graph in their paper.

Figure 4: Part-time pay penalty - by gender



full-time experience. Table B.13 shows the same patterns as the regression for the entire sample, however, table B.14 does not show any impact of differential returns of part-time employment on men's log hourly wages. The lower constant in the Mincer wage regressions of women compared to men shows that a woman with no education and no experience earns less than her male's counterpart. In addition, the higher coefficient on total hours of experience for women indicates that experience has a larger positive impact on hourly wages of women.

The above estimated Mincer wage equations suffer from the possibility of selection bias. If those with potentially lower skills select into part-time employment, there might be a negative selection bias in estimation of returns to part-time employment. Therefore, the estimated coefficients of the above regression cannot be correctly interpreted. In the next section, I develop a model of fertility, labour supply, marital, and child care decisions of men and women in a dynamic framework to understand whether the return to part-time employment is different from the return to full-time employment. In my estimations, I take into account fertility, marital, and child care decisions.

3 Model

In this section I develop a dynamic model of labour supply, fertility, child care, and marital decisions of women w and men m. I start modeling behaviour of non-college and college

graduate individuals at age $a = 18$ and $a = 22$, respectively. Individual i can be a woman or man, $j \in \{m, w\}$, and starts her/his finite life with no work experience and the decision horizon ends at age $A = 50$, an age after which there are no fertility decisions for most people.

3.1 Choice Sets

In each period, labour supply, fertility, child care, and marital decisions are endogenously determined as a result of an individual's or a couple's optimizing behaviour. To make the model computationally feasible, I make four assumptions. First, men only work full-time but can choose to work different hours within full-time employment. This assumption is not very restrictive as the observed proportions of non-working and part-time employed men are low in the data. Secondly, I assume a static budget constraint which does not allow for consumption smoothing through savings over the life-cycle. Although, a model with endogenous savings and human capital would be more realistic, I have made the choice of focusing on the endogenous part-time and full-time human capital accumulation of women. Adding another source of dynamics to the model increases the state space and adds considerable computational burden to the solution of the model. The third assumption is that the individual's total time endowment is spent on home production and labour market work. This assumption is made to reduce the size of the choice sets. Fourthly, to avoid tracking number of children and to reduce the size of the state space, I assume that individuals can have only one child .

Women can choose between three different states of employment denoted by $k \in \{f, p, o\}$ representing full-time (f) and part-time (p) employment, and not working (o). At each age a, individuals decide on labour supply (l_a^j), fertility ($n_a^j \in \{0, 1\}$) as well as the decision to marry. Mothers and fathers also decide on how much child care to use ($H_{CC,a}^j$). Hours of child care are also discrete: $CC \in \{f_{cc}, p_{cc}, o_{cc}\}$ representing full-time, part-time and no child care, respectively. When married, husband and wife jointly decide on the above choices as well as the decision to divorce. The vector of choices are as follows:

Single men's choices: $\Psi_{single}^m = (l_a^m, H_{CC,a}^m, n_a^m)$
Single women's choices: $\Psi_{single}^f = (l_a^w, H_{CC,a}^w, n_a^w)$
Married couple's choices: $\Psi_{mar} = (l_a^w, l_a^m, H_{CC,a}, n_a)$

Working hours of men and women are $l_a^m \in \{7, 9\}$ and $l_a^w \in \{0, 3, 5, 7, 9\}$ hours per day, respectively. 0 represents not working, 3 and 5 are part-time working hours and 7 and 9 are full-time working hours. Hours of child care are $CC \in \{9, 4, 1\}$. If an individual has

a child, she has to use at least one hours of child care. In section 3.5.2 I will explain the reasons for making this assumption.

3.2 Human Capital and Wage Equations

In estimating the returns to participation in the labour market, one of the main issues is selection bias (Heckman, 1977). The problem is that wages of non workers are not observed. If those who decide to work are individuals with a higher productivity at home, by ignoring the wages of non-workers, one might get a selection bias in estimation of the wage equation. A similar selection problem persists when we estimate the returns to part-time and full-time employment decisions. In particular, there might be some unobserved factors which affect part-time and full-time employment decisions and are correlated with observed factors such as labour market experience, presence of children, marriage, and/or availability of child care.

I address the problem of selection bias by estimating wages and participation decisions, simultaneously. I estimate two different wage equations for part-time and full-time employment which are a function of observed and unobserved factors. The unobserved factors can endogenize the impact of the factors affecting wages, which are not observed in the data but eventually determine participation into part-time and full-time employment. In the wage equations, hours of work are translated into part-time and full-time experience levels which affect wages differently. Similar to Francesconi (2002), I allow the returns to full-time and part-time experiences to vary by the current employment status. Allowing such differences in parameters can generate state dependence in part-time and full-time employment and enforce employment in the sector with a higher accumulated human capital.

Part-time and full-time hourly wage equations are:

$$\begin{aligned} log(y^w_{k,a}) = \beta^w_{0,k} + \beta^w_{1,k} X_{f,a-1} + \beta^w_{2,k} (X_{f,a-1})^2 \\ + \beta^w_{3,k} S^w + \beta_{4,k} X_{p,a-1} \\ + \beta_{5,k} (X_{p,a-1})^2 + \epsilon^w_{k,a} \end{aligned}$$

$y^w_{k,a}$ are women's hourly wages depending on age and employment status $k \in \{f, p\}$. X_k are part-time and full-time specific experiences. $S^w \in \{0, 1\}$ is equal to 1 if the individual is a college graduate and is equal to 0 if has lower education levels. $\epsilon^w_{k,a}$ reflect any changes in earnings which is independent of household decision process [7]. $\epsilon^w_{k,a}$ are per period shocks

[7] I expect the estimated wage equations to differ from Francesconi (2002) since my unconditional wage estimates take into account not only fertility and employment decisions but also marital and child care decisions.

to full-time and part-time wage offers.

Since men only work full-time their wages depend only on full-time experience:

$$log(y^m_{f,a}) = \beta^m_{0,f} + \beta^m_{1,f} X_{f,a-1} + \beta^m_{2,f}(X_{f,a-1})^2 + \beta^m_{3,f} S^m + \epsilon^m_{f,a}$$

$\epsilon^m_{f,t}$ is the shock to the full-time wage offers of men. The wages shocks are independently and identically normally distributed:

$$\epsilon^m_{f,a} \overset{i.i.d}{\sim} N(0, (\sigma^m_f)^2)$$
$$\epsilon^w_{f,a} \overset{i.i.d}{\sim} N(0, (\sigma^w_f)^2)$$
$$\epsilon^w_{p,a} \overset{i.i.d}{\sim} N(0, (\sigma^w_p)^2)$$

The dynamics is introduced to the model using a learning by doing framework in which past experiences directly determine wages. In a learning by doing model the value of work is no longer simply wages but includes the return to experience. Part-time and full-time work experience accumulate according to the following laws of motion:

$$X^j_{f,a} = X^j_{f,a-1} + 1 \times 1\{l^j_a = 7, 9\}$$
$$X^w_{p,a} = X^w_{p,a-1} + 1 \times 1\{l^w_a = 3, 5\}$$

By working full-time or part time the sector specific human capital accumulates by 1. Since men always work full-time, their age and experience can be used interchangeably; e.g. a male college graduate's full-time experience is $X^m_{f,a} = age^m - 22$.

3.3 State Space

I start explaining the model by specifying the state variables and their evolution over the life-cycle. The state space of a single man comprises of education, full-time experience, stock of children (N^m_a), wage shocks, child care costs' shocks ($\epsilon_{CC,a}$), and shocks to utility of having children ($\epsilon_{ch,a}$).

$$\Omega^m_a = \{S^m, X^m_{f,a-1}, N^m_a, \epsilon^m_{f,a}, \epsilon_{ch,a}, \epsilon_{CC,a}\}$$

State space for a single woman, contains all the above variables as well as her part-time experience and shocks to her part-time wage.

$$\Omega_a^w = \{S^w, X_{f,a-1}^w, X_{p,a-1}^w, N_a^w, \epsilon_{f,a}^w, \epsilon_{p,a}^w, \epsilon_{ch,a}, \epsilon_{CC,a}\}$$

When married, the state of a couple, in addition to the union of the above state variables, includes shocks to utility of marriage ($\epsilon_{mar,a}$). Each partner receives the same marriage and child preference shock. The number of children in the household at the time of marriage is equal to $N_a = max\{N_a^w, N_a^m\}$.

$$\Omega_a = \left\{S^m, S^w, X_{f,a-1}^h, X_{f,a-1}^w, X_{p,a-1}^w, N_a, \epsilon_{f,a}^m, \epsilon_{f,a}^w, \epsilon_{p,a}^w, \epsilon_{ch,a}, \epsilon_{mar,a}, \epsilon_{CC,a}\right\}$$

Individuals with a college degree, enter the model at $a = 22$ and those without a college degree enter the model at age $a = 18$. Since education is exogenous, its value remains the same in the entire life-cycle. I assume that individuals have no previous labour market experience at the age that they finish schooling implying that initial part-time and full-time experiences are zero. The evolution of state variables over the life-cycle depends on fertility and employment decisions. The choice of hours of child care and marital decisions also affect the state variables, however, only through affecting employment and fertility decisions.

3.4 Individual's and Couple's Problems

In the model, single and married individuals face different choice sets, state spaces, and constraints. I start with explaining the behaviour of single individuals in the terminal period A and then I move backwards to period $A-1$. I explain the model from the terminal period since the model does not have a closed form solution and it is solved numerically using backward recursion.

3.4.1 Singles at age A

The individual's problem in the terminal period is to maximize the instantaneous utility subject to budget and time constraints. The individual's problem in period A is characterized as follows:

$$V_A^j(\Omega_A^j) = \max_{\Psi_{single}^j} \quad U(c_A^j, Q_{1,A}^j, Q_{2,A}^j, \epsilon)$$

$$s.t. \qquad h_A^j = 17 - l_A^j$$

$$NI^j + y_{f,A}^j l_A^j \times 1\{l_A^j = 7, 9\} + y_{p,A}^w l_A^w \times 1\{l_A^w = 3, 5\} = c_A^j + (\pi_{CC} + \epsilon_{CC,A}) H_{CC,A}^j \times N_A^j$$

$$Q_{1,A} = f(h_A^j)$$
$$Q_{2,A} = f(h_A^j, H_{CC,A}^j) \times N_A^j$$

In each period, individuals gain utility from consumption of a private good (c_A) and household goods. There are two different types of household goods: $Q_{1,A}$ and $Q_{2,A}$. $Q_{1,A}$ represents value of goods produced at home such as a meal or a clean house. $Q_{2,A}$ serves as child's qualities which are valued by the parent: such as the child's kindness, honesty or self-discipline. Parents enjoy $Q_{2,A}$ in addition to $Q_{1,A}$ while individuals without a child only gain utility from $Q_{1,A}$. ϵ is a vector of preference shocks containing per period shocks to utility of having a child $\epsilon_{ch,A}$ and utility of being married $\epsilon_{mar,A}$. Ω_A^j comprises of the values of state variables of individual j in period A. h_A^j represents housework hours of individual j, π_{CC} represents hourly cost of child care and $\epsilon_{CC,A}$ is shocks to the cost of child care. NI is Non-labour income. $H_{CC,A}^j$ is market hours of child care. Household goods are produced using housework hours. However, parents can use both housework hours and paid child care in the child quality production function. The problem of the single individual is therefore to find a combination of employment, fertility and child care decisions which maximizes his/her utility. Finally, $V_A^j(\Omega_A^j)$ is the the value function for individual j at state Ω_A^j when j is single. The transitory shocks to child care costs, and preference shocks are distributed as follows:

$$\epsilon_{CC,a} \overset{i.i.d}{\sim} N(0, \sigma_{CC}^2)$$
$$\epsilon_{ch,a} \overset{i.i.d}{\sim} N(0, \sigma_{ch}^2)$$
$$\epsilon_{mar,a} \overset{i.i.d}{\sim} N(0, \sigma_{mar}^2)$$

3.4.2 Couples at age A

Value of marriage is determined by solving a Nash bargaining problem in which the outside options are defined as values of remaining/becoming single of each partner. The outside option (threat point) is given by the utility of an agent in case negotiations break. Therefore, the threat point in a household bargaining model is the value of divorce or the value

of remaining single. The outcome of Nash bargaining is characterized by the solution to the following maximization problem:

$$\max_{\{c_A^j, \Psi_{mar}\}} (U(c_A^m, Q_{1,A}, Q_{2,A}, \epsilon) - V_A^m(\Omega_A^m))^\theta (U(c_A^w, Q_{1,A}, Q_{2,A}, \epsilon) - V_A^w(\Omega_A^w))^{(1-\theta)}$$

$$\begin{aligned} s.t. \qquad & h_A^j = 17 - l_A^j, \qquad j = m, w \\ \sum_{j=m,w} & NI^j + y_{f,A}^m l_A^m + y_{f,A}^w l_A^w \times 1\{l_A^w = 7, 9\} + y_A^w l_A^w \times 1\{l_A^w = 3, 5\} \\ & = \sum_{j=m,w} c_A^j + (\pi_{CC} + \epsilon_{CC,A}) h_{CC,A} \times N_A \\ & G_A = f(h_A^m, h_A^w) \\ & Q_{1,A} = f(G_A) \\ & Q_{2,A} = f(G_A, H_{CC,A}) \times N_A \end{aligned}$$

In the Nash product, $V_A^j(\Omega_A^j)$ is the value of being single for individual j. θ determines the bargaining power of each spouse. G_A is a composite good produced at home with the housework hours of men and women. The composite good will be used in production of household goods $Q_{1,A}$ and $Q_{2,A}$. By solving the above maximization problem, optimal transfers and optimal choice within marriage can be found. I denote by $W_A^j(\Omega_A)$, $j = m, w$, the value functions for both partners corresponding to the optimal choices of the couple obtained from Nash bargaining. These value functions include the optimal transfers between spouses through their individual incomes and individual consumption.

3.4.3 Singles at age $a < A$

Single individual's problem at age $a < A$ is to maximize the instantaneous utility as well as the expected discounted value of life-time utility. If individual j meets a potential partner, they can decide to marry which affects their value functions at age $a+1$. For $a+1 = A$, this was explained in Section 3.4.2. For $a + 1 < A$, the Nash bargaining problem is described in Section 3.4.5. The individual's problem in period a is characterized as follows:

$$V_a^j(\Omega_a^j) = \max_{\Psi_{single}^j} U(c_a^j, Q_{1,a}^j, Q_{2,a}^j, \epsilon) + \delta \begin{cases} E[V_{a+1}^j(\Omega_{a+1}^j|\Omega_a^j)], & \text{if stays single} \\ E[W_{a+1}^j(\Omega_{a+1}|\Omega_a)], & \text{if gets married} \end{cases}$$

$$s.t. \qquad h_a^j = 17 - l_a^j$$

$$NI^j + y_{f,a}^j l_a^j \times 1\{l_a^j = 7, 9\} + y_{p,a}^w l_a^w \times 1\{l_a^w = 3, 5\} = c_a^j + (\pi_{CC} + \epsilon_{CC,a}) H_{CC,a}^j \times N_a^j$$

$$Q_{1,a} = f(h_a^j)$$
$$Q_{2,a} = f(h_a^j, H_{CC,a}^j) \times N_a^j$$

δ is the discount factor. If j decides to marry the match, then the problem will involve calculations of future expected values of getting married [8]. Therefore, expected future values of life-time utility for single individuals include the expectations from future possibilities of getting married.

3.4.4 Marriage Market

In each period a, individual j meets a potential partner with probability ω. When a meeting occurs, the characteristics of the potential partner are determined by a random draw from the distribution of potential partners. These characteristics of the potential partners are discretely uniformly distributed. I assume that individuals always meet a potential partner of the same age. This assumption is made due to the computational purposes, to avoid including age of the partner as a variable in the state space. Therefore, the characteristics of a potential spouse of a woman, only includes education and current stock of children of the partner because age of men are enough characteristics to learn about work experiences of men. However, vector of characteristics for potential spouse of a man includes full-time and part-time experience levels of the woman.

3.4.5 Couples at age $a < A$

As for $a = A$, value of marriage in period a is determined by solving a Nash bargaining problem in which the outside options are defined as values of remaining/becoming single of each partner. The outside options in period $a < A$ also include the possibilities of possible future marriages. The outcome of Nash bargaining is characterized by the solution to the following maximization problem:

[8] The expectations are taken over the transitory shocks and are calculated using Monte Carlo Integration.

$$\max_{\{c_a^j,\Psi_{mar}\}} \left(U(c_a^m, Q_{1,a}, Q_{2,a}, \epsilon) + \delta \begin{Bmatrix} E[V_{a+1}^m(\Omega_{a+1}^m|\Omega_a^m)], & \text{if single} \\ E[W_{a+1}^m(\Omega_{a+1}|\Omega_a)], & \text{if married} \end{Bmatrix} - V_a^m(\Omega_a^m) \right)^{\theta}$$
$$\left((U(c_a^w, Q_{1,a}, Q_{2,a}, \epsilon) + \delta \begin{Bmatrix} E[V_{a+1}^w(\Omega_{a+1}^w|\Omega_a^w)], & \text{if single} \\ E[W_{a+1}^w(\Omega_{a+1}|\Omega_a)], & \text{if married} \end{Bmatrix} - V_a^w(\Omega_a^w) \right)^{(1-\theta)}$$

$$\begin{aligned} s.t. \qquad & h_A^j = 17 - l_A^j, \qquad j = m, w \\ \sum_{j=m,w} & NI^j + y_{f,A}^m l_A^m + y_{f,A}^w l_A^w \times 1\{l_A^w = 7,9\} + y_A^w l_A^w \times 1\{l_A^w = 3,5\} \\ & = \sum_{j=m,w} c_A^j + (\pi_{CC} + \epsilon_{CC,A}) h_{CC,A} \times N_a \\ & G_A = f(h_A^m, h_A^w) \\ & Q_{1,A} = f(G_A) \\ & Q_{2,A} = f(G_A, H_{CC,A}) \times N_a \end{aligned}$$

The solution to the above problem, entails all possibilities of future marriages and future values of remaining single. Considering the possibilities of future marriages and divorces, optimal transfers and optimal choice within marriage will be determined. The marriage decision of individual j at age a, affects the value functions at age $a+1$. If individual j decides to get divorce, his value function in period $a+1$, will be a single individual's value function and if decides to stay married, his value function in period $a+1$ will be a married individual's value function. For period $a+1 = A$, the calculation of single value functions and married value functions were explained in Sections 3.4.1 and 3.4.2, respectively.

3.5 Functional Forms

3.5.1 Preferences

The instantaneous utility function is:

$$U_a = \alpha_c\, c_a + \alpha_{q1}\, Q_{1,a} + (\alpha_{q2}\, Q_{2,a} + \alpha_{ch} + \epsilon_{ch,a}) \times N_a + \epsilon_{mar,a} \times 1\{married\}$$

α_c and α_{q1} represent marginal utility of consumption and household goods. α_{q2} represents marginal utility from child's quality. α_{ch} is the direct utility from having a child. $\epsilon_{ch,a}$ and $\epsilon_{mar,a}$ are per period shocks to utility of having a child and being married. These shocks are independently and identically normally distributed.

3.5.2 Household Production

Singles: Single individuals without a child produce the household good using housework hours:

$$Q_{1a}^{j} = \lambda h_a^j$$

λ represents marginal productivity of housework hours. When a child is present in the household, housework hours can be used not only to produce the household good, but also contribute to production of child's quality which is enjoyed by the mother/father.

$$Q_{2a}^{j} = \lambda\Big((h_a^j)^{\gamma} + (H_{CC_a^j})^{\gamma}\Big)^{\frac{1}{\gamma}}$$

I assume a Constant Elasticity of Substitution (CES) production technology to estimate the degree of substitutability between housework hours and child care. γ determines this degree of substitutability. To be able to estimate the curvature of the production technology, I assume that when a child is in the household, parents always use an hour of child care.

Couples: When individuals are married both husband's and wife's housework hours is spent on production of a composite good (G_a).

$$G_a = \alpha_m h_a^m + \alpha_w h_a^f$$

I assume that housework hours of men and women are perfect substitutes. Therefore, production of this composite good depends only on the marginal productivity of husband's (α_m) and wife's (α_w) housework hours. This composite good is an input into production of household's goods.

$$Q_{1a} = \lambda G_a$$

Similar to the case of single individuals, when a child is present the production function takes the following CES functional form:

$$Q_{2a} = \lambda\Big(G_a^{\gamma} + (H_{CC_a})^{\gamma}\Big)^{\frac{1}{\gamma}}$$

The only difference between the production of household goods of single and married individuals is that the inputs into single individual's production function is the individual's housework hours. On the other hand, married individuals use the composite good as an input into the production function.

4 Estimation

McFadden (1989) proposes to use Method of Simulated Moments in estimating models that require numerical integrations. I use the following method of moment estimator:

$$argmin \qquad g(\theta)' W g(\theta)$$

The simulated method of moments searches for the values of θ (a vector that contains all the unknown parameters) that minimize the distance between the moments calculated from the simulated data and the moments calculated from the actual data. W are the weights, which are the inverse of the estimated variances obtained from the actual data, divided by the number of individuals that contribute to each moment. g(θ) is defined as follows:

$$g(\theta) = \frac{1}{N} \sum_{i=1}^{N} g_i(\theta) = [\bar{m}_1 - \mu_1(\theta), ..., \bar{m}_k - \mu_k(\theta)]$$

where $(\bar{m}_1, .., \bar{m}_k)$ correspond to the data moments, and $(\mu_1(\theta), .., \mu_1(\theta))$ are the corresponding model moments. N denotes the number of individuals in the sample.

Data from 1968-1997 of PSID are used to estimate 31 parameters of the model, structurally. The steps are as follows, the solved model is used to simulate an artificial database of labour supply, fertility, child care choices, and marital status of individuals. Thereafter, the moments of these simulated data are calculated and will be compared to the actual moment from the data.

4.1 Identification

Various moments conditional on individuals' age and transition matrices are used to identify 31 parameters of the dynamic model. I use average full-time hourly wages of men conditional on returns to full-time experience and returns to schooling by age, to identify the parameters on returns to full-time experience and returns to schooling. To identify the parameters of full-time and part-time wage equations of women, I use part-time and full-time average hourly wages conditional on full-time experience, part-time experience and education by age. Variations in part-time and full-time wages pin down the shocks to full-time and part-time wages.

There are 3 free parameters in the utility function to be estimated: $\alpha_C + \alpha_{q1} + \alpha_{q2} + \alpha_{ch} = 1$. Average wages conditional on employment decisions by age identify marginal utilities from consumption and household production. Fraction of people having children identifies direct utility from having a child and the transitory shocks to utility of having a child but I

cannot identify these two parameters separately. I use fraction of married individuals and transitions into divorce and marriage to identify probability of meeting a potential partner as well as shocks to utility of being married.

The degree of substitutability between housework hours and child care is identified using variations in proportions of individuals using child care conditional on full-time employment, part-time employment and not working. Parameters on marginal productivity of housework hours of married men and women are identified using the change in labour market hours after marriage and I assume $\alpha_m + \alpha_f = 1$. Since I do not have data on consumption of individuals in the household, I cannot identify the bargaining parameter in the Nash Product. Therefore, I assume that bargaining power of husband and wife are equal.

5 Results

I present the set of estimated moments obtained from estimations in this section to show how the model performs in fitting the patterns observed in the data.

5.1 Model Fit

Figures C.1-C.19 and Tables C.1-C.3 show the model fit.

Figures C.1-C.4 show the patterns in employment rates for single and married mothers compared to non-mothers. The model does a very good job in fitting the life-cycle employment patterns observed in the data. However, it overstates the full-time employment rates and understates the unemployment rates of both single and married mothers. Figures C.5 - C.8 show that the model also does very well in fitting the employment patterns of single and married women by their education.

Figure C.9 shows the fit for log hourly wages of women by education and employment status, by age. The model does a good job in fitting wages but overstates hourly wages of part-time employed women without a college degree. Figures C.10 and C.11 illustrate the log hourly wages by employment status and education. The model in general does a good job in fitting the marginal return to full-time experience of part-time and full-time employed women. However, the fitted part-time wages, show a larger decreasing marginal return to full-time experience of part-time employed women (Figure C.10). The returns to part-time experience when the individual is part-time employed is also overstated (Figure C.11). Figure C.12 shows the fraction of part-time and full-time employed women by part and full-time experience. It can fit the patterns observed in the data that full-time employment

is a negative function of part-time experience. However, full-time employment is relatively flat in full-time experience which is not in line with the data. The model does a good job in showing that part-time employment decreases as full-time employment increases and it is positively related to part-time experience. These features are particularly important in my estimations because they help in showing the state dependence in part-time and full-time employment.

Figure C.13 and C.14 show the fitted patterns in log hourly wages of men by education and marital status. The model does a good job in showing that wages of college graduates are higher than non-college graduates. However, it overstates wages of men without a college degree. Figure C.15 shows the log hourly wages of single and married women. The model does a good job in fitting the wages by marriage but it slightly overstates the wages of married part-time workers. Figure C.16 the daily income from full-time and part-time employment are also well-fit fir the data.

Figure C.17 and C.18 show that the model can predict marriage rates and divorce rates of men and women. However marriage rates are overstated and as a result divorce rates are understated. Figure C.19 shows the model does a good job in predicting the patterns in the fraction of single women and men with children. It, however, overstates the proportion of individuals having children.

Table C.1 fits the pattern in the data that full-time and part-time working single mothers use more child care than non-working mothers. However, very few single mothers use child care when we compare these fractions with the data. We can see more variations in the child care moments of married women. However, the variation in hours of child care does not vary by employment status of the married mother. Table C.2 shows the log daily child care cost used by men and women. In general the model fits the daily cost of full-time child care well but overstates the part-time daily cost of child care. The patterns in the data suggest that single and married women with lower income, use less child care hours than higher income women. Table C.3 fits this pattern for only single mothers but not for married mothers.

5.2 Parameter Estimates

Table 1 reports the parameters estimated for wage equations. The difference between the intercepts of log hourly wages of men and full-time working women shows the difference in wages that cannot be explained by experience and education. The return to full-time experience of men is estimated to be larger than the return to full-time experience of women. The degree of concavity of return to full-time experience is estimated to be larger for men than women. As a result as women gain more full-time experience, the difference

Table 1: Wage Parameters

Model Parameters	Description	Estimated Values
Wage parameters (Full-time Employment, Male)		
$\beta^m_{0,full}$		1.764
$\beta^m_{1,full}$	Return to full-time experience	0.085
$\beta^m_{2,full}$	Dec/inc return to full-time experience	-.0025
$\beta^m_{3,full}$	Return to education if full-time employed	0.211
Wage parameters (Part-time Employment, Female)		
$\beta^w_{0,part}$		1.393
$\beta^w_{1,part}$	Return to full-time experience	0.0325
$\beta^w_{2,part}$	Dec/inc return to full-time experience	-0.0060
$\beta^w_{3,part}$	Return to education if part-time employed	0.157
$\beta^w_{4,part}$	Return to part-time experience	-0.078
$\beta^w_{5,part}$	Dec/inc return to part-time experience	-0.0023
Wage parameters (Full-time Employment, Female)		
$\beta^w_{0,full}$		1.296
$\beta^w_{1,full}$	Return to full-time experience	0.065
$\beta^w_{2,full}$	Dec/inc return to full-time experience	-0.0032
$\beta^w_{3,full}$	Return to education if full-time employed	0.111
$\beta^w_{4,full}$	Return to part-time experience	0.029
$\beta^w_{5,full}$	Dec/inc return to part-time experience	-0.004

in return to full-time experience of men and women decreases. The return to education of full-time employed men is twice as large as full-time employed women. The hourly college wage premium is estimated to be 1.17 dollars for part-time working women and $1.11 for full-time working women.

The difference in the intercept between part-time and full-time log hourly wages of women can be interpreted as part-time wage penalty. However, my estimates does not suggest that a part-time pay penalty exists. The only difference between the wages of part-time and full-time employed women can be captured b the differences in returns to experience of these different states of employment. In fact, a part-time employed woman with no experience without a college degree earns about half a dollar more per hour compared to a full-time employed woman of the same characteristics. The marginal return to full-time experiences of a full-time employed woman is estimated to be higher than the marginal return to part-time experience (also the marginal return to part-time experience decreases at a much faster rate than the return to full-time experience). In addition, when part-time employed, the return to part-time experience is higher than the return to full-time experience. These differential returns to part-time and full-time experience conditional on different employment status is substantial enough to create state dependence in part-time and full-time sectors. To the extent that women with more part-time experience earn more by being employed in a part-time job while those women with more full-time experience

benefit more from employment in full-time sector.

Table 2 reports preferences and household production parameters. The estimated preference parameters are such that an additional unit of consumption gives a lower utility than an additional unit of household goods. However, marginal utility of the child's quality is estimated to be about three times larger than the marginal utility of other household's goods. The estimated preferences show that when a child is present, more income is needed to compensate for the time spent by the parents with the child. Marginal productivity of housework hours of women is larger than for men which results in women's specialization in household production.

This estimate is a reflection of higher wages of men in the labour market compared to women. Since men earn higher wages in the labour market they have higher cost of working at home and therefore 1 hour of their work at home needs to be compensated with more housework hours of women.

The utility of having a child is estimated to be positive and at 0.038 and the shock to utility of having a child is 0.25. Probability of meeting a potential partner is 39 percent and the variance in utility of marriage is estimated to be 3.7. This high variance in utility of marriage, increases the risk of marriage. However, marriage is still an attractive option because of public good and the positive utility obtained from having a child.

One hour of child care is estimated to cost 4.75 dollars which is larger than an hour return to both full-time and part-time employment of a woman without a college degree and no work experience. Therefore, women with low work experience and education might prefer to stay at home and take care of their children. The degree of substitutability between child care and housework hours is estimated at 0.381 resulting to an elasticity of substitution of 1.6 indicating that housework hours and child care hours are close substitutes. Therefore, at this cost of child care reducing labour hours and increasing house work hours can be expected as long as the discounted expected future wages, due to lower of experience, do not deter women from spending more time in home production. On the other hand, a relative decline in the cost of child care, keeping the opportunity cost of home production (wages) constant, should increase the use of child care and decrease housework hours (or increase labour supply).

6 Policy Experiments 1

The objective of this paper is to understand whether child care subsidies can facilitate the process of human capital accumulation and therefore affect life-time income of women. In this section, I analyse the impact of such policies. In the first policy experiment The first

Table 2: Parameters: Preferences and Household Production

Model Parameters	Description	Estimated Values
Preference parameters		
α_c	Marginal utility from consumption	0.081
α_{q1}	Marginal utility from household production	0.250
α_{q1}	Marginal utility from household production	0.630
α_{ch}	Marginal utility from having a child	0.038
Household Production		
α_m	Marginal productivity of housework hours (married men)	0.304
α_w	Marginal productivity of housework hours (married women)	0.695
λ	Marginal productivity of housework hours	0.808
γ	Degree of substitutability between child care and housework hours	0.381
Shocks		
ϵ_f^m	Variance of full-time wages, male	0.152
ϵ_f^w	Variance of full-time wages, women	0.466
ϵ_p^w	Variance of part-time wages, women	0.562
ϵ_{mar}	Variance in utility of marriage	3.692
ϵ_{ch}	Variance in utility of having a child	0.251
ϵ_{CC}	Variance of child care cost	0.554
δ	Discount factor	0.954
ω	Probability of meeting a potential partner (men and women)	0.386
π_{CC}	Log Hourly child care cost	1.56
θ	Bargaining weight in Nash product (not estimated)	0.5

policy evaluates the impacts of a free child care subsidy which is given to women who are either part-time or full-time employed (Policy 1). The second policy analyses the impacts of a free child care subsidy which is only given to full-time employed individuals (Policy 2). My model allows me to evaluate how these policies affect employment decisions, wages, divorce, marriage, and fertility rates simultaneously.

Figures D.5 and D.3 show the impact of these two policies on employment of single and married mothers. Both policies move mothers from unemployment to employment. The child care policy which is given to all employed women irrespective of their hours of work moves women to from unemployment to part-time employment (Policy 1). We can see that the proportion of part-time employed women over the life-cycle increases. The observation of this pattern is due to the existence of a strong state dependence in sector-specific employment. If an individual has more part-time experience than full-time experience, her wages in part-time sector would be higher. Therefore, women who have chosen to work part-time for some periods, become more likely to move to part-time employment in the end of their life-cycle. However, the child care subsidy policy which is given to only full-time employed women moves women from unemployment and part-time employment to full-time employment. It can be seen that more women choose to continue to work full-time towards the end of the life cycle. The state dependence in full-time employment, makes women to seek

Figure 5: Employment Rate - Married Mothers

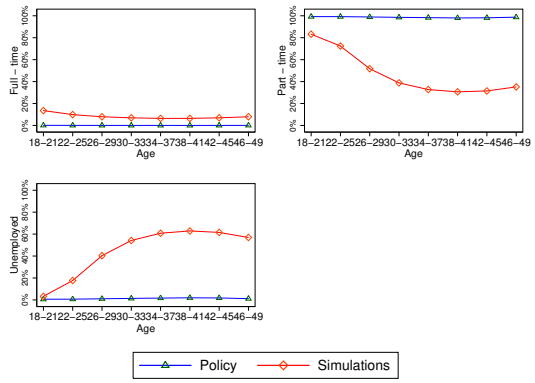
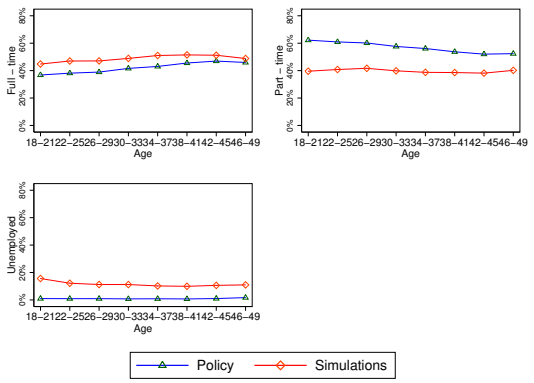


Figure 6: Employment Rate - Single Mothers



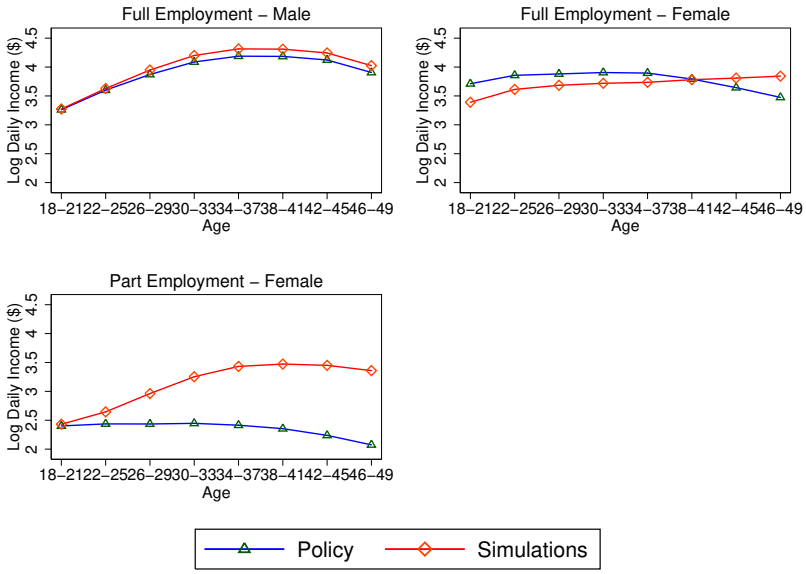
employment in the sector with the highest accumulated sector-specific human capital.

Figures D.4 and D.2 show that the policy has similar impacts on non-mothers. This behaviour can be due to the fact that individuals in the model are forward looking. Single women, anticipate that in case of having children, they might want to spend time with the child at home. Since the return to part-time experience in part-time employment is higher than the return to full-time experience, they decide to accumulate human capital in the part-time sector. By accumulating experience in part-time sector, in case they have children, they can obtain higher wages. Therefore, part-time employment in the part-time sector even for non-mothers increases.

Figure 7 shows the impact of these two policies on life-time log daily income of full-time and part-time employed women and full-time employed men. The policy does not have any impact on daily income of men. Policy 1 leads to a decrease in the labour income of part-time employed mothers which can be explained by the lower returns to part-time experience. Policy 2 decreases daily labour income of both full-time and part-time employed mothers. The reason for observing such an impact is that policy 2 moves women from all different skill levels to full-time employment. Therefore, the average income of full-time employed mothers decreases.

Figure **??**-D.1 show the impact of these two policies on divorce rates, marriage rates, and fertility rates. Both policies result in an increase in divorce rates and a decrease in marriage rates. However, they do not affect the proportion of divorced men and women having kids. The increase in the divorcees' fraction can be explained by two channels in the model. Firstly, since house work hours and child care hours are close substitutes, in case of divorce, single individuals can increase labour market hours and substitute housework hours with child care at no cost. In the absence of policy, the cost of child care in case of divorce would not allow men and women to do so. The policy therefore reduces the cost

Figure 7: Daily Income from Employment (log)



of divorce and increases divorce rates. Secondly, the reform improves the outside option of mothers to divorce, which is the value of being single. Prior to the reform, women who did not have any work experience and had specialized in household production, upon divorce would have a lower income outside marriage. The free child care policy allows these women to substitute housework with child care and move to employment. Therefore, due to a higher accumulated human capital, they will have a better income upon divorce. Since the men's income has remained unchanged, the husband cannot offer a higher transfer to the wife to make the marriage a feasible option. Therefore, those marriages in which women would have a lower consumption within marriage compared to their private consumption in case of divorce dissolve.

7 Policy Experiments 2

A free child care subsidy program in practice must be financed. In this section, I show the results of a free child care policy which is financed through a 20 percent income tax. The choice of a 20 percent income tax is motivated by the fact that the estimated daily child care costs comprise of about 20 percent of individuals' daily income. In this section, I compare the impact of 4 different policies on the estimated lifetime daily labour income of men and women. The first two policies explore the implications of the child care subsidy programs discussed in the previous section and the two other policies allow for general equilibrium effects of these policies.

Table 3 reports a comparison of the effect of these policies on the estimated lifetime labour income. In the upper panel of table 3 we can see that the free child care subsidy programs conditional on employment and full-time employment, do not affect daily income and working hours of men. When the policy is financed through an income tax, the hourly wage and income decrease by the tax rate but men's working hours remain almost unchanged. The lower panel in table 3 shows the results of the same policy experiments for women. We can see that a child care policy conditional on employment leads to a 3 percent decrease in income. The decrease in income can be explained by the 20 percent decrease in the daily working hours of women. When the child care subsidy is given to women who are full-time employed, daily income compared to the benchmark model increases by 10 percent which can be explained by an 18 percent increase in daily working hours.

Table 3: Lifetime Daily Labour Income (in dollars)*

	All Sample	
Experiments	Daily Income	Daily Working Hours
Male		
Benchmark Model	97.80	9
Child Care|Employment	97.80	9
Child Care|Full-Employment	97.80	9
Child Care|Employment,taxes	78.22	8.998
Child Care|Full-Employment,taxes	78.22	8.998
Female		
Benchmark Model	44.25	7.391
Child Care|Employment	42.69	5.822
Child Care|Full-Employment	49.21	8.758
Child Care|Employment,taxes	26.90	4.136
Child Care|Full-Employment,taxes	36.11	8.222

* Estimated daily lifetime labour income is the average of daily labour income taken across individuals and over the lifetime. Non-workers have no daily lifetime income.

When I incorporate the general equilibrium effects of the first and the second policy by introducing a 20 percent income tax, the life-time income of women decreases by 37 percent compared to the first policy and decreases by 26 percent compared to the second policy. Introducing the income tax decreases income by more than the 20 percent tax rate. A tax rise decreases the opportunity cost of home production and consequently decreases working hours. Since the decrease in working hours when we introduce taxes to the first policy is larger than the decrease in working hours when we introduce taxes to the second

policy, the decrease in lifetime income will also be larger in the former compared to the latter.

Table 4 reports the same results for employed women. We can see that the average daily income of employed women in the benchmark model is higher than the income in any of the policy experiments. This result indicates that in the benchmark model those women who were receiving negative wage shocks and had lower skills would specialise in home production and would not pay for the child care. However, when child care is free for employed women,all women irrespective of the income shock specialize in the labour market. The results from tables 3 and 4 imply that a free child care policy increases the overall lifetime income of women by moving nonworking women to employment, nevertheless, the average income of employed women decreases. The decrease in income of employed women can be explained by the fact that under the free child care policy women from all different skill and human capital levels can participate in the labour market while in the absence of a free child care policy, those with lower skills cannot afford to do so.

Table 4: Lifetime Daily Labour Income of Employed women (in dollars)*

	All Sample	
Experiments	Daily Income	Daily Working Hours
Benchmark Model	58.92	7.391
Child Care|Employment	42.72	5.822
Child Care|Full-Employment	50.15	8.758
Child Care|Employment,taxes	26.92	4.136
Child Care|Full-Employment,taxes	36.88	8.222

* Estimated daily lifetime labour income is the average of daily labour income taken across individuals and over the lifetime. These averages are reported for working women and the income of nonworking women are treated as missing.

Table 5 shows the the average life-time accumulated human capital of women. Comparing the impact of these policies with the benchmark model, it becomes clear that all the free child care programs decrease the number of years that women spend out of the labour market. But a free child care policy that is given to all mothers, leads to a 7 year increase in the accumulated part-time human capital and a one year decrease in full-time employment. A child care subsidy which is given to only full-time employed women, increases the accumulated full-time human capital from 10 to 19 years and decreases part-time human capital from 6 to 2 years. The increase in part-time (full-time) human capital when the policy is conditioned on employment (full-time employment) can be explained by the strong state dependence in part-time and full-time employment.

Table 5: Lifetime Human Capital (in years)*

	Average Lifetime Experience		
Experiments	Full-time	Part-time	Notworking
Benchmark Model	10.49	6.408	5.601
Child Care|Employment	9.062	13.42	0.0119
Child Care|Full-Employment	19.47	2.598	0.424
Child Care|Employment,taxes	4.652	17.83	0.0137
Child Care|Full-Employment,taxes	19.79	2.236	0.469

* Estimated daily lifetime labour income is the average of daily labour income taken across individuals and over the lifetime. Non-workers have no daily lifetime income.

8 Conclusion

I develop and estimate a dynamic model of employment and fertility decisions in order to understand the reasons for lower hourly wages of part-time employment relative to that of full-time employment. In the model, labour supply, fertility, parental child investments, and marital decisions are endogenously determined. Household decisions are modeled in a Nash bargaining framework, where outside options are specified as spouses' value of making decisions as single agents. I use the dynamic model to evaluate the impact of child care policies on prevalence and returns to employment.

I structurally estimate 31 parameters of the model using 1968-1996 waves of PSID. My estimation results indicate that child care and house work hours are close substitutes. I show that a policy that provides working mothers with free child care, when it is not conditional on hours of work, moves women to part-time employment. Since the return to part-time employment is lower than full-time employment, such a policy might decrease the overall earnings of women over the life-cycle. In contrast, child care subsidies that target intensive margins of employment rather than only extensive margins, increase full-time employment and consequently labour income of women.

I further show that child care policies have implications on marriage markets. Child care subsidy programs lead to an increase in women's accumulated human capital and subsequently their income. As a result, the value of being single, as compared to the value of being single in absence of the policy, increases and marriages which were not reflecting the preferences of women dissolve. Therefore, free child care subsidies increase the fraction of divorcees and decrease the fraction of married individuals.

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Appendices

A History of Child Care Policies in the US

This section gives a brief overview of the US child care policies after World War II. Parents face different child care options: nurseries, kindergartens, care by relatives, and care by non-relatives. Up to early twentieth century, most of the child care was provided by relatives in the US. During the second World War, congress passed the Lanham Act, in 1941, to provide funds for child care of working mothers. The Act was motivated by the increase in employment rate of mothers whose employment was encouraged by Rosie the Riveter campaign. The Lehman Act was the only universal child care policy adopted in the history of the US child care policy which did not target women based on their income. However, its funding was withdrawn in 1946 after the end of the WWII (Herbst, 2017).

In 1965, motivated by War on Poverty program of President Johnson, a comprehensive child care program, known as Head start, was adopted which targeted children from low income families. Its pilot program started as a summer school to prepare children from low-income families for elementary school. Thereafter, it was expanded to a full school year in 1966 and started offering services to children aged 0-3 in 1977. In 1994, Early Head

Start program was adopted which provided services to pregnant women and infants and toddlers (Learnings and Knowledge Center, 2017).

In 1977, the Comprehensive Child Development Act was passed by bipartisan vote in the congress. The Act proposed an allocation of $2.1 billion for a national childcare program. which would have offered low-income families free child care services while families from higher income families would have faced progressive costs based on their income (Dinner, 2010). However, the bill, despite the support from both the House of Representatives and the Senate, was vetoed by President Nixon. Several other child care policies were proposed afterwards, including Act for Better Child Care Services (ABC), which were vetoed or did not pass by the congress (Palley and Shdaimah, 2014, pg. 51-60).

Between 1986 and 1996, there were 4 different programs in the US providing child care assistance to low income families. Aid to Families with Dependent Children (AFDC) was a program adopted in 1935 which provided financial assistance to low (no) income families with children. Following the family support Act of 1988, families who were eligible for AFDC became automatically eligible for child care assistance and those families who were no longer eligible for AFDC and could not afford to pay for child care received Transitional Child Care (TCC) assistance. Omnibus Budget Reconciliation Act of 1990, approved of two different types of child care: At Risk Child care (ARCC) and Child Care and Development Block Grant (CCDBG). The former targeted families who were at risk of needing assistance and the latter offered child care assistance to families whose income fell below 75 percent of median income of the state (Michel, 2017).

In 1996, after ratification of Personal Responsibility and Work Opportunity Act (PRWORA), AFDC was replaced by Temporary Assistance for Needy Families (TANF). The above 4 different child care policies were also put into a single block grant: Child Care and Development Fund (CCDF). According to PRWORA, if families do not have access to child care, they should be exempt from work requirement criterion for welfare eligibility. However, in practice, many families with children younger than 13 ,who are eligible for child care services under federal law, fail to receive them under state law. The states can reduce the child care service requirement age and lower the income eligibility ceiling to receive subsidies (Herbst, 2008). According to Mezey et al. (2002) only 14 percent of federally eligible children received child care in 2000. Hence, the US is falling behind other OECD countries in assisting families to balance work and family by failing to provide them with adequate child care. While many high and middle income families can afford to pay for child care, the low income families who are not eligible for child care subsidies need to rely on relatives for child care. The need for child care in the US is hence an ongoing debate.

B Supplementary Graphs and Tables

Table B.1: Employment by marital status - Men and Women

Gender	Marital Status		Out of LM	Part-time	Full-time	Total
Female	Married	% of total	28.77	22.49	29.07	80.33
		% of row	35.82	27.99	36.19	100
		No.	17,523	13,695	17,706	48,924
	Single	% of total	3.133	4.591	11.94	19.67
		% of row	15.93	23.34	60.72	100
		No.	1,908	2,796	7,273	11,977
Male	Married	% of total	1.692	7.575	74.79	84.06
		% of row	2.013	9.012	88.97	100
		No.	912	4,082	40,302	45,296
	Single	% of total	0.854	2.667	12.42	15.94
		% of row	5.355	16.73	77.92	100
		No.	460	1,437	6,693	8,590

Table B.2: Employment by marital status and child - Mothers and Fathers

Marital Status		Out of LM	Part-time	Full-time	Total
Single Non-mothers	% of total	0.360	1.791	5.313	7.465
	% of row	4.826	24.00	71.18	100
	No.	218	1,084	3,215	4,517
Single Mothers	% of total	2.733	2.737	6.529	12.00
	% of row	22.78	22.81	54.41	100
	No.	1,654	1,656	3,951	7,261
Married Non-mothers	% of total	1.932	3.680	7.762	13.37
	% of row	14.44	27.52	58.04	100
	No.	1,169	2,227	4,697	8,093
Married Mothers	% of total	26.98	18.83	21.35	67.16
	% of row	40.18	28.04	31.78	100
	No.	16,328	11,394	12,917	40,639
Single Non-fathers	% of total	0.343	1.709	7.265	9.316
	% of row	3.677	18.34	77.98	100
	No.	183	913	3,881	4,977
Single Fathers	% of total	0.481	0.895	4.981	6.357
	% of row	7.568	14.08	78.36	100
	No.	257	478	2,661	3,396
Married Non-fathers	% of total	0.277	1.761	11.47	13.51
	% of row	2.051	13.04	84.91	100
	No.	148	941	6,126	7,215
Married Fathers	% of total	1.404	5.746	63.67	70.82
	% of row	1.982	8.114	89.90	100
	No.	750	3,070	34,016	37,836

Table B.1: Child Care Arrangements - matched and original sample - a comparison

		Hours			Cost			Child's Age		
Arrangements	Proportion (%)	Mean	No.	SE	Mean	No.	SE	Mean	No.	SE
Child Care Arrangements in the original sample										
Relative in the child's home	11.22	29.81	588	0.963	52.83	183	2.811	3.509	595	0.0976
Non-relative in the child's home	6.150	28.82	326	0.848	101.9	295	4.123	3.377	326	0.125
Care in relatives' home	24.34	33.18	1268	0.599	43.91	600	0.969	3.529	1290	0.0684
Care in non-relatives' home	26.41	33.00	1390	0.370	63.69	1305	1.068	3.013	1400	0.0488
Head-start program	2.264	26.85	120	1.319	46.91	18	6.473	4.183	120	0.121
Pre-school or child care center	27.11	31.19	1427	0.402	60.38	1247	1.011	3.510	1437	0.0418
Before or after school program	0.773	12.29	41	1.052	33.42	32	4.546	6.854	41	0.260
Other	1.736	30.81	88	4.559	43.20	56	5.021	3.304	92	0.173
Child Care Arrangements in the Matched Sample										
Relative in the child's home	6.052	23.35	98	1.564	49.81	32	10.39	3.851	101	0.244
Non-relative in the child's home	9.047	27.21	151	1.285	102.7	131	6.407	3.682	151	0.192
Care in relatives' home	21.03	31.24	335	1.325	49.59	118	2.765	3.724	351	0.133
Care in non-relatives' home	35.11	32.36	581	0.586	63.71	547	1.593	2.932	586	0.0707
Head-start program	0.659	26.45	11	4.457	109.4	1	.	4.182	11	0.182
Pre-school or child care center	25.64	29.83	419	0.779	66.29	381	1.963	3.572	428	0.0787
Before or after school program	0.839	11.21	14	2.583	26.40	7	4.464	7	14	0.314
Other	1.618	18.18	25	2.443	47.35	14	10.68	3.593	27	0.407

Table B.2: Number of periods each observation is interviewed - Entire Sample

No. of Periods	Men	Women	Total	% of Total
3	361	313	674	7.500
4	367	380	747	8.400
5	260	282	542	6.100
6	230	226	456	5.100
7	210	219	429	4.800
8	198	192	390	4.400
9	197	187	384	4.300
10	197	208	405	4.500
11	182	189	371	4.200
12	168	187	355	4
13	157	172	329	3.700
14	130	147	277	3.100
15	147	157	304	3.400
16	144	145	289	3.200
17	129	160	289	3.200
18	137	150	287	3.200
19	106	137	243	2.700
20	123	113	236	2.600
21	117	122	239	2.700
22	116	126	242	2.700
23	89	120	209	2.300
24	108	134	242	2.700
25	109	116	225	2.500
26	113	107	220	2.500
27	76	114	190	2.100
28	79	80	159	1.800
29	63	135	198	2.200
Total	4,313	4,618	8,931	
% of total	48%	52%	100%	

Table B.3: Number of periods each observation is interviewed - Matched with CDS

No. of Periods	Men	Women	Total	% of Total
3	69	57	126	6
4	79	84	163	7.800
5	52	74	126	6
6	55	57	112	5.300
7	46	47	93	4.400
8	51	65	116	5.500
9	46	46	92	4.400
10	55	63	118	5.600
11	48	55	103	4.900
12	51	61	112	5.300
13	45	58	103	4.900
14	47	45	92	4.400
15	50	52	102	4.900
16	47	55	102	4.900
17	37	49	86	4.100
18	41	46	87	4.100
19	25	30	55	2.600
20	28	33	61	2.900
21	27	23	50	2.400
22	22	29	51	2.400
23	20	14	34	1.600
24	21	17	38	1.800
25	12	15	27	1.300
26	11	5	16	0.800
27	9	4	13	0.600
28	8	4	12	0.600
29	6	6	12	0.600
Total	1,008	1,094	2,102	
% of total	48%	52%	100%	

Table B.4: CDS and Non-CDS sample differences

	Variable	Sex	Mean	Std.	Min	Max	No.
Non-CDS	College	Male	0.487	0.00207	0	1	58050
	Divorced		0.251	0.00180	0	1	58050
	Married		0.681	0.00193	0	1	58050
	Single		0.0676	0.00104	0	1	58050
	College	Female	0.421	0.00197	0	1	62572
	Divorced		0.267	0.00177	0	1	62572
	Married		0.667	0.00188	0	1	62572
	Single		0.0655	0.000989	0	1	62572
CDS	College	Male	0.604	0.00400	0	1	14935
	Divorced		0.122	0.00268	0	1	14935
	Married		0.803	0.00325	0	1	14935
	Single		0.0745	0.00215	0	1	14935
	College	Female	0.622	0.00391	0	1	15366
	Divorced		0.132	0.00273	0	1	15366
	Married		0.777	0.00336	0	1	15366
	Single		0.0910	0.00232	0	1	15366

Table B.5: Hours and Cost of Child Care - by marital and employment status - mothers

		Weekly Hours			Weekly Cost		
Employment Status	Proportion	Mean	SE	No.	Mean	SE	No.
		Married					
Full-time	32.27%	17.21	0.420	2155	30.61	0.944	2010
Part-time	33.83%	8.995	0.309	2259	19.71	0.827	2157
Not Working	33.90%	2.349	0.168	2264	4.341	0.351	2217
		Single					
Full-time	47.00%	13.86	0.830	509	17.71	1.364	456
Part-time	27.79%	9.832	1.035	301	12.80	1.669	283
Not Working	25.21%	4.728	0.788	273	3.072	0.698	261

Table B.6: Hours and Cost of Child Care - by marital and employment status - fathers

		Weekly Hours			Weekly Cost		
Employment Status	Proportion	Mean	SE	No.	Mean	SE	No.
		Married					
Full-time	89.72	9.322	0.202	5855	18.15	0.481	5604
Part-time	8.351	9.983	0.758	545	16.22	1.343	521
Not Working	1.931	8.540	1.786	126	11.93	3.683	119
		Single					
Full-time	69.75	10.05	1.116	302	13.97	1.692	280
Part-time	18.01	4.028	1.138	78	5.742	2.007	75
Not Working	12.24	6.840	1.966	53	10.16	4.803	48

Table B.7: Two step labour market transition patterns, women vs men (10<part-time<35)

Year t		Year t+1 Not Working	Part-time	Full-time	Row Totals
			Women		
Not Working	% of total	25.72	5.072	1.420	32.22
	% of row	79.85	15.74	4.406	
	No.	14,261	2,812	787	17,860
Part-time	% of total	4.784	14.96	7.295	27.04
	% of row	17.69	55.34	26.97	
	No.	2,652	8,296	4,044	14,992
Full-time	% of total	1.360	6.708	32.67	40.74
	% of row	3.338	16.47	80.20	
	No.	754	3,719	18,114	22,587
Column Totals		31.87	26.74	41.39	100.00
			Men		
Not Working	% of total	1.088	0.541	0.480	2.109
	% of row	51.60	25.66	22.74	
	No.	531	264	234	1,029
Part-time	% of total	0.660	3.505	5.630	9.794
	% of row	6.738	35.78	57.48	
	No.	322	1,710	2,747	4,779
Full-time	% of total	0.553	5.322	82.22	88.10
	% of row	0.628	6.042	93.33	
	No.	270	2,597	40,118	42,985
Column Totals		2.30	9.37	88.33	100.00

Table B.8: Two step labour market transition patterns, women vs men (10<part-time<30)

Year t		Year t+1 Not Working	Part-time	Full-time	Row Totals
			Women		
Not Working	% of total	25.72	4.464	2.027	32.22
	% of row	79.85	13.86	6.293	100
	No.	14,261	2,475	1,124	17,860
Part-time	% of total	4.192	8.970	6.236	19.40
	% of row	21.61	46.24	32.15	100
	No.	2,324	4,973	3,457	10,754
Full-time	% of total	1.952	5.662	40.77	48.39
	% of row	4.034	11.70	84.26	100
	No.	1,082	3,139	22,604	26,825
Column Totals		31.87	19.1	49.04	100.00
			Men		
Not Working	% of total	1.088	0.434	0.586	2.109
	% of row	51.60	20.60	27.79	
	No.	531	212	286	1,029
Part-time	% of total	0.525	1.601	3.730	5.855
	% of row	8.960	27.34	63.70	
	No.	256	781	1,820	2,857
Full-time	% of total	0.689	3.589	87.76	92.04
	% of row	0.748	3.899	95.35	
	No.	336	1,751	42,820	44,907
Column Totals		2.30	5.62	92.07	100.00

Table B.9: Two step labour market transition patterns, women vs men (10<part-time<37)

Year t		Year t+1 Not Working	Part-time	Full-time	Row Totals
			Women		
Not Working	% of total	25.72	5.251	1.241	32.22
	% of row	79.85	16.30	3.852	
	No.	14,261	2,911	688	17,860
Part-time	% of total	4.971	17.68	7.711	30.36
	% of row	16.38	58.22	25.40	
	No.	2,756	9,799	4,275	16,830
Full-time	% of total	1.172	7.172	29.08	
	% of row	3.133	19.16	77.70	37.43
	No.	650	3,976	16,123	20,749
Column Totals		31.86	30.10	38.03	100.00
			Men		
Not Working	% of total	1.088	0.570	0.451	2.109
	% of row	51.60	27.02	21.38	
	No.	531	278	220	1,029
Part-time	% of total	0.709	4.974	6.398	12.08
	% of row	5.869	41.17	52.96	
	No.	346	2,427	3,122	5,895
Full-time	% of total	0.504	6.105	79.20	85.81
	% of row	0.588	7.115	92.30	
	No.	246	2,979	38,644	41,869
Column Totals		2.30	11.65	86.05	100.00

Table B.10: Three step labour market transition patterns, women (10<part-time<35)

Year t & t+1		Year t+2 Not Working	Part-time	Full-time	Row Totals
Not working,Not working	% of total	22.06	3.396	0.690	26.15
	% of row	84.37	12.99	2.640	
	No.	11088	1707	347	13142
Not working,Part-time	% of total	1.484	2.537	1.176	5.197
	% of row	28.56	48.81	22.63	
	No.	746	1275	591	2612
Not working,Full-time	% of total	0.209	0.388	0.840	1.437
	% of row	14.54	27.01	58.45	
	No.	105	195	422	722
Part-time,Not working	% of total	3.108	1.301	0.414	4.823
	% of row	64.44	26.98	8.581	
	No.	1562	654	208	2424
Part-time,Part-time	% of total	2.000	9.789	3.116	14.90
	% of row	13.42	65.68	20.91	
	No.	1005	4920	1566	7491
Part-time,Full-time	% of total	0.374	1.966	4.970	7.310
	% of row	5.117	26.89	67.99	
	No.	188	988	2498	3674
Full-time,Not working	% of total	0.754	0.334	0.219	1.307
	% of row	57.69	25.57	16.74	
	No.	379	168	110	657
Full-time,Part-time	% of total	1.168	2.730	2.698	6.596
	% of row	17.71	41.39	40.90	
	No.	587	1372	1356	3315
Full-time,Full-time	% of total	0.734	4.250	27.29	32.28
	% of row	2.275	13.17	84.56	
	No.	369	2136	13717	16222
Column Totals		31.89	26.69	41.42	100.00

Table B.11: Three step labour market transition patterns, men

Year t & t+1		Year t+2 Not Working	Part-time	Full-time	Row Totals
Not Working,Not Working	% of total	0.708	0.152	0.0863	0.947
	% of row	74.82	16.07	9.113	100
	No.	312	67	38	417
Not Working,Part-time	% of total	0.0795	0.204	0.234	0.518
	% of row	15.35	39.47	45.18	100
	No.	35	90	103	228
Not Working,Full-time	% of total	0.0227	0.0817	0.370	0.475
	% of row	4.785	17.22	77.99	100
	No.	10	36	163	209
Part-time,Not Working	% of total	0.204	0.236	0.127	0.568
	% of row	36	41.60	22.40	100
	No.	90	104	56	250
Part-time,Part-time	% of total	0.238	1.548	1.560	3.347
	% of row	7.123	46.27	46.61	100
	No.	105	682	687	1474
Part-time,Full-time	% of total	0.104	1.010	4.493	5.608
	% of row	1.862	18.02	80.12	100
	No.	46	445	1979	2470
Full-time,Not Working	% of total	0.143	0.114	0.204	0.461
	% of row	31.03	24.63	44.33	100
	No.	63	50	90	203
Full-time,Part-time	% of total	0.325	1.551	3.245	5.120
	% of row	6.341	30.29	63.37	100
	No.	143	683	1429	2255
Full-time,Full-time	% of total	0.434	4.101	78.42	82.96
	% of row	0.523	4.943	94.53	100
	No.	191	1806	34540	36537
Column Totals		2.26	9	88.74	100.00

Table B.12: Differential Returns to Hourly Experience, Part-time Specification

	Log Hourly Wages		
	10<part<30	10<part<35	10<part<37
	b/t	b/t	b/t
TotalExper(Hour)	0.000088***	0.000089***	0.000089***
	40.24	39.19	38.36
PartExper(Hour)	-0.000075***	-0.000042***	-0.000033***
	-6.42	-5.96	-5.07
TotalExper^2	-0.000000***	-0.000000***	-0.000000***
	-23.26	-22.95	-22.63
PartExper^2	0.000000***	0.000000***	0.000000***
	5.61	6.56	5.36
College	0.399***	0.405***	0.407***
	16.43	16.62	16.68
Constant	0.563***	0.552***	0.544***
	23.28	23.19	22.89
R^2	0.425	0.423	0.422
No. of cases	30585	30585	30585

Source: PSID - t-statistics are reported

Table B.13: The differnetial impact of part-time experience on wages (Women)

	Log Hourly Wages		
	10<part<30	10<part<35	10<part<37
	b/t	b/t	b/t
TotalExper(Hour)	0.000104***	0.000104***	0.000103***
	27.93	25.89	24.52
PartExper(Hour)	-0.000040**	-0.000019*	-0.000012
	-2.97	-2.18	-1.49
TotalExper^2	-0.000000***	-0.000000***	-0.000000***
	-15.07	-14.41	-14.01
PartExper^2	0.000000***	0.000000***	0.000000**
	3.95	4.09	3.03
College	0.341***	0.342***	0.344***
	12.40	12.40	12.45
Constant	0.369***	0.361***	0.355***
	14.62	14.85	14.70
R^2	0.387	0.387	0.386
No. of cases	18965	18965	18965

Source: PSID - t-statistics are reported

Table B.14: The differnetial impact of part-time experience on wages (Men)

	Log Hourly Wages		
	10<part<30	10<part<35	10<part<37
	b/t	b/t	b/t
TotalExper(Hour)	0.000054*	0.000054*	0.000054*
	26.31	26.02	25.59
PartExper(Hour)	0.000036	0.000000	-0.000013
	1.04	0.78	-0.91
TotalExper^2	-0.000000*	-0.000000*	-0.000000*
	-14.85	-14.81	-14.67
PartExper^2	-0.000000*	-0.000020	0.000000
	-2.03	-1.16	0.89
College	0.390*	0.394*	0.397*
	9.42	9.22	9.27
Constant	1.107*	1.117*	1.112*
	28.23	27.26	27.15
R^2	0.332	0.327	0.326
No. of cases	11620	11620	11620

Source: PSID - t-statistics are reported

Figure B.1: Year of Birth of Children in CDS

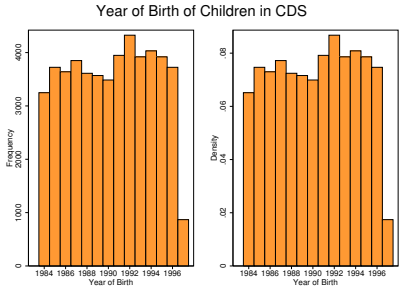


Figure B.2: Part-time employment, men vs women

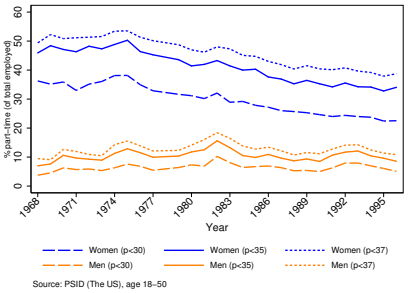


Figure B.3: Part-time employment, men vs women

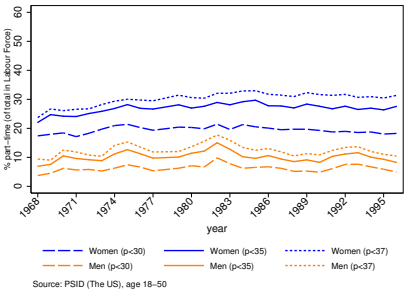


Figure B.4: Employment around the time of first birth - Women

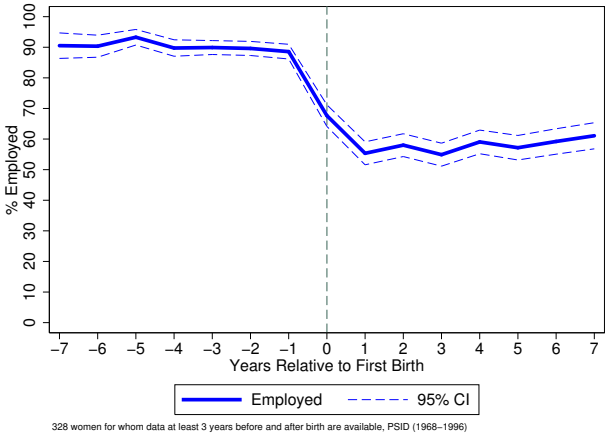


Figure B.5: Part-time employment around the time of first birth -Women

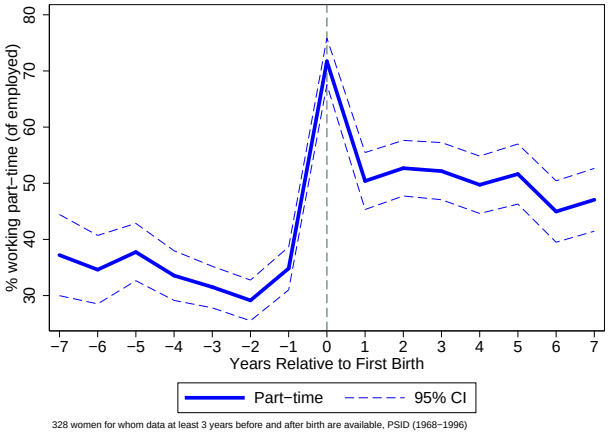


Figure B.6: Part-time employment around the time of first birth - Women

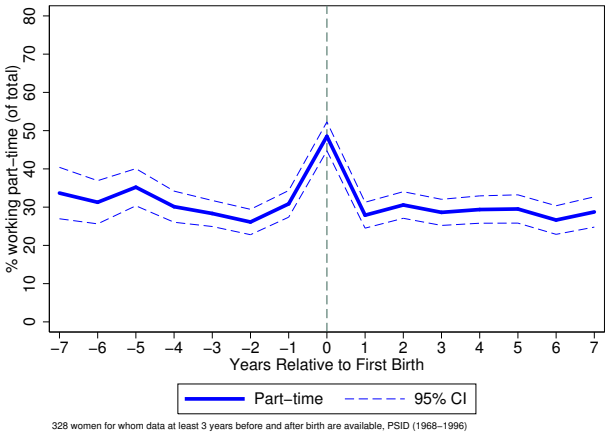


Figure B.7: Employment around the time of first birth - Men

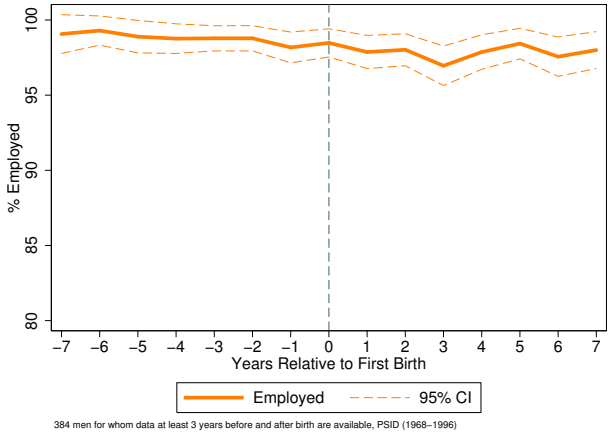


Figure B.8: Part-time employment around the time of first birth - Men

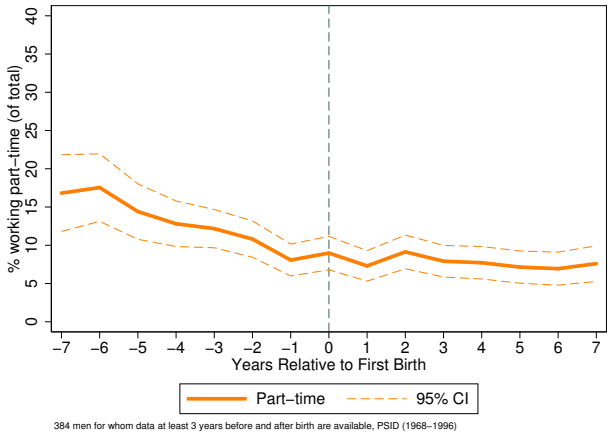


Figure B.9: Hourly Cost of Child Care of Mothers - by employmnet status and child's age

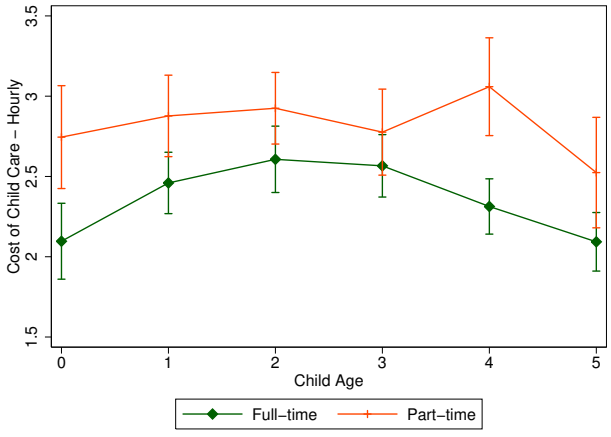


Figure B.10: Hourly Cost of Child Care of Mothers - by marital status and child's age

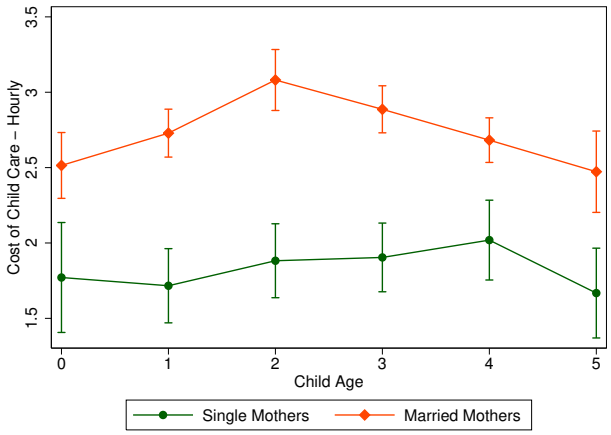


Figure B.11: Log hourly wage differentials by working hours

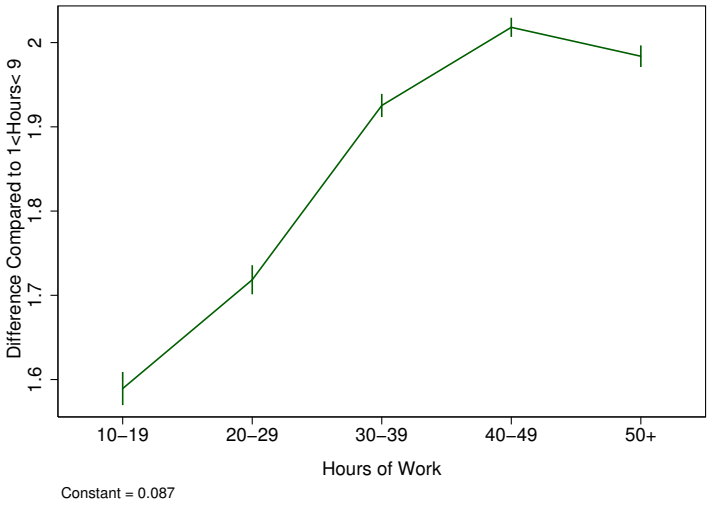


Figure B.12: Log hourly wage differentials by working hours

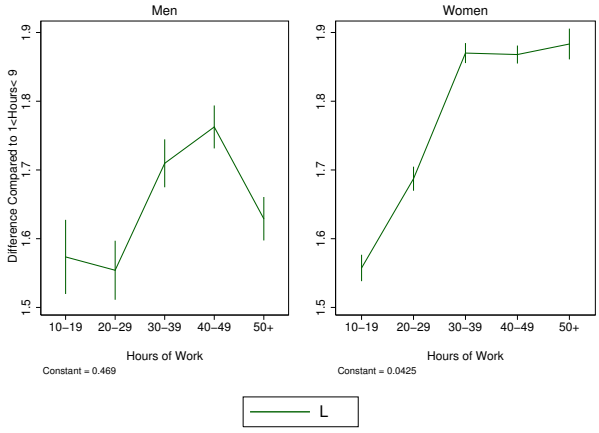


Figure B.13: Average Child's Age, by Arrangements

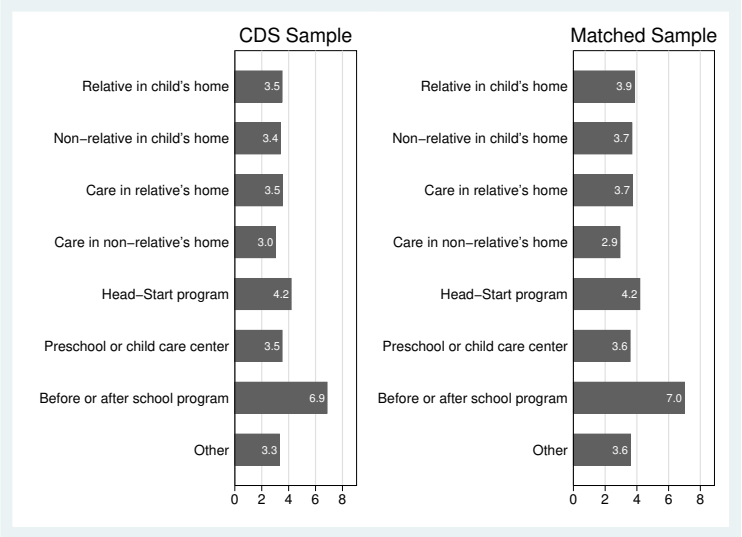


Figure B.14: Average Weekly Cost, by Arrangements

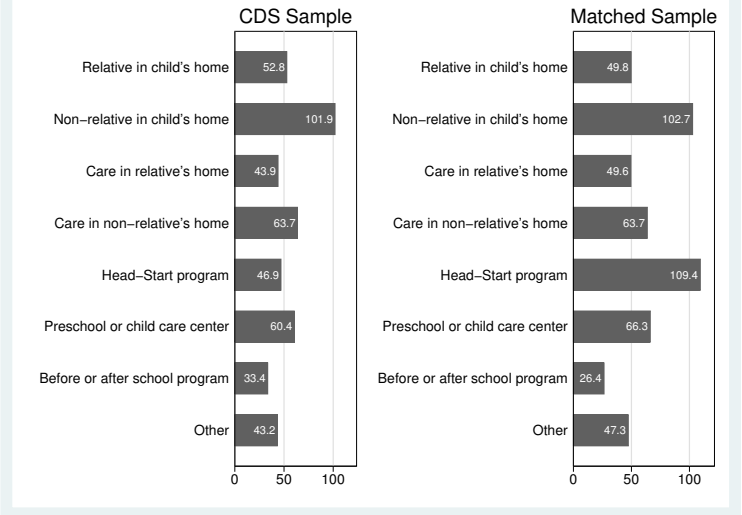


Figure B.15: Average Weekly Hours, by Arrangements

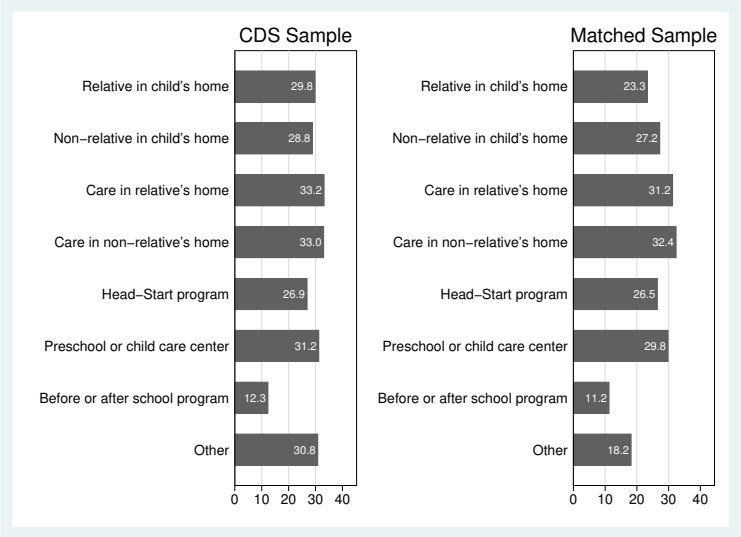


Figure B.16: Average Child's Age, by Arrangements and Year

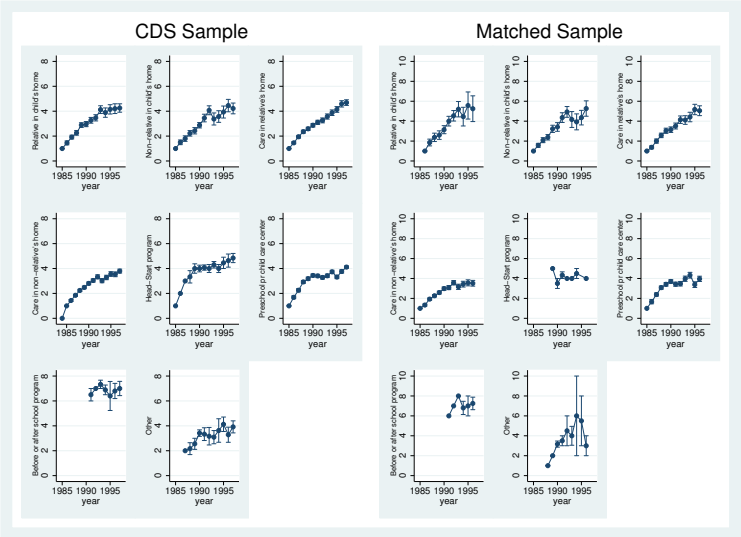


Figure B.17: Average Weekly Cost, by Arrangement and Year

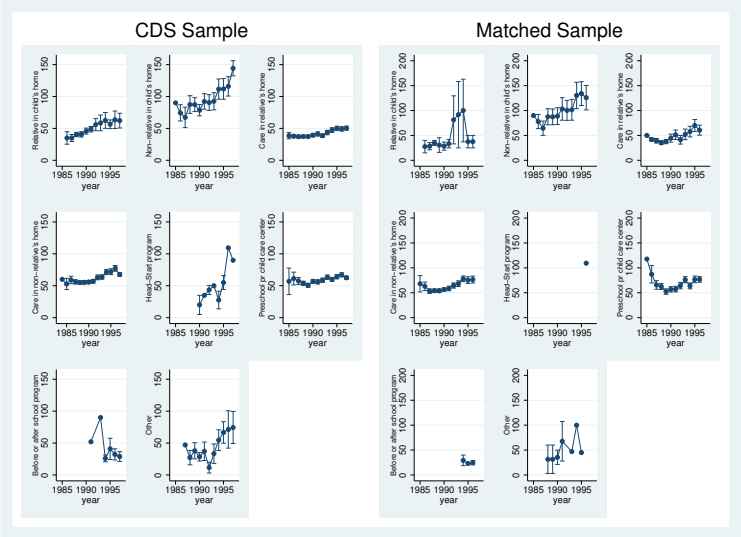
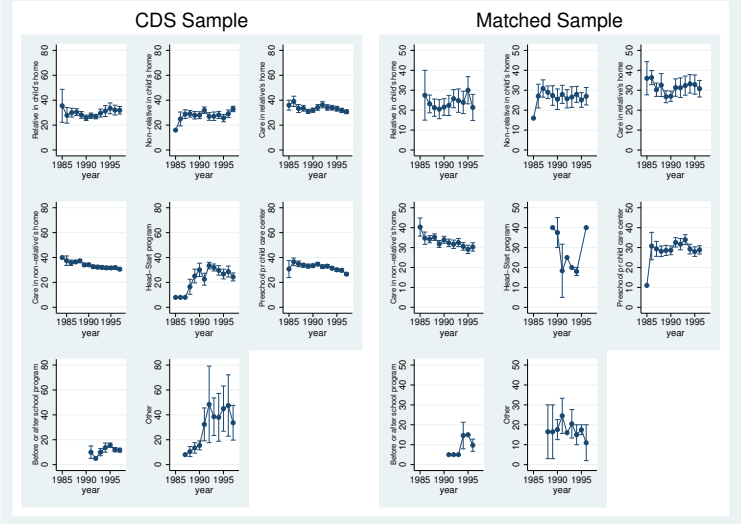


Figure B.18: Average Weekly Hours, by Arrangement and Year



C Model Fit

Figure C.1: Employment Rate - Single Women - No child

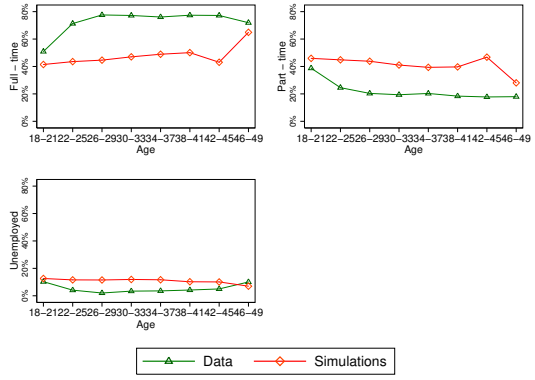


Figure C.2: Employment Rate - Single Mothers

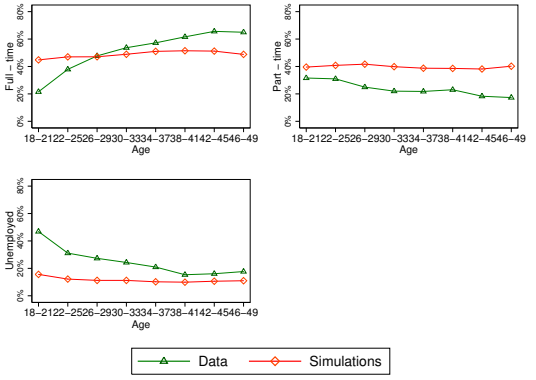


Figure C.3: Employment Rate - Married Women - No child

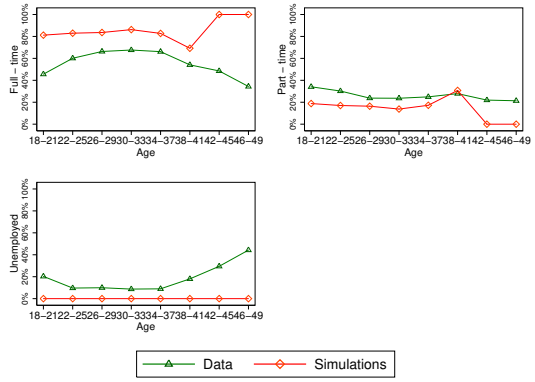


Figure C.4: Employment Rate - Married Mothers

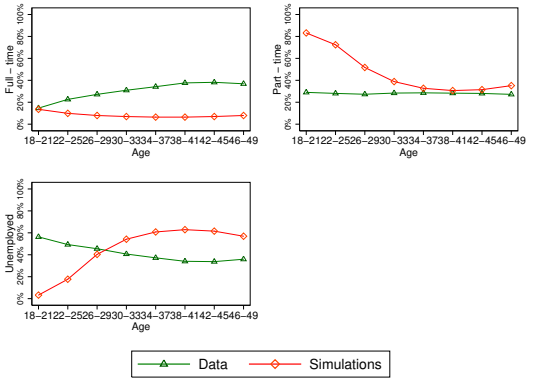


Figure C.5: Employment Rate - Single Women - No College

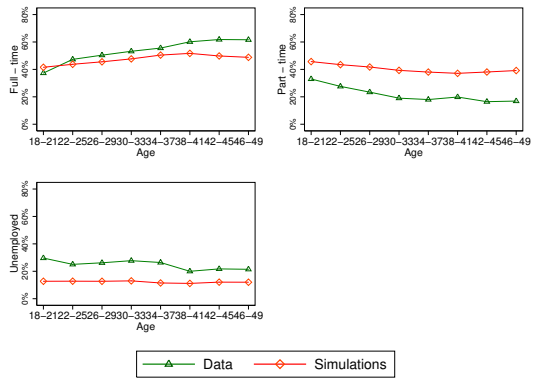


Figure C.6: Employment Rate - Single Women - College

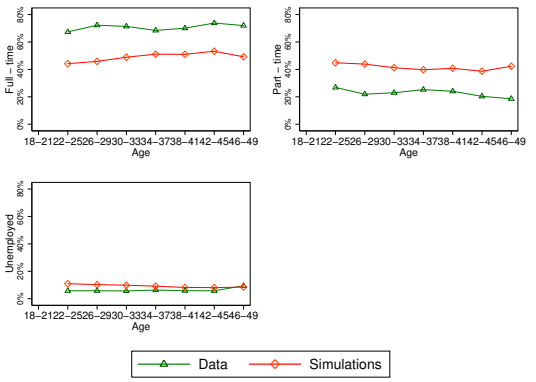


Figure C.7: Employment Rate - Married Women - No College

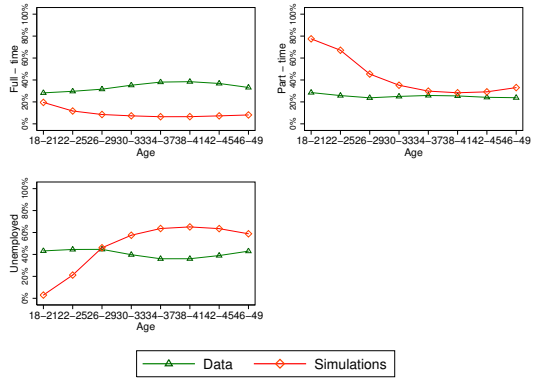


Figure C.8: Employment Rate - Married Women - College

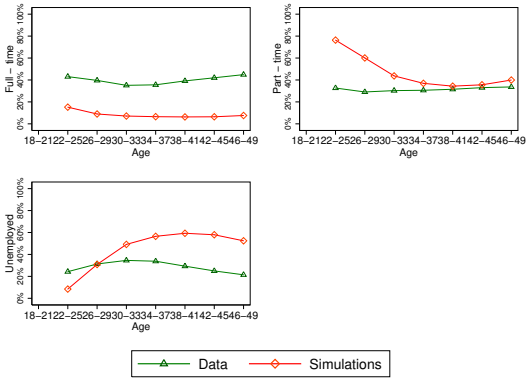


Figure C.9: Log hourly wage - by education and employment status - women

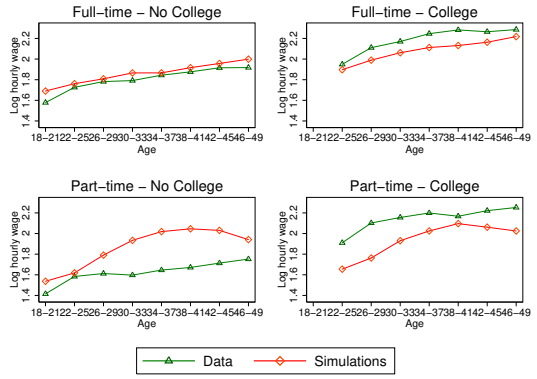


Figure C.10: Log hourly wage by employment status and education - women

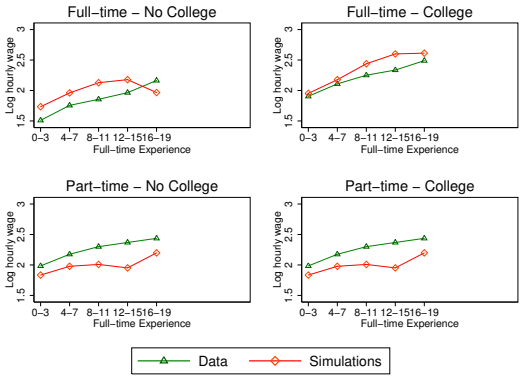


Figure C.11: Log hourly wage by employment status and education - women

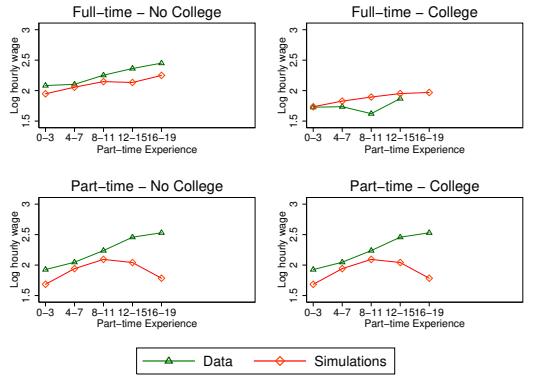


Figure C.12: Female employment rates - by experience

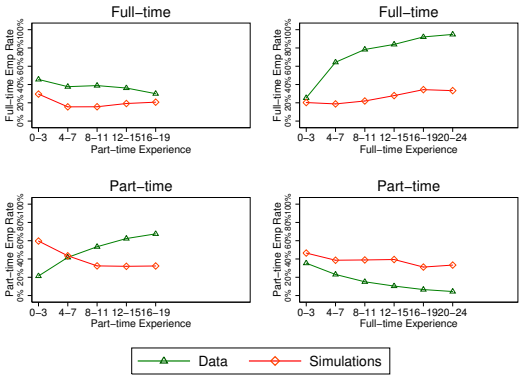


Figure C.13: Log hourly wage by education - Men

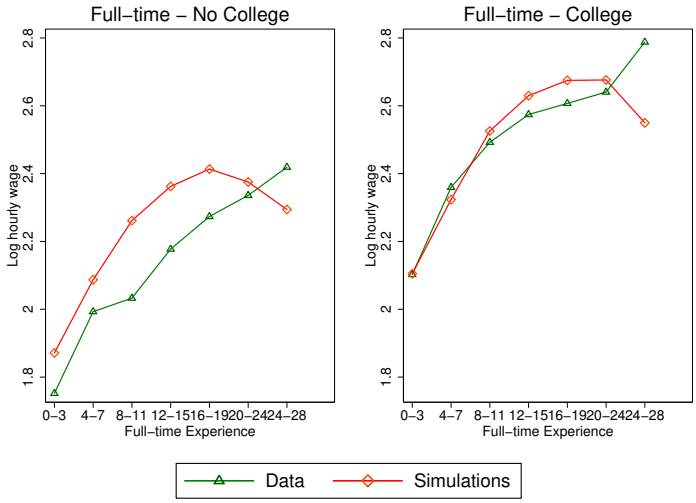


Figure C.14: Log hourly wage by marital status - Men

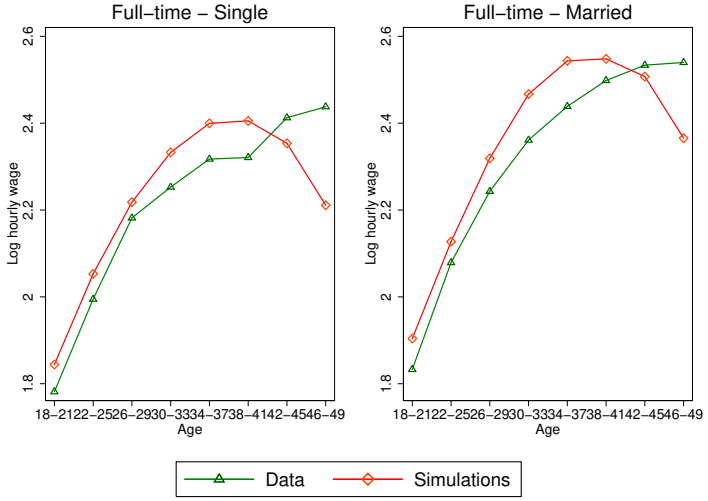


Figure C.15: Log hourly wage by marital status - women

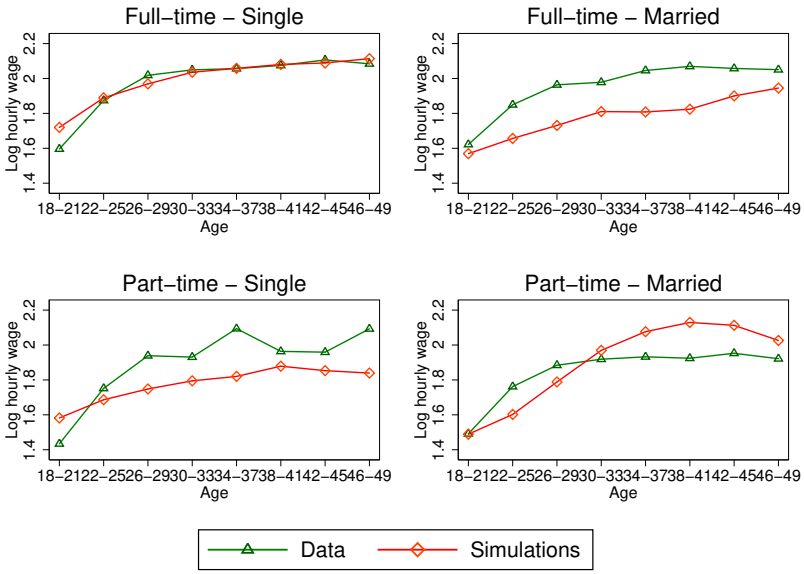


Figure C.16: Log Daily Income from Employment

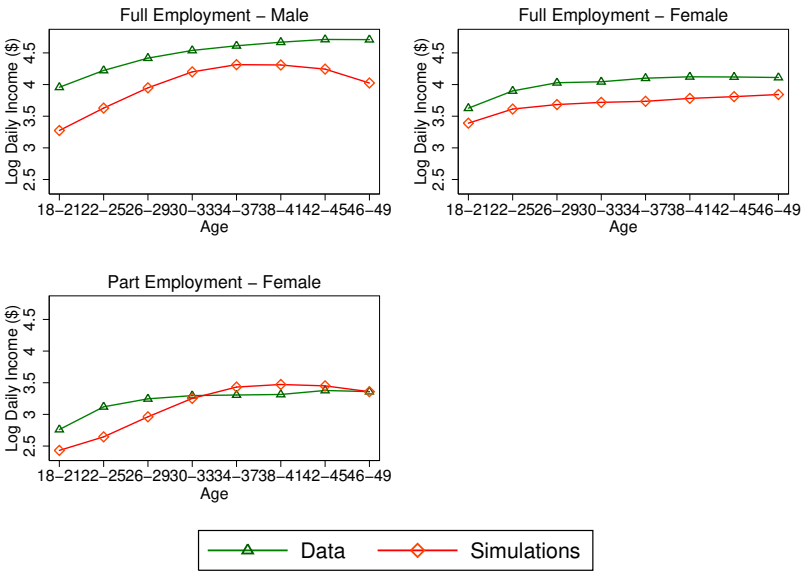


Figure C.17: Fraction Married - by gender

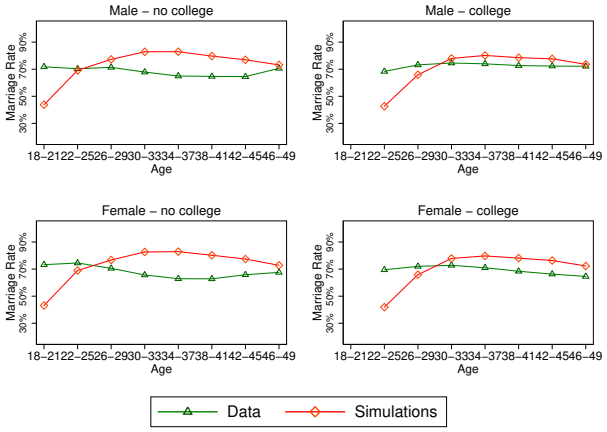


Figure C.18: Fraction Divorced - by gender

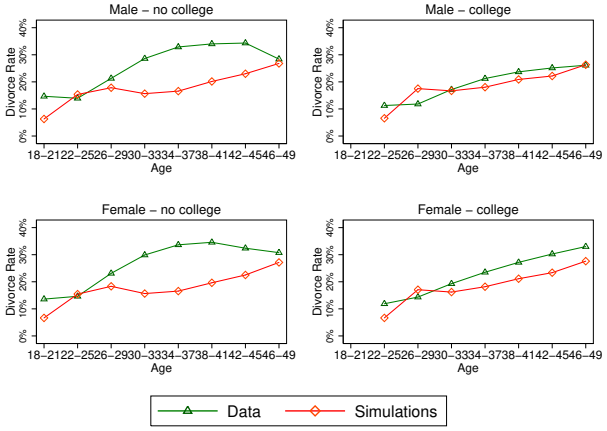


Figure C.19: Fraction Having Kids - by marital status

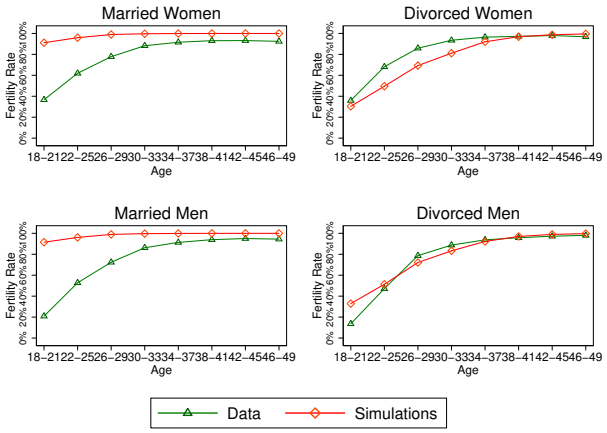


Table C.1: Child Care Hours - by gender and marital status

Gender	Marital Status	Labour Hours	CChours	Simulations	Data
Women	Single	Full-time	No CCare	0.815	0.247
			Part-time	0.166	0.351
			Full-time	0.020	0.403
		Part-time	No CCare	0.810	0.364
			Part-time	0.172	0.455
			Full-time	0.019	0.182
		Unemployed	No CCare	0.934	0.674
			Part-time	0.058	0.281
			Full-time	0.007	0.045
Men	Single	Full-time	No CCare	0.816	0.439
			Part-time	0.165	0.394
			Full-time	0.019	0.168
Women	Married	Full-time	No CCare	0.322	0.213
			Part-time	0.439	0.370
			Full-time	0.240	0.418
		Part-time	No CCare	0.319	0.401
			Part-time	0.439	0.489
			Full-time	0.243	0.110
		Unemployed	No CCare	0.316	0.753
			Part-time	0.439	0.221
			Full-time	0.245	0.025

Table C.2: Log Daily Child Care Cost - by gender and marital status

Gender	Marital Status	Labour Hours	CChours	Simulations	Data
Women	Single	Full-time	Part-time	2.809	1.903
			Full-time	2.732	2.369
		Part-time	Part-time	2.806	1.648
			Full-time	2.729	2.424
		Unemployed	Part-time	2.526	1.468
			Full-time	2.539	2.130
Men	Single	Full-time	Part-time	2.809	1.824
			Full-time	2.732	2.629
Women	Married	Full-time	Part-time	3.422	2.075
			Full-time	3.305	2.564
		Part-time	Part-time	3.423	2.061
			Full-time	3.304	2.597
		Unemployed	Part-time	3.420	1.448
			Full-time	3.303	2.346

Table C.3: Log Daily Income - by hours of child care, gender, and marital status

Gender	Marital Status	CChours	Simulations	Data
Male	Single	No CCare	4.541	3.245
		Part-time	4.540	3.642
		Full-time	4.538	3.290
Female		No CCare	3.168	1.468
		Part-time	3.570	2.420
		Full-time	3.595	3.510
Male	Married	No CCare	4.583	4.319
		Part-time	4.581	4.436
		Full-time	4.581	4.305
Female		No CCare	2.555	1.287
		Part-time	2.538	2.829
		Full-time	2.518	3.779

D Policy Experiments

Figure D.1: Fraction Having Kids - by marital status

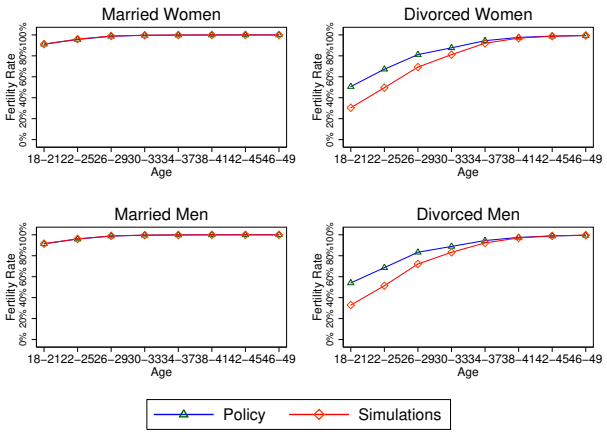


Figure D.2: Employment Rate - Single Women - No child

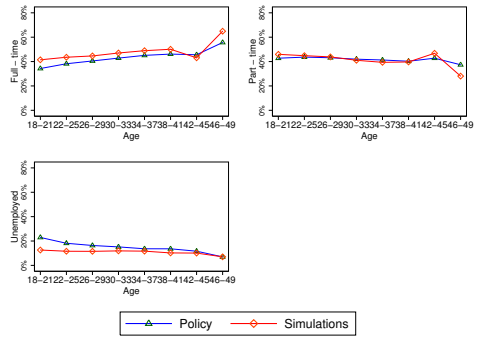


Figure D.3: Employment Rate - Single Mothers

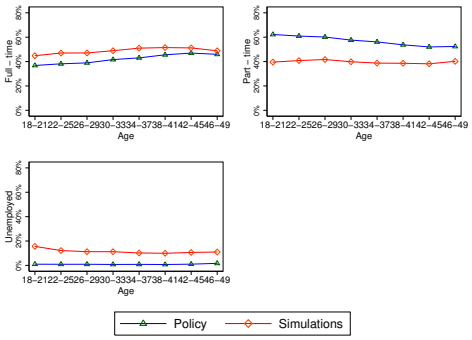


Figure D.4: Employment Rate - Married Women - No child

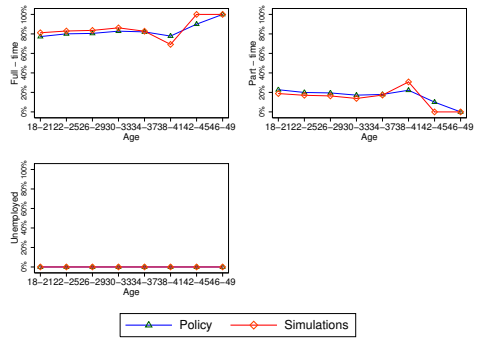


Figure D.5: Employment Rate - Married Mothers