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# Career Mobility Patterns of Public School Teachers

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**Abstract.-** One issue that has pervaded policy discussions for decades is the difficulty that school districts experience in retaining teachers. Almost a quarter of entering public school teachers leave teaching within the first three years and empirical evidence has related high attrition rates of beginner teachers to family circumstances, such as maternity or marriage. I examine female teachers' career choices and inquire about the effects that wage increases and child care subsidies have on their employment decisions. I set up a dynamic model of job search where individuals simultaneously make employment and fertility decisions, fit it to data from a national longitudinal survey and estimate it by Simulated Method of Moments. Estimates indicate that gains of exiting the teaching workforce to start a family vary between 75% and 88% of the average teaching wage if the exit occurs during the first five years. At late periods and provided a positive stock of children, nonpecuniary penalties to return to teach lie between one and two times the average teaching wage. A 20 percent raise in teaching wages increases retention by 14% and decreases the proportion of teachers giving birth by 50%. Results suggest that fertility changes occur not only at earlier periods but also after a career interruption when teachers are considering a returning decision. The effectiveness of the wage policy in attracting back to the field individuals who left teaching to enroll in nonteaching jobs is positively associated with the greatest impact that the policy has on fertility in nonteaching. Child care subsidies increase retention by 11% and 29% with the lowest and highest subsidy, respectively. New births are concentrated at earlier periods of teachers' careers and thus, generate longer first teaching spells. However, large nonpecuniary rewards at late periods of the non labor market alternative relative to being in teaching as well as exits out of the workforce concentrated at later periods lead the decrease of returning rates of teachers who dropped the workforce altogether.

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**JEL Classification:** J13, J44, J45, C61.

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# 1 Introduction

One particular issue that has pervaded policy discussions for decades is the difficulty that school districts experience in retaining teachers. Almost a quarter of entering public school teachers leave teaching within the first three years (Keigher, 2010). Empirical evidence has related high attrition rates of beginner teachers to family circumstances, such as maternity and marriage.[1] This is consistent with the reality that women account for approximately 76% of the national public teaching force (NCES, 2012) and that teachers can reentry the sector after a career interruption without suffering a wage loss.[2] These demographic and institutional features have two important implications. First, the option of leaving the workforce may be especially appealing for those in the teaching occupation. Second, family size variables acquire an influential role in determining employment decisions. As stated by Flyer and Rosen (1997), Stinebrickner (1998, 2001a,b, 2002) and Stinebrickner et al. (2006), those with a bigger taste for spending time with their children are not only more likely to leave the workforce when they start a family, but also to select teaching as a profession.

Despite it is well established that family formation variables play an important role in explaining teachers' career choices, there is no study that jointly models teachers' labor market and fertility decisions. In this paper, I fill this gap by specifying and estimating a dynamic model of individual decision-making that endogenously accounts for fertility and that is conducive for simulating the effects that potential wage changes and child care subsidies would have on female teachers' employment decisions. By allowing fertility and labor supply be jointly determined, the model considers an extra effect on labor supply that previous studies did not take into account. The additional effect comes from the impact of both policies on fertility choices, which in turn affects labor-force attachment to the teaching sector. I find that wage policies have a negative effect on fertility, and thus increase retention through lower attrition rates and higher returning rates. On the other hand, child care subsidies

[1] In this paper, I refer to attrition as voluntary separations from the entire public school system. While movements of teachers across schools or districts represent attrition from individual schools or districts, it does not correspond to teachers leaving the teaching profession entirely. Similarly, most attrition from teaching is voluntary given widespread tenure rates and the prevalence of unionized grievance policies regarding termination.

[2] While teaching is not the only female-dominated occupation, it is the only large occupation consistent mainly of public employees, and as a result, teaching pay has a rigid structure depending only on teaching experience and post bachelor education levels.

have a positive effect on fertility and increase the first teaching spell as more births occur at earlier periods of their careers.

Another way the present paper differs from previous works is that it offers a different approach to understand teachers' retention. While most efforts have been focused on examining the length of the first teaching spell, I think of retention as a joint outcome of attrition and returning decisions.[3] Therefore, through this paper, I quantify the impact of regime changes on both attrition and returning rates. My results show that the effectiveness of higher wages in attracting former teachers who left teaching to enroll in nonteaching jobs responds to the greatest impact that this policy has in reducing births in the nonteaching sector. On the other hand, child care subsidies yield longer first teaching spells, especially for those who dropped the workforce entirely. Although attrition rates focused at later periods partially explain why fewer returners are observed,[4] results suggest that large nonpecuniary rewards outside the workforce relative to being in teaching keep teachers away from public schools at later periods.

The impending shortfall of teachers that attrition creates would force many of the nation's school systems to lower standards to fill the increasing number of teaching openings, inevitably resulting in a less qualified teaching force and lower school performance. Teacher attrition may affect student learning in several ways. First, in high-turnover schools, students may be more likely to have inexperienced teachers who are less effective on average (Rockoff, 2004; Rivkin et al., 2005; Kane et al., 2006). Second, high turnover creates instability in schools, making it more difficult to have coherent instruction.[5] Third, high turnover can be costly in that time and effort is needed to continuously recruit teachers.

In an attempt to quantify attrition costs, Milanowski and Odden (2004) signal that every time a school district loses an experienced teacher with two or more years of experience and is forced to hire a novice teacher, the students assigned to the novice teacher over the first two years of their career lose roughly 0.10 standard deviation in student achievement. Based on this result and using the estimations of the value of a one standard deviation gain in math

[3]Given that institutional arrangements facilitate reentry to the sector, whether certified teachers will be adequate depends on both the length of time that new entrants stay in the classroom and the percentage of teachers who return to teaching after a career interruption.

[4]Longer first teaching spells reduce the likelihood of former teachers to be observed back to the field.

[5]This instability may be particularly problematic in schools trying to implement reforms, as new teachers coming in each year are likely to repeat mistakes, rather than improve upon reform implementation.

that Kane and Staiger (2002) present in their work, Staiger and Rockoff (2010) conclude that the monetary value of the loss in student achievement outweighs the direct hiring costs.

Not only are teachers central to promoting student achievements, but their compensation represents an important portion of the national investment in public education. According to the work by Speakman et al. (1996) and Guthrie and Rothstein (1999), in a typical school district, wages account for at least half of the expenditures.

Previous research has established that a strong, positive relationship exists between teacher pay and the length of time that a person remains in his/her first teaching job.[6] Although some studies suggest that child care provision may have significant positive effects on retention, potential initiatives have not been empirically tested. Stinebrickner's (2001b) estimates indicate that this would not be a cost-effective policy given the large effect that children have on nonpecuniary utility of teachers. According to his estimates, a female teacher with a single child would have to receive a pay rise of approximately 60 percent to keep her utility from teaching relative to not working, the same as it would be if she had no children. Frijters et al. (2004) and Stinebrickner et al. (2006) also mention a day care subsidy for women with young children as a policy alternative but rely on Stinebrickner's (2001b) results to conclude that this may not be a cost-effective policy.

Relatively few studies have examined former teachers' reentrance into the public school workforce. Those that have analyzed the issue have used "teacher-specific" data that were constructed from administrative records of a particular state or school district and, as a result, contained no information about the labor force status of individuals after they left teaching, or family formation variables.[7] Murnane et al. (1988) found that the percentage of Michigan returner teachers varies from 28% to 31% and is higher for younger women. Kirby et al. (1991) reported returning rates for teachers in Indiana of 30% of new hires. Using data for the state of Michigan, Beaudin (1993) found that teachers with subjects area specialties that provide limited opportunities for better paying employment outside of public schools, teachers who have more than two years of experience and a master's degree, and

[6]See Murnane and Olsen (1989, 1990),Gritz and Theobald (1996), Stinebrickner (1998) and Dolton and van der Klaauw (1999) for an examination of the issue in reduced-form models and van der Klaauw (2012), Stinebrickner (1998, 2001a,b) for an overview of teacher attrition in a dynamic setting.

[7]An exception is Stinebrickner (2002) who used longitudinal data and reported returning rates between 23% and 40%. He also found teachers' returning rates do not differ substantially by the exit reason and are lower than returning rates for nonteachers.

those who interrupted their careers at an older rather than at younger age are more likely to return. Grissmer and Kirby (1997) performed a descriptive analysis of National Center for Education Statistics data and found that during the 1980s returning teachers composed about 40 percent of all entering teachers.

I construct a dynamic model where individuals jointly make employment and fertility decisions. Data on wages, employment and fertility choices allow the model to separately identify how wages and nonpecuniary utility in the various options affect labor market decisions. With this framework, I generate predicted life-cycle trajectories and distributions for employment status, wages, and fertility that match the observed ones. The behavioral parameters of the model are recovered through the Simulated Method of Moments using data from a general longitudinal survey of high school graduates.

The remainder of this paper is set out as follows. Section 2 introduces the data and describes the salient characteristics of the sample. The model and estimation methodology are outlined in sections 3 and 4 with a discussion of the estimation results being provided in section 5. Section 6 evidences the model fit. Section 7 simulates the two policy experiments and section 8 concludes.

# 2 Data

The data come from the National Longitudinal Study of the High School Class of 1972 (NLS-72). This survey collects longitudinal data on post-secondary educational activities of a sample of high school seniors who graduated in 1972. The first wave was completed in 1972. Follow up surveys were taken in 1973, 1974, 1976, 1979 and 1986. For each person the survey contains detailed information about work experience, education, marriage and fertility decisions. Individuals who had teaching experience or were certified to teach in elementary or secondary schools were sent a Teaching Supplement questionnaire which asked questions about their teaching experiences. This specific questionnaire applied to teachers has been relevant to identify the final sample and to construct job and personal histories. Given that teachers were oversampled in the survey design, the NLS-72 provides a valuable source for the study of teachers' mobility patterns.

Considering the importance of females in the teaching occupation and given that males

respond different than females to family formation variables,[8] the final sample consists of 391 female teachers.[9]

Since this paper focuses on career choices after certification and most individuals spent four years after high school in training courses to be certified, the final data set contains between one and eleven years of information for every individual. Most individuals are observed ten or fewer years, only those who spent three years in college are observed eleven years.

Table 1 presents descriptive statistics of the final sample and indicators of exits and returns.[10]The proportion of female teachers with a break in their careers is 61% and the main exit reason is to drop the workforce altogether (69% of leavers drop the workforce altogether and the remaining 31% leave her teaching job to work in the nonteaching sector).[11]

On average, a career interruption occurs after 3.20 years of teaching experience. The length of time becomes 2.55 years if the exit reason is to enroll in the nonteaching sector, and 3.49 years if the exit reason is to drop the workforce altogether. Regarding family-size variables, 17% of teachers who leave the field have at least one child at exiting time. The percentage of departing teachers with children at exiting time is 9% and 20% for exits to nonteaching and out of the workforce, respectively.

Table 1 shows that 36% of departing teachers return at some point to a teaching job.[12] Returner teachers stay out of teaching in average 1.95 years and 30% of them give birth to new children at least once during career interruption. At returning time, 42% of them have at least one child.

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[8]Stinebrickner (2001a) found that whereas the participation rate in nonteaching occupations remains largely unchanged for the female sample between the years when the teaching participation declines, it increases significantly for the male sample, suggesting that a large increase in the proportion of women who are out of the workforce plays a more important role in their declining teaching participation rate whereas the large increase in male teachers who start a nonteaching job explains the decrease in the male teaching participation rate.

[9]The sample of teachers was constructed in the following way: among the 750 individuals who responded all waves and the Teaching Supplement, who became certified to teach and who said in the Teaching Supplement they have had some teaching experience, 137 were dropped because they had some missing data which made impossible to construct work and personal histories. From the remaining, 82 records were dropped because they did not have teaching experience after certification. 73.63% of the remaining sample are female. Therefore, the final sample consist of 391 female teachers.

[10]People are considered to be"working" if they work more than 20 hours a week. Thus, the "out of the workforce" designation includes individuals who are working fewer than 20 hours a week.

[11]The exit reason is determined by the person's activity in the period after departure.

[12]The return event has been characterized as the observance of individuals who interrupted their careers and were seen later at a teaching job (not necessarily the same school or school district).

# 3 The Dynamic Model

Each individual has a finite decision horizon beginning the year after they get certified and exogenously ending 40 periods later. At the beginning of each school year, a particular female teacher seeks to maximize her expected lifetime utility by choosing (i) an exclusive employment alternative, $j_t = 0$ (not to work),[13]1 (to work in a teaching job), or 2 (to work in a nonteaching job) and (ii) whether she has a child ($b_t = 1$) or not ($b_t = 0$). Let $d$ denote the available alternatives: $d = 1$ if she has a teaching job and doesn't give birth; $d = 2$ if she has a teaching job and gives birth; $d = 3$ if she has a nonteaching job and doesn't give birth; $d = 4$ if she has a nonteaching job and gives birth, $d = 5$ if she is out of the workforce and doesn't give birth, and $d = 6$ if she is out of the workforce and gives birth.

The law of motion for the number of children is:

$$\begin{aligned} k_{t+1} &= k_t + b_t \quad \text{if} \quad 0 \leq k_t \leq 2 \quad \text{and,} \\ &= 3 \quad \text{if} \quad k_t = 3, \end{aligned} \tag{1}$$

where $k_t$ represents the number of children at the beginning of period $t$. Equation (1) captures the idea that the maximum number of children allowed in the model is three. Therefore, the number of mutually exclusive alternatives from which she can choose every period depends on the stock of children at the beginning of every period. If $k_t < 3$, she can choose from alternatives $d = 1, 2, 3, 4, 5, 6$ whereas if $k_t = 3$, she can only choose from alternatives $d = 2, 4, 6$.

The set of available employment options in a given year depends on the person's employment status in the previous year. If in $t-1$ the individual is employed as a teacher, in $t$ she has the option of returning to the previously held job and also receives a new nonteaching job offer drawn from a wage offer distribution $F^N(.), (x^N \in (\underline{\omega}^N, \overline{\omega}^N), 0 < \underline{\omega}^N < \overline{\omega}^N < \infty)$. Likewise, if in $t-1$ the person is employed in a nonteaching job, in $t$ she has the option of returning to the previously held job and also receives a new teaching job offer drawn from a different wage offer distribution $F^E(.)(x^E \in (\underline{\omega}^E, \overline{\omega}^E), 0 < \underline{\omega}^E < \overline{\omega}^E < \infty)$. If in $t-1$ the person is out of the workforce, in $t$ she receives a teaching job offer with probability $\rho$ and

[13]In this paper, the term "being out of the workforce" is indistinguishable from staying at home.

a non teaching job offer with probability $1-\rho$, both job offers are drawn from wage offer distributions $F^E(.)$ and $F^N(.)$, respectively. The person has always the option of choosing the non labor market alternative.

The utility teachers derive from their choices each period contains pecuniary and non-pecuniary benefits. The first component, pecuniary utility, equals her wage income. The second component, nonpecuniary utility, has an occupation-specific part and a children-specific part. The former nonpecuniary part comes from all the nonpecuniary enjoyment and dislikes that the teacher receives from a specific occupation and is activated only when the teacher is working (either teaching or nonteaching). The children-specific part has a similar interpretation and is activated only if the teacher has children for all employment alternatives. Stochastic changes in the utility of each choice are captured by random variation in her wage earnings.

Let $W_t^r$ and $Q_t^r$ represent the pecuniary and nonpecuniary utility (in wage equivalents), respectively, that a particular teacher receives at time $t$ from employment alternative $r$. Let $r=E$, $r=N$, and $r=H$ denote a teaching job, a nonteaching job, and the home option, respectively. The total current period utility $U_t^r$ that a particular teacher receives in $t$ by choosing employment sector $r$ is assumed to be additive in $W_t^r$ and $Q_t^r$:

$$U_t^r = W_t^r + Q_t^r, \qquad \text{for r=E,N,H.}$$

The pecuniary utility is given by:[14]

$$\begin{aligned} W_t^r &= \omega^r \, EXP(\alpha_1^r \, t + \alpha_2^r \, t^2) \qquad \text{for r=E,N} \qquad \text{and} \\ W_t^H &= 0. \end{aligned}$$

The nonpecuniary utility is given by:

$$Q_t^r = \gamma^r + \alpha_3^r \, k_t + \alpha_4^r \, k_t \, t + \alpha_5^r \, k_t \, t^2 + \alpha_6^r \, k_t^2 + \alpha_7^r \, k_t^2 \, t + \alpha_8^r \, k_t^2 \, t^2, \qquad \text{for r=E,N,H.} \quad (2)$$

The first term in equation (2), $\gamma^r$, is the occupation-specific part and represents the nonpecuniary utility in teaching and nonteaching jobs relative to the nonpecuniary utility

[14]CPI is used to deflate nominal wage values into 1986 dollar values.

derived from not working when the teacher doesn't have children.[15] The remaining terms represent the children-specific part and are assumed to be quadratic to reflect diminishing returns of children. Functional forms of pecuniary and nonpecuniary utilities imply that if the teacher is not working she will not receive any wage income nor nonpecuniary utility unless she has children.

In this model, rather than being myopic, the teacher knows that current period decisions affect future utility through the determination of her available options in the future. The setting up of this model is closely related to the way teaching markets work. The teacher knows that one result of choosing to teach in the current period is that she will accumulate an additional year of teaching experience. Given the rigidity in the teaching wage structure, the extra year of experience is likely to have an important effect on future teaching wages. Therefore, a set up in which the individual cares not only about her current period utility but also about the discounted utility that she will receive over a finite work horizon is needed. A dynamic model performs this task.

However, although the teacher is assumed to know with certainty the utility associated with each option in the current period, this is not accurate about future periods; in reality, the teacher cannot know exactly what types of jobs (wages and nonpecuniary characteristics) will be offered to her in the future. For instance, she knows that if she currently is employed in a teaching job, she can hold the job next period but she is uncertain about the value of the nonteaching wage offer she will receive. This is how the model captures uncertainty: the future realizations are not known (although the individual does know the distributions) which implies that, for an option $d$, the teacher can not compute the exact discounted utility that she will receive over her finite work horizon but, instead, calculates and makes decisions based on the discounted expected utility of the option over her finite work horizon.

A teachers' expected present value of lifetime rewards depends on her employment status the previous period and on how many children she enters the current period with.[16] Particularly, if in period $t-1$ she is employed in a teaching job with $\omega^E$ and has accumulated $k_{t-1}$

[15] This is a result of normalizing $\gamma^H$ to zero.

[16] The number of children a teacher enters period $t$ with, $k_t$, is equivalent to the stock of children accumulated in period $t-1$, $k_{t-1}$.

children, her expected lifetime utility in $t$ is:

$$\begin{aligned} V^E(k_t,\omega^E,t) &= U_t^E + \beta E \max\ [V^E(k_t,\omega^E,t+1),\ V^E(k_t+1,\omega^E,t+1), \\ &\quad V^N(k_t,\omega^N,t+1), V^N(k_t+1,\omega^N,t+1), \\ &\quad V^H(k_t,t+1), V^H(k_t+1,t+1)]. \qquad (3) \\ &= U_t^E + \beta \int \max\ [V^E(k_t,\omega^E,t+1),\ V^E(k_t+1,\omega^E,t+1), \\ &\quad V^N(k_t,x^N,t+1), V^N(k_t+1,x^N,t+1),\ V^H(k_t,t+1), \\ &\quad V^H(k_t+1,t+1)]\, dF^N(x^N), \qquad \text{if} \quad k_t < 3. \end{aligned}$$

and

$$\begin{aligned} V^E(k_t,\omega^E,t) &= U_t^E + \beta E \max\ [V^E(3,\omega^E,t+1),\ V^N(3,\omega^N,t+1),\ V^H(3,t+1)]. \\ &= U_t^E + \beta \int \max\ [V^E(3,\omega^E,t+1),\ V^N(3,x^N,t+1), \\ &\quad V^H(3,t+1)]\, dF^N(x^N), \qquad \text{if } k_t = 3. \end{aligned}$$

Similarly, if the teacher is employed in period $t-1$ in a nonteaching job with $\omega^N$, the

expected lifetime utility depends on how many children she enters $t$ with. It is given by:

$$\begin{aligned} V^N(k_t, \omega^N, t) &= U_t^N + \beta E \max \ [V^E(k_t, \omega^E, t+1),\ V^E(k_t+1, \omega^E, t+1), \\ &\quad V^N(k_t, \omega^N, t+1),\ V^N(k_t+1, \omega^N, t+1), \\ &\quad V^H(k_t, t+1),\ V^H(k_t+1, t+1)] \qquad (4) \\ &= U_t^N + \beta \int \max \ [V^E(k_t, x^E, t+1),\ V^E(k_t+1, x^E, t+1), \\ &\quad V^N(k_t, \omega^N, t+1), V^N(k_t+1, \omega^N, t+1),\ V^H(k_t, t+1), \\ &\quad V^H(k_t+1, t+1)]\, dF^E(x^E), \qquad \text{if} \quad k_t < 3 \end{aligned}$$

and

$$\begin{aligned} V^N(k_t, \omega^N, t) &= U_t + \beta E \max \ [V^E(3, \omega^E, t+1),\ V^N(3, \omega^N, t+1),\ V^H(3, t+1)] \\ &= U_t^N + \beta \int \max \ [V^E(3, x^E, t+1),\ V^N(3, \omega^N, t+1), \\ &\quad V^H(3, t+1)]\, dF^E(x^E), \qquad \text{if } \ k_t = 3. \end{aligned}$$

Finally, if in period $t-1$ the teacher is out of the workforce, the expected lifetime utility

depends on the stock of children accumulated in $t-1$, and it is :

$$\begin{aligned} V^H(k_t,t) &= U_t^H + \beta \ \{\rho E \max \ [V^E(k_t,\omega^E,t+1),\ V^E(k_t+1,\omega^E,t+1), \\ &\quad V^H(k_t,t+1), V^H(k_t+1,t+1)] + \\ &\quad +(1-\rho)E \max \ [V^N(k_t,\omega^N,t+1),\ V^N(k_t+1,\omega^N,t+1), \\ &\quad V^H(k_t,t+1), V^H(k_t+1,t+1)]\}. \qquad (5) \end{aligned}$$

$$\begin{aligned} &= U_t^H + \beta \ \{\rho \int \max \ [V^E(k_t,x^E,t+1),\ V^E(k_t+1,x^E,t+1), \\ &\quad V^H(k_t,t+1), V^H(k_t+1,t+1)]\, dF^E(x^E) + \\ &\quad (1-\rho) \int \max \ [V^N(k_t,x^N,t+1),\ V^N(k_t+1,x^N,t+1), \\ &\quad V^H(k_t,t+1), V^H(k_t+1,t+1)]\, dF^N(x^N)\}, \qquad \text{if} \quad k_t < 3. \end{aligned}$$

and

$$\begin{aligned} V^H(k_t,t) &= U_t^H + \beta \ \{\rho E \max \ [V_t^E(3,\omega^E,t+1),\ V^H(3,t+1)] + \\ &\quad +(1-\rho)E \max \ [V_t^N(3,\omega^N,t+1),\ V^H(3,t+1)]\}. \end{aligned}$$

$$\begin{aligned} &= U_t^H + \beta \ \{\rho \int \max \ [V^E(3,x^E,t+1),\ V^H(3,t+1)]\, dF^E(x^E) + \\ &\quad +(1-\rho) \int \max \ [V^N(3,x^N,t+1), \\ &\quad V^H(3,t+1)]\, dF^N(x^N)\}, \ \text{if} \ k_t = 3. \end{aligned}$$

Notice that the pair of employment alternatives inside the expectation term in equations (3) to (5) correspond to the options of giving birth or not. Therefore, $k_{t+1}$ has been expressed in terms of $k_t$, as equation (1) indicates.

Agents solve the dynamic problem with a finite horizon T=40. Given the sample period in the data, I generate life cycle choices of employment and fertility for 11 periods.

# 4 Estimation Methodology

The estimation strategy is a Simulated Method of Moments procedure and its aim is to recover the behavioral parameters of the theoretical model. For each estimated parame-

ter set, I solve the Dynamic Programming problem, generate simulated paths of employment and fertility, and construct a criterion function that measures the distance between the observed and simulated moments. I minimize the criterion function and find the parameter estimates of the theoretical model, $\phi = \{\Theta^r,\ \alpha_3^H,\ \alpha_4^H,\ \alpha_5^H,\ \alpha_6^H,\ \alpha_7^H,\ \alpha_8^H,\ \rho\}$ where $\Theta^r = \{\gamma^r,\ \alpha_1^r,\ \alpha_2^r,\ \alpha_3^r,\ \alpha_4^r,\ \alpha_5^r,\ \alpha_6^r,\ \alpha_7^r,\ \alpha_8^r,\ \mu^r,\ \sigma^r\}$ for r=E,N.

The criterion function is as follows :

$$S(\phi) = \sum_{j=1}^{12} \sum_{i=1}^{N_j} WT_{ij}(R_{ij}^{obs} - R_{ij}^{sim})^2,$$

where $N_1 = 33$ are the employment status (3 moments $\times$ 11 years), $N_2 = 44$ are the wage levels (4 moments $\times$ 11 years), $N_3 = 44$ are the children status (4 moments $\times$ 11 years), $N_4 = 30$ are the employment transitions from teaching (3 moments $\times$ 10 years), $N_5 = 30$ are the employment transitions from nonteaching (3 moments $\times$ 10 years), $N_6 = 30$ are the employment transitions from out of the workforce (3 moments $\times$ 10 years), $N_7 = 20$ are the number of children transitions from no children (2 moments $\times$ 10 years), $N_8 = 20$ are the number of children transitions from one child (2 moments $\times$ 10 years), $N_9 = 20$ are the number of children transitions from two children (2 moments $\times$ 10 years), $N_{10} = 110$ are the attrition rates (11 moments $\times$ 10 years), $N_{11} = 20$ are the returning rates from nonteaching (2 moments $\times$ 10 years), $N_{12} = 20$ are the returning rates from out of the workforce (2 moments $\times$ 10 years), and $WT$ is a weighting matrix. In this study, $WT$ is an identity matrix and each moment is weighted the same.

Thus, there are 322 moments to estimate 29 parameters. I use the model to simulate employment, wages and fertility choices at every period.[17] The function is minimized using Powells method (Powell, 1964), which require function evaluations but not derivatives.

# 5 Estimation Results

The parameters that characterize the pecuniary utility are reported in the upper part of Table 2. Teaching jobs present a higher mean and a lower standard deviation of the log-wage offer distribution than nonteaching jobs. These parameters imply an estimated initial

[17] Each individual in the real data has three representatives in the model.

mean yearly wage offer for teaching jobs of $\$10,482.75$ and of $\$9,477.11$ for nonteaching jobs. The wage growth parameters show that wages grow at a declining rate for both teaching and nonteaching occupations.

The estimated parameters of the nonpecuniary utility are reported at the middle of Table 2. The nonpecuniary constant is negative for both teaching and nonteaching jobs reflecting the fact that teachers perceive a negative satisfaction when they are working relative to the leisure option. The nonpecuniary constant is less negative for teaching than for nonteaching jobs, suggesting that teachers find more enjoyable (or less unpleasant) working in a teaching job than in a nonteaching job.

The parameters related to the number of children provide information of the effect that children have on teachers' nonpecuniary utility. An intuitive way to explain the employment flows across teachers' careers is analyzing choice premia of several alternatives. I present below a discussion of three different premia calculated. They are expressed in terms of the average teaching wage to facilitate economic interpretation.

The "*children premia*" correspond to the nonpecuniary rewards of having children given a particular employment sector.[18] They measure the gains of starting and enlarging families in a particular occupation. Table 3 displays children premia for the first, second and third birth. The marginal nonpecuniary utility of the first child is only positive if the teacher is employed in a nonteaching job or if she is out of the workforce, and it is greater in the latter case. For instance, the nonpecuniary gain of having the first child in the nonteaching sector in year 5 is equivalent to 3% of the average teaching wage, whereas it corresponds to 12% if she is out of the workforce. The loss of starting and enlarging families during the first five years doesn't exceed 2 percent of the teaching wage but becomes important at late periods.[19] This suggests that if the individual is employed in a teaching job, she does not have nonpecuniary incentives to give birth to her first child and keep her current teaching job. An interesting result is that the well established diminishing returns on having children only hold for the nonteaching and home options.[20] As a result, the teaching sector is the only employment option generating rewards to give birth to a third child after period five.

[18] It has been calculated as $Q_t^r(k+1) - Q_t^r(k)$, for $r = E, N, H$ and $k = 0, 1, 2$.

[19] If the first birth occurs in period 12, the loss is equivalent to 19 percent of the teaching wage.

[20] See Clark and Oswald (2002); Alesina et al. (2004); Tella et al. (2003) for an analysis of diminishing returns of children.

The "*occupation premia*" evaluate the nonpecuniary gains of employment alternatives conditional on a positive stock of children.[21] These premia are important to identify gains and losses of reentry teaching with children after a career interruption. Table 4 shows that provided a positive stock of children, a reentry to teaching is only rewarding if the former teacher returns from the nonteaching sector. For instance, the gain of doing so during periods 8-12 varies between 61 and 47 percent of the average teaching wage, whereas the nonpecuniary penalty of reenter teaching from out of the workforce in the same period lies between 1.24 and 1.96 times the average teaching wage. The gain (loss) decreases (increases) with time suggesting that rewards of returning to teach with children are more important at early years when children are younger.

Table 4 also indicates that given a positive number of children, the non labor market alternative offers nonpecuniary rewards relative to both teaching and nonteaching employment sectors.[22] Conditional on having two children, choosing a teaching job instead of staying out of the workforce in year 5 is equivalent to a loss of 91% of the average current teaching wage, whereas being enrolled in a nonteaching job rather than not working at all has a nonpecuniary loss equivalent to 1.59 times the teaching wage in the same period. The fact that being in nonteaching generates a greater loss than being in teaching complements our understanding of the negative values of $\gamma^E$ and $\gamma^N$ shown in Table 2. These results suggest that both with and without children, working in teaching is always better than being employed in a nonteaching job.

The "*children cross premia*" evaluate the nonpecuniary gains of giving birth in the current employment, as well as the gains of switching employment sectors to do so, and thus are relevant to understand exit behavior.[23] Tables 5 and 6 show that regardless of the stock of children, it is rewarding to exit the workforce to give birth. The gain is greater if individuals

[21] The nonpecuniary gain of teaching relative to nonteaching has been calculated as $Q_t^E(k) - Q_t^N(k)$, for $k = 1, 2, 3$; the nonpecuniary gain of teaching relative to out of the workforce has been calculated as $Q_t^E(k) - Q_t^H(k)$, for $k = 1, 2, 3$; the nonpecuniary gain of nonteaching relative to out of the workforce has been calculated as $Q_t^N(k) - Q_t^H(k)$, for $k = 1, 2, 3$.

[22] Recall that the teaching-out of the workforce premium is equivalent to the negative of the out of the workforce-teaching premium. Therefore, the negative values of the premia shown in Figures 5.2(b) and 5.2(c) imply a positive value for the out of the workforce-teaching premium.

[23] The teaching cross premium has been calculated subtracting $Q_t^E(k)$ from $Q_t^r(k+1)$, for $k = 0, 1, 2$ and $r = E, N, H$; the nonteaching cross premium has been calculated subtracting $Q_t^N(k)$ from $Q_t^r(k+1)$, for $k = 0, 1, 2$ and $r = E, N, H$; and the out of the workforce cross premium is the subtraction of $Q_t^H(k)$ from $Q_t^r(k+1)$, for $k = 0, 1, 2$ and $r = E, N, H$.

drop the workforce from nonteaching rather than from teaching, reinforcing the "family-friendly" characteristic usually attributed to the teaching occupation. Nonpecuniary benefits of dropping out the workforce to give birth to the first child during the first five years lie between 75 and 78 percent of the average teaching wage if the exit is from the teaching sector, and vary between 1.45 and 1.59 times the teaching wage if the departure is from the nonteaching option. Also, the law of diminishing returns only holds for the nonteaching and home sector. The gain in exiting the teaching workforce increases with time and the number of children until the second birth. For instance, the nonpecuniary gain of giving birth to a first child in the non labor market alternative relative to teaching in year 5 is equivalent to 88% of the average teaching wage. The gain becomes 90% and 82% of the teaching wage if the birth corresponds to the second and third child, respectively.

These trends are supported by the out of the workforce cross premium presented in Table 7. The non labor market alternative offers nonpecuniary gains of giving birth to the first two children relative to both teaching and nonteaching sectors. A third birth produces nonpecuniary losses in all employment sectors relative to the non labor market alternative. The loss is greater if the third birth occurs in the nonteaching sector, which supports the view that the nonteaching sector is the least rewarding employment alternative to have children.

Although the lifetime expected utility, represented by the value function, considers the expected utility of future periods besides the instantaneous utility, the previous analysis provides an idea of the forces that drive teachers' decisions. The model predicts that as families are created or enlarged, female teachers become relatively less likely to be employed in teaching jobs and become more likely to drop the workforce altogether.[24] At late periods, when families have been created, the non labor market alternative offers large nonpecuniary rewards relative to teaching. The nonpecuniary losses of returning with children to the teaching sector between years 8-12 lie between one and two times the average teaching wage.

[24]A valid concern towards my results is that the data used represent preferences of teachers of several generations past. Unfortunately, there are not more current longitudinal surveys that focus on teachers' dynamics. However, Stinebrickner et al. (2006) types of exits are very similar to what this thesis finds: family reasons drive teachers' job changes.

# 6 Model Fit

To assess how well the parameter estimates mimic the data, I compare the observed and the predicted choice distributions and transitions of the moments specified in Section 4.

Table 8 compares actual and predicted employment and wage moments for selected years. The observed teaching decreasing trend is very well fit by the model prediction. However, the model barely replicates the flow occurring in reality between teaching and the non labor market alternative at earlier years, probably as a result of an over prediction of the nonteaching wage which in turn drives more individuals to the nonteaching sector.

Since the analysis time in this paper is years after certification, transitions shown in Table 8 reproduce how teachers move across employment options and do not necessarily represent exit and return rates.[25] The model is able to replicate occupation flows closely, especially transitions from out of the workforce, which although not perfectly, are related to the reentry into the teaching sector. However, predicted transitions to out of the workforce from teaching and nonteaching sectors do not exhibit the same pattern at early years of their observed counterpart. This may be related to the underestimation of the predicted share of individuals in the non labor market alternative at early years discussed above.

Table 9 displays actual and predicted number of children distributions. The replication of these moments is fairly good. The predicted zero percentage of individuals who give birth to a third child is a result of the low or negative premium that a third birth generates, as discussed in Section 5.

Predicted and actual return rates are reported in Table 10.[26] The model is very accurate to replicate returning rates if the exit reason has been to drop the workforce. The returning rates for exits to the nonteaching sector are slightly understated, specially for individuals who are observed few years after departure. The ability of the model in better replicating

[25]For instance, an individual who started her teaching spell at the beginning years after certification, who left after few years and never came back to teach is included in the group of non returners, as well as the individual who started her teaching spell many years after certification, left one or two years before the end of survey and was never seen again in the survey. However, given that both individuals have their first teaching spells at different times during their career paths, it is very likely that the second individual comes back to teach after the last year of observation in the survey which would make her belong to a different group if the data contained more years of observation.

[26]Returning Rates have been calculated following Stinebrickner (2002). The returning rate at time $t$ is the percentage of departing teachers for which $t$ or more years are observed who return to teach at some point within $t$ after leaving.

returning rates for exits out of the workforce reinforce the overall fit of my estimates since the model is particularly successful in reproducing reentry decisions for departing teachers who exited for family circumstances. This in turn indicates that the proposed model is able to identify that family formation variables matter not only at exiting but also at returning time.

# 7 Policy Experiments

After recovering the behavioral parameters and assessing their success in replicating the data, I explore the effects of two regime changes on teachers' career choices. First, I consider raising the salary of all teachers by 20 percent. This uniform wage increase, which will be referred to as "policy one" represents an increase in the pecuniary benefits of choosing a teaching job and is consistent with the current rigid wage structure in public schools. Second, to illustrate the link between teachers' employment decisions and family changes, I increase the children-specific component of the nonpecuniary teaching utility. This policy, referred to as "policy two" can be viewed as a child care subsidy if we consider that it also represents the net benefit of having children.[27] I have simulated the effects of three different amounts and I will refer to them as subsidy "level $i$," where $i = 1, 2, 3$ and higher values of $i$ represent larger subsidies.[28]

## 7.1 Policy One: A 20 Percent Increase in Teaching Wages

Figure 1 compares predicted and counterfactuals participation rates, wages and children distributions for policy one. Higher teaching salaries increase the teaching participation rate from period 3 and the effect becomes more significant with time. At period three, the proportion of teachers employed in teaching jobs increases by 1.3%; at period seven, the increase is by 18% and at the last period, the effect is 20%. Figures 1c and 1d suggest that a large decrease in the proportion of women who are out of the workforce, rather than more

[27]Implementing a child care subsidy is equivalent to increasing the net benefit of having children and being employed in a teaching job (which will reduce the cost of having children). In terms of the model, policy two has been implemented by modifying $\alpha_3^E$.

[28]The equivalent in dollars for every subsidy level as well as the corresponding change in the children parameter, $\alpha_3^E$, are presented in Table 11

individuals leaving nonteaching jobs, plays the relevant role in this trend.

The measure of retention used in this paper is the percentage of aggregate years spent in teaching.[29] A 20 percent raise in teaching pay increases retention by 14% (from 66% to 75%).[30] Consistent with the previous analysis, the higher retention responds to a larger decrease in the aggregate years spent out of the workforce rather than to a decline in the proportion of years spent in nonteaching.[31]

Figure 1d is illustrative of changes in fertility choices. Over my sample period, the proportion of teachers without children increases from 68% to 82%.[32] A closer examination to the data indicates that this result is mainly attributed to fertility changes occurring in the nonteaching sector. The average birth rate for teachers employed in nonteaching jobs decreases by 21% whereas it declines by 7% for individuals out of the workforce and remains constant in the teaching sector.[33]

Taking employment and fertility changes together, results suggest that teachers perceive working in a teaching job and having children as exclusive goods and that they find rewarding to be employed in a teaching job only if they have fewer children.

Columns one and two of Tables 12 and 13 compare attrition rates of the benchmark model and policy one for exits to nonteaching jobs and out of the workforce, respectively. The discussion of attrition is accompanied by an analysis of indicator of exits and returns presented in Table 14. According to Table 14, higher teaching wages diminish the percentage of teachers leaving the field from 56% to 43% and the average length of the first teaching spell from 3.94 to 3.61 years. The effect on the stay in teaching is greater if the exit reason is to drop the workforce altogether.[34] The first columns of Tables 12 and 13 show that attrition rates are lower at every period, regardless of their destination sector.

The bottom part of Table 14 depicts fertility behavior of teachers at exiting and returning

[29]Stinebrickner (2001a,b) also uses the same indicator.

[30]Importantly, this may underestimate the effect of the relative wage hike on the stock of public school teachers as there may be a further beneficial effect on recruitment.

[31]The aggregate years spent in nonteaching decrease by 15% whereas the aggregate years spent out of the workforce decline by 50%.

[32]This proportion has been calculated as the weighted average of the percentage of teachers without children at every period.

[33]The model predicts that no birth to new children occurs in the teaching sector and policy one does not change this pattern.

[34]The first teaching spell diminishes by 4% if the exit destination sector is nonteaching, and by 7% for exits out of the workforce.

times. Whereas 50% of returners have at least one child at returning time in benchmark, this percentage decreases to 25% with policy one, suggesting that changes in fertility behavior occur not only at early periods as more teachers are employed in teaching jobs, but also after a career interruption when they are considering to return. The 53% decrease in the proportion of returners who give birth to new children at least once during career interruption confirms this view.

To understand reentry behavior, I present return indicators in Table 14 and compare returning rates for exits to nonteaching and out of the workforce under benchmark and policy one in columns one and two of Tables 15 and 16, respectively. Table 14 shows that the proportion of teachers who return to the field after a career break increases from 32% to 48% and that the length of time out of teaching doesn't change significantly. According to Tables 15 and 16, returning rates for teachers observed different periods after leaving increase regardless of the exit destination sector. The positive effect on returning rates for exits out of the workforce vary between 19% and 54% and for exits to the nonteaching sector from 31% to 68%. Since changes in returning rates come from either changes in the number of individuals who are observed a certain amount of time after leaving teaching (denominator), changes in the number of individuals observed returning to teach (numerator), or a combination of both, it is important to examine those changes in order to have a deeper understanding of the decision process of teachers between exiting and returning times.

Table 17 indicates that the higher returning rates for leavers to the nonteaching sector respond to both a lower attrition at every period (which makes fewer individuals observed $t$ years after leaving teaching), but also but also to an increase in the number of returners compared to the benchmark model. However, the higher returning rates for exits out of the workforce respond to both a lower attrition at every period (which makes fewer individuals observed $t$ years after leaving teaching) and to a decrease in the number of teachers who come back at every period, as Table 18 shows.[35] From the analysis of employment and fertility changes, these results suggest that the effectiveness of the wage policy in attracting back individuals who left teaching to enroll in nonteaching jobs is associated with the greatest impact this policy has in reducing the proportion of individuals who give birth in that sector.

[35]The number of leavers decreases in a higher proportion resulting in a higher returning rate.

## 7.2 Policy Two: Child Care Subsidies

Figure 2 presents predicted and counterfactuals participation rates and children distributions under policy two scenario. The teaching participation rate increases with the subsidies. At the fourth period after certification, subsidy "level one" increases the proportion of teachers employed in teaching jobs by 11% and subsidy "level two" and "level three" do so by 17% and 21%, respectively. The higher proportion of teachers employed in teaching jobs at earlier periods is mainly a result of a decrease in the proportion of teachers employed in the nonteaching sector, as Figures 2(a-c) illustrate. With higher subsidies, the share of individuals out of the workforce responds more and contributes to increase the stock of teachers employed in teaching jobs. Overall, retention (measured as the percentage of aggregate years spent in teaching) increases by 11% and 29% with the lowest and highest level of subsidy, respectively.

Figure 2d depicts fertility behavior under policy two. Over my sample period, child care subsidies increase the proportion of teachers with children,[36] outcome mainly attributed to changes in fertility choices occurring in the teaching sector, especially at earlier periods. Whereas the average birth rates in the nonteaching and out of the workforce sectors decrease, the corresponding rate in teaching is equivalent to about 23% for all levels of subsidies, representing a 100% increase with respect to the result produced by benchmark. Additionally, 98% and 97% of teachers employed in teaching jobs give birth to new children in the first and second period, respectively, and less than 10% do so at later years. An interesting result is that unlike the wage policy experiment, child care subsidies have a greater negative fertility effect in the non labor market alternative rather than in the nonteaching sector.[37]

To complement our understanding of teachers' family and career choices under policy two, I examine exit and return indicators (see columns 1 and 3-5 in Table 14 as well as attrition rates (see columns 1 and 3-5 in Tables 12 and 13 for exits to nonteaching and out of the workforce, respectively). According to Table 14, child care subsidies decrease the

[36]This proportion has been calculated as the weighted average of the percentage of teachers with at least one child at every period.

[37]The percentage of new births occurring in the nonteaching sector decreases from 14% in benchmark to 11% and 12% with subsidies "level one" and "level two," and slightly increases to 16% with subsidy "level three," whereas the corresponding percentage in the non labor market alternative decreases from 43% in benchmark to 16%, 19% and 16% with subsidies "level one," "level two" and "level three," respectively.

proportion of individuals who leave teaching from 56% to 54% and to 29% with subsidies "level one" and "level three," respectively.

Table 13 illustrates that child care subsidies reduce the percentage of individuals dropping the workforce altogether only at early periods whereas they have a similar effect for exit to nonteaching both at early and very late periods, as shown in Table 12.[38] Relating these findings to the fertility behavior discussed above, while I would expect that teachers interrupt their careers at periods where more birth events occur, my results suggest that child care subsidies yield longer first teaching spells as more teachers give birth to new children while employed in teaching jobs. According to Table 14, the length of stay in the field increases from 3.94 to 4.44 years with subsidy "level one" and to 4.14 with subsidy "level two." The impact is greater if the exit reason is to drop the workforce altogether.[39]

The analysis of the nonpecuniary children premia in Section 5 give some insights into this pattern. Estimated parameters indicate that teachers employed in teaching jobs have nonpecuniary incentives to give birth only if they drop the workforce entirely. At every period, child care subsidies change the children premia in the teaching sector, the teaching premium relative to nonteaching and to the non labor market alternative conditional on a positive stock of children, and the teaching, nonteaching and out of the workforce cross premia.

Figure 3 shows that children premia in the teaching sector increase with child care subsidies.[40] Higher children premia in the teaching sector now offset the nonpecuniary gains of giving birth in the non labor market alternative at earlier periods and remain lower at later periods. Therefore, the teaching sector is now the employment option that offers the highest nonpecuniary gain of giving birth to the first and second child at earlier periods. This explains the longer first teaching spells observed with child care subsidies: teachers stay longer in the field to start their families. Figure 3c illustrates that giving birth to the third child in the teaching sector is the most rewarding option along the teachers' career

[38]For example, the attrition rate for exits out of the workforce in period 2 decreases by 8% with subsidy "level one," by 69% with subsidy "level two," and by 80% with subsidy "level three." Conversely, attrition rate at period 10 increases by 165% and 95% with subsidies "level one" and "level two," respectively.

[39]The length of stay in teaching for individuals who interrupted their careers and enrolled in a nonteaching job remains unchanged or slightly decreases whereas it increases by at least 21% for exits out of the workforce.

[40]Recall that the nonpecuniary gain of giving birth in teaching has been calculated as $Q_t^E(k+1) - Q_t^E(k)$ for k=0,1,2, which increases with $\alpha_3^E$.

paths with all levels of subsidies.

Similarly, incentives to return to teaching with children increase with $\alpha_3^E$, the parameter used to simulate child care subsidies. Thus, conditional on a positive stock of children, the nonpecuniary gains of teaching relative to other employment options have the same shape than those generated by benchmark (see Table 4) but have higher values.[41] Gains to return to teaching from nonteaching with one child during periods 8-12 increase by approximately 20, 40 and 42 percent, and losses of doing so from out of the workforce during the same period decrease by roughly 9, 15 and 25 percent.

A crucial policy question is to investigate if child care subsidies offset the large nonpecuniary benefits that the non labor market alternative offers in benchmark model (see Tables 5-7). Cross premia changes are shown in Figures 4-6. Two forces play in these series. First, child care subsidies increase the gain of staying in (or switching to) the teaching sector to give birth. This gain increases with the stock of children. Second, nonpecuniary benefits of dropping out the teaching workforce to give birth decrease since doing so implies quitting the employment sector whose nonpecuniary rewards have been raised. Figure 4 shows that the gap between gains of staying in teaching and exiting the workforce to give birth is significantly reduced, especially at early years. This result complements Figure 3 in that child care subsidies are effective in prolonging the first teaching spell as teachers simultaneously create and enlarge their families.[42]

Overall, policy simulations of nonpecuniary premia indicate that with policy two, the increase in the nonpecuniary rewards of teaching relative to the non labor market alternative is large enough for teachers to stay longer in the field and simultaneously increase the size of their families only at earlier periods. At later periods, child care subsidies do not reward enough teachers to offset the large nonpecuniary benefits that being out of the

[41] To represent graphically changes in teaching premia will result in unreadable figures since nonpecuniary gains depend also on the stock of children. For instance, to reproduce the effect of child care subsidies on occupation premia, each figure would have six series, even if I restrict the analysis to only one subsidy level. Numerical values can be provided upon request.

[42] Notice that although the non labor market alternative remains the sector that offers the highest nonpecuniary gains to give birth to the first child, teachers also consider wages to decide an employment sector. A narrower gap between gains in teaching and out of the workforce, as well as teaching wages unchanged seem to be a good combination to keep teachers in the sector to start their families, and thus generate longer first teaching spells. The gap narrows further with more children and after the second child, nonpecuniary gains themselves are enough to maintain teachers in the sector during the first eight years of their careers as they increase the size of their families.

workforce offers. Quits to nonteaching seem to be driven by higher pecuniary incentives in the nonteaching sector and not by fertility variables. This explains why the first teaching spell doesn't change significantly if the exit reason is to enroll in nonteaching jobs.

The bottom part of Table 14 presents fertility behavior of teachers at exiting and returning times. The percentage of teachers with at least one child at the last year of their first teaching spell increases to almost four times its benchmark value, consistent with new births concentrated at early periods in the teaching sector as discussed above. On the other hand, the birth rate during career interruption barely changes, suggesting that unlike wage policies, child care subsidies concentrate changes in fertility behavior before career interruption.[43]

Finally, I analyze reentry decisions using information provided in Table 14 and returning rates at different periods for exits to nonteaching and out of the workforce presented in Tables 15 and 16, respectively. Table 14 indicates that child care subsidies increase the proportion of departing teachers who come back to the field by 13%, 41% and 91% for subsidies "level one," "level two" and "level three," respectively.

Tables 15 and 16 indicate that all levels of subsidy increase returning rates if the exit reason has been to enroll in a nonteaching job, and that only subsidy "level three" increases the returning rates for teachers observed most periods after dropping out the workforce altogether. A closer examination of returning rates provides valuable information regarding the decision process of teachers who leave public schools.

Tables 19 and 20 indicate that fewer individuals are observed $t$ or more years after leaving their teaching job for exits both to nonteaching and out of the workforce, which induces returning rates to increase. However, more individuals are observed returning to a teaching job only if the exit destination sector has been nonteaching. Fewer returners after dropping the workforce entirely offset the increasing trend of the returning rate caused by a lower denominator. The impact is greater in the number of returners (numerator) than in the number of individuals observed back at different periods (denominator), resulting in lower returning rates for exits out of the workforce.

The number of departing teachers observed to reenter teaching depends not only on the effectiveness of the policy to attract them back to the field, but also on how many periods

[43]The fact that child care subsidies generate that all returners come back to public schools with at least one child respond to the fact that more changes in fertility have already occurred before exiting time.

they have left to be observed back into teaching. Given attrition rates for exits out of the workforce concentrated at late periods, teachers who dropped the workforce altogether are less likely to be observed back in the field. Another possible reason for the negative impact in the number of returners is that higher teaching premia of giving birth to new children relative to out of the workforce become relevant only at earlier years. Therefore, teachers who dropped the workforce altogether and who face a reentry decision at later years have nonpecuniary incentives to stay out of the workforce with the positive stock of children that they had accumulated before career interruption.

The positive impact of the highest subsidy in returning rates for exits out of the workforce at earlier periods responds to the fact that only subsidy "level three" offsets the large nonpecuniary premia out of the workforce at earlier years (see Figure 4). Although both the number of leavers and returners decline, the positive trend of the nonpecuniary gains in teaching produced by subsidy "level three" leads to a more important decrease in the number of departing teachers (denominator) than in the number of returners (numerator), resulting in higher returning rates at earlier periods.

# 8 Conclusions

The main purpose of this paper has been to explore the effects that two regime changes have on teachers' employment decisions. I extend previous efforts in the literature by endogenously accounting the decision of having children in a dynamic framework and by incorporating into the analysis the teachers' returning decision after a career interruption. The first contribution allows this study to simulate the effects of regime changes not only on teachers' labor force participation decisions but also on fertility behavior. Considering that family changes are relevant to explain the exit decision, knowing how fertility choices simultaneously vary with career decisions broadens the current understanding of the teachers' decision process at different points during their career paths, and allows the design of more accurate policy initiatives. Additionally, I offer a new approach to understand teachers' career choices as one in which attrition and returning decisions are not isolated events but joint outcomes, and estimate effects of regime changes on attrition and returning rates at different points during their careers.

I propose a structural approach to understand teachers' mobility patterns. Individuals maximize their life time expected utility and choose to participate in the teaching, non teaching sector or not to work, as well as to give birth or not. I estimate the model by Simulated Method of Moments using data from the National Longitudinal Survey, 1972. The proposed model is able to match correctly the employment distribution and transitions, wages distributions, number of children distributions and transitions, as well as attrition and returning rates.

My estimates indicate that starting teachers don't have nonpecuniary incentives to give birth to their first child and keep their current teaching job. Instead, the non labor market alternative is the most rewarding sector to give birth and the gain increases with time. These results provide new insights into understanding teachers' career paths. Female teachers face nonpecuniary gains equivalent to about 80 percent of the average teaching wage if they exit the workforce during the first five years to start or enlarge their families. At late periods and provided a positive stock of children, nonpecuniary penalties associated to reentry teaching vary between one and two times the average teaching wage.

A 20 percent raise in teaching wages increases retention, measured as the percentage of aggregate years spent in teaching, by 14%. Transitions from out of the workforce to teaching seem to account for most of the increase in the stock of teachers in public schools. As more individuals are choosing to be employed in teaching jobs, fewer teachers are choosing to give birth to new children, suggesting that wage policies induce teachers to perceive working in teaching jobs and having children as exclusive goods and that they find rewarding to participate in the teaching sector only if they have fewer children.

Higher teaching wages reduce overall attrition rate from 56% to 43% as well as the percentage of teachers leaving at every period, regardless of the destination sector. Teachers who interrupt their careers do it sooner, and the lower proportion of returners who give birth during their career interruption suggests that changes in fertility behavior occur not only at early periods but also after the career interruption, when former teachers are considering to return to public schools.

The returning rates for exits to both nonteaching and out of the workforce increase with higher teaching wages but they respond to different forces. From a smaller pool of departing teachers, more returners are observed back to the field only if the exit reason has been

to enroll in a nonteaching job. On the other hand, higher returning rates for exits out of workforce are entirely attributed to fewer individuals dropping out the workforce at every period. The effectiveness of wage policies in attracting back to the field individuals who left teaching to enroll in nonteaching jobs seems to be associated with the greatest impact that this policy have on fertility in that sector.

Child care subsidies "level one," "level two," and "level three," increase retention by 11%, 21%, and 29%, respectively. Policy simulations of nonpecuniary premia indicate that child care subsidies decrease the gap between rewards of giving birth in teaching and gains of dropping out the teaching workforce, especially at early periods, and thus generate longer first teaching spells. At late periods, the non labor market alternative remains the best sector compatible with having children and therefore, decrease the likelihood of observing more departing teachers back to the field. Gains to return to teaching from nonteaching with one child during periods 8-12 increase by approximately 20, 40 and 42 percent, and losses of doing so from out of the workforce during the same period decrease by roughly 9, 15 and 25 percent.

All levels of subsidies decrease attrition rates to the nonteaching sector at every year but they do so mostly at earlier periods if the exit reason was to drop the workforce altogether. As a consequence, child care subsidies increase first teaching spells, specially for exits out of the workforce. More births occurring at earlier periods in teaching and attrition rates for exits out of the workforce concentrated at later periods confirm the view that exits to the nonteaching sector are not related to fertility behavior.

Increases in the number of returners rather than variations in the number of departing teachers seem to explain the positive effect of child care subsidies on returning rates for exits to nonteaching. Analysis of children premia indicate that teaching is more "child-friendly" than the nonteaching sector. Additionally, new births during career interruption barely change. Therefore, the fact that policy two is effective in attracting back to the field departing teachers who enrolled in nonteaching jobs respond to the rapid increase in family size during the first teaching spell. Two factors explain the negative impact that child care subsidies "level one" and "level two" have on returning rates if the exit reason was to drop the workforce altogether. First, attrition rates concentrated at later periods reduce the likelihood of departing teachers to be observed back in the field given the simulation

period in the model. Second, large nonpecuniary rewards outside the workforce at later years relative to teaching contribute to keep teachers away from public schools.

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# Appendix: Tables and Figures

Table 1: Actual Longitudinal Indicators of Exit and Return

| | Mean | Std. Dev |
|---|---|---|
| **Type of individuals** | | |
| Percent left | 60.87 | - |
| Percent returned[a] | 36.13 | - |
| **LEAVERS** | | |
| **Exit reasons** | | |
| Nonteaching | 31.09 | - |
| Out of the workforce | 68.91 | - |
| **Exit timing** | | |
| Years of teaching experience | 3.20 | 2.14 |
| **Exit timing to nonteaching** | | |
| Years of teaching experience | 2.55 | 1.90 |
| **Exit timing out of the workforce** | | |
| Years of teaching experience | 3.49 | 2.18 |
| **Percent with children at exit time[b]** | 16.81 | - |
| Nonteaching | 9.46 | - |
| Out of the workforce | 20.12 | - |
| **Number of children at exit time[b]** | 0.23 | 0.58 |
| Nonteaching | 0.14 | 0.45 |
| Out of the workforce | 0.27 | 0.63 |
| **RETURNERS** | | |
| Percent with children at returning time[c] | 41.86 | - |
| Percent have first child during interruption | 29.33 | - |
| Percent give birth during interruption | 30.23 | - |
| Length of career interruption | 1.95 | 1.50 |

[a] Percent of returners and non-returners are calculated as a proportion of leavers.

[b] Exit time is the last year of the first teaching spell.

[c] Return time is the first year she is observed in a teaching job after a career interruption.

Table 2: Parameters Estimates

| Parameter | Teaching | Nonteaching | Out of the Workforce |
|---|---|---|---|
| **Pecuniary Utility** | | | |
| Mean of log wage dbn: $\mu^r$ | 5.2471 | 5.0267 | - |
| St. dev. of log wage dbn: $\sigma^r$ | 0.3430 | 0.5930 | - |
| Wage growth (linear): $\alpha_1^r$ | 0.0017 | 0.0372 | - |
| Wage growth (quadrat): $\alpha_2^r$ | -0.0007 | -0.0054 | - |
| **Non-Pecuniary Utility** | | | |
| Constant: $\gamma^r$ | -7,867.1289 | -15,230.3804 | - |
| Children: $\alpha_3^r$ | 213.4316 | 84.6971 | -82.2224 |
| Children growth (linear): $\alpha_4^r$ | 32.8257 | 34.4288 | 15.2542 |
| Children growth (quadrat):$\alpha_5^r$ | -21.0079 | 9.4374 | 73.7082 |
| Children$^2$:$\alpha_6^r$ | -83.0717 | -40.4978 | 0.6207 |
| Children$^2$ growth (linear):$\alpha_7^r$ | -5.1551 | -10.5826 | -4.2249 |
| Children$^2$ growth (quadrat):$\alpha_8^r$ | 4.9765 | -4.7833 | -21.9534 |
| **Labor Market** | | | |
| Prob offer if out workforce: $\rho$ | 0.4060 | 0.5940 | - |

Table 3: Children Premia
(In terms of average teaching wage)

| | **Years** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **First Child** | | | | | | | | | | | | |
| Teaching | 0.01 | 0.01 | 0.01 | 0.00 | -0.01 | -0.03 | -0.05 | -0.07 | -0.09 | -0.12 | -0.15 | -0.19 |
| Nonteaching | 0.01 | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.05 | 0.06 | 0.08 | 0.09 | 0.10 |
| Out of the workforce | 0.00 | 0.01 | 0.04 | 0.08 | 0.12 | 0.18 | 0.25 | 0.33 | 0.42 | 0.52 | 0.64 | 0.78 |
| **Second Child** | | | | | | | | | | | | |
| Teaching | 0.00 | 0.00 | 0.00 | -0.01 | -0.01 | -0.01 | -0.02 | -0.03 | -0.04 | -0.05 | -0.06 | -0.07 |
| Nonteaching | 0.00 | 0.00 | -0.01 | -0.01 | -0.01 | -0.02 | -0.03 | -0.03 | -0.04 | -0.05 | -0.06 | -0.07 |
| Out of the workforce | -0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.03 | 0.04 | 0.06 | 0.07 | 0.09 | 0.11 |
| **Third Child** | | | | | | | | | | | | |
| Teaching | -0.02 | -0.02 | -0.01 | -0.01 | -0.01 | 0.00 | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 |
| Nonteaching | -0.01 | -0.02 | -0.03 | -0.04 | -0.06 | -0.07 | -0.09 | -0.12 | -0.14 | -0.18 | -0.21 | -0.25 |
| Out of the workforce | -0.01 | -0.02 | -0.04 | -0.07 | -0.10 | -0.14 | -0.18 | -0.24 | -0.30 | -0.38 | -0.46 | -0.55 |

Table 4: Occupation Premia
(In terms of average teaching wage)

| | Years | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **1** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **T-NT** | | | | | | | | | | | | |
| 1 child | 0.71 | 0.70 | 0.69 | 0.68 | 0.67 | 0.65 | 0.63 | 0.61 | 0.58 | 0.55 | 0.51 | 0.47 |
| 2 children | 0.71 | 0.71 | 0.70 | 0.69 | 0.67 | 0.66 | 0.64 | 0.61 | 0.58 | 0.55 | 0.51 | 0.47 |
| 3 children | 0.71 | 0.71 | 0.71 | 0.72 | 0.72 | 0.73 | 0.73 | 0.74 | 0.74 | 0.75 | 0.76 | 0.76 |
| **T-OWF** | | | | | | | | | | | | |
| 1 child | -0.73 | -0.75 | -0.78 | -0.83 | -0.89 | -0.97 | -1.06 | -1.17 | -1.29 | -1.44 | -1.60 | -1.78 |
| 2 children | -0.73 | -0.75 | -0.79 | -0.84 | -0.91 | -1.00 | -1.11 | -1.24 | -1.39 | -1.56 | -1.75 | -1.96 |
| 3 children | -0.74 | -0.74 | -0.76 | -0.79 | -0.82 | -0.87 | -0.92 | -0.99 | -1.07 | -1.15 | -1.25 | -1.37 |
| **NT-OWF** | | | | | | | | | | | | |
| 1 child | -1.44 | -1.46 | -1.48 | -1.51 | -1.56 | -1.62 | -1.69 | -1.77 | -1.87 | -1.98 | -2.11 | -2.25 |
| 2 children | -1.44 | -1.46 | -1.49 | -1.53 | -1.59 | -1.66 | -1.75 | -1.85 | -1.97 | -2.10 | -2.26 | -2.43 |
| 3 children | -1.44 | -1.45 | -1.48 | -1.51 | -1.55 | -1.60 | -1.66 | -1.73 | -1.81 | -1.90 | -2.01 | -2.13 |

Table 5: Cross Premia from Teaching
(In terms of average teaching wage)

| | Years | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **First Child** | | | | | | | | | | | | |
| T | 0.01 | 0.01 | 0.01 | -0.00 | -0.01 | 0.01 | -0.05 | -0.07 | -0.09 | -0.12 | -0.15 | -0.19 |
| NT | -0.69 | -0.69 | -0.69 | -0.69 | -0.68 | -0.68 | -0.68 | -0.67 | -0.67 | -0.67 | -0.66 | -0.66 |
| OWF | 0.75 | 0.76 | 0.79 | 0.83 | 0.88 | 0.94 | 1.01 | 1.10 | 1.20 | 1.31 | 1.44 | 1.59 |
| **2nd Child** | | | | | | | | | | | | |
| T | 0.00 | 0.00 | 0.00 | -0.01 | -0.01 | -0.00 | -0.02 | -0.03 | -0.04 | -0.05 | -0.06 | -0.07 |
| NT | -0.71 | -0.71 | -0.70 | -0.69 | -0.68 | -0.67 | -0.66 | -0.64 | -0.62 | -0.60 | -0.57 | -0.54 |
| OWF | 0.73 | 0.75 | 0.78 | 0.84 | 0.90 | 0.99 | 1.09 | 1.21 | 1.35 | 1.51 | 1.69 | 1.89 |
| **3rd Child** | | | | | | | | | | | | |
| T | -0.02 | -0.02 | -0.01 | -0.01 | -0.01 | -0.02 | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 |
| NT | -0.72 | -0.73 | -0.73 | -0.73 | -0.73 | -0.73 | -0.73 | -0.73 | -0.73 | -0.72 | -0.72 | -0.72 |
| OWF | 0.72 | 0.73 | 0.75 | 0.78 | 0.82 | 0.87 | 0.93 | 1.00 | 1.08 | 1.18 | 1.29 | 1.41 |

Table 6: Cross Premia from Nonteaching
(In terms of average teaching wage)

| | Years | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **1** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **1st child** | | | | | | | | | | | | |
| NT | 0.01 | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.05 | 0.06 | 0.08 | 0.09 | 0.10 |
| T | 0.72 | 0.71 | 0.71 | 0.70 | 0.70 | 0.69 | 0.67 | 0.66 | 0.64 | 0.62 | 0.60 | 0.57 |
| OWF | 1.45 | 1.47 | 1.49 | 1.54 | 1.59 | 1.65 | 1.73 | 1.83 | 1.93 | 2.06 | 2.19 | 2.35 |
| **2nd child** | | | | | | | | | | | | |
| NT | -0.00 | -0.00 | -0.01 | -0.01 | -0.01 | -0.02 | -0.03 | -0.03 | -0.04 | -0.05 | -0.06 | -0.07 |
| T | 0.71 | 0.70 | 0.69 | 0.68 | 0.66 | 0.64 | 0.61 | 0.58 | 0.54 | 0.50 | 0.45 | 0.39 |
| OWF | 1.44 | 1.45 | 1.48 | 1.52 | 1.57 | 1.64 | 1.72 | 1.82 | 1.93 | 2.05 | 2.20 | 2.36 |
| **3rd child** | | | | | | | | | | | | |
| NT | -0.01 | -0.02 | -0.03 | -0.04 | -0.06 | -0.07 | -0.09 | -0.12 | -0.14 | -0.18 | -0.21 | -0.25 |
| T | 0.69 | 0.69 | 0.68 | 0.68 | 0.67 | 0.65 | 0.64 | 0.62 | 0.60 | 0.57 | 0.55 | 0.51 |
| OWF | 1.43 | 1.43 | 1.45 | 1.46 | 1.49 | 1.52 | 1.56 | 1.61 | 1.66 | 1.73 | 1.80 | 1.88 |

Table 7: Cross Premia from Out of the Workforce
(In terms of average teaching wage)

| | Years | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **1** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **1st Child** | | | | | | | | | | | | |
| OWF | -0.00 | 0.01 | 0.04 | 0.08 | 0.12 | 0.18 | 0.25 | 0.33 | 0.42 | 0.52 | 0.64 | 0.78 |
| T | -0.74 | -0.74 | -0.74 | -0.76 | -0.77 | -0.79 | -0.81 | -0.84 | -0.87 | -0.91 | -0.96 | -1.00 |
| NT | -1.44 | -1.44 | -1.44 | -1.44 | -1.44 | -1.44 | -1.44 | -1.45 | -1.45 | -1.46 | -1.46 | -1.47 |
| **2nd Child** | | | | | | | | | | | | |
| OWF | -0.01 | -0.00 | -0.00 | 0.01 | 0.01 | 0.02 | 0.03 | 0.04 | 0.06 | 0.07 | 0.09 | 0.11 |
| T | -0.74 | -0.75 | -0.79 | -0.84 | -0.90 | -0.98 | -1.08 | -1.20 | -1.33 | -1.48 | -1.66 | -1.85 |
| NT | -1.45 | -1.46 | -1.49 | -1.52 | -1.58 | -1.64 | -1.72 | -1.81 | -1.91 | -2.03 | -2.17 | -2.32 |
| **3rd Child** | | | | | | | | | | | | |
| OWF | -0.01 | -0.02 | -0.04 | -0.07 | -0.10 | -0.14 | -0.18 | -0.24 | -0.30 | -0.38 | -0.46 | -0.55 |
| T | -0.75 | -0.77 | -0.80 | -0.85 | -0.92 | -1.01 | -1.11 | -1.23 | -1.37 | -1.53 | -1.71 | -1.92 |
| NT | -1.45 | -1.48 | -1.52 | -1.57 | -1.64 | -1.73 | -1.84 | -1.97 | -2.11 | -2.28 | -2.47 | -2.68 |

Table 8: Model Fit: Employment Moments, selected years

| | Year 3 | | Year 6 | | Year 9 | |
|---|---|---|---|---|---|---|
| | Act | Pred | Act | Pred | Act | Pred |
| **Employment Distributions** | | | | | | |
| Teaching | 73.52 | 74.64 | 58.85 | 66.32 | 53.30 | 54.12 |
| Non Teaching | 13.11 | 16.54 | 14.32 | 22.83 | 14.84 | 18.68 |
| Out of the Workforce | 13.37 | 8.83 | 26.82 | 10.85 | 31.87 | 27.20 |
| **Transitions from T** | | | | | | |
| T-T | 86.82 | 94.32 | 86.50 | 89.49 | 89.32 | 84.22 |
| T-NT | 4.73 | 5.68 | 3.80 | 4.52 | 0.49 | 3.54 |
| T-OWF | 8.45 | 0.00 | 9.70 | 5.99 | 10.19 | 12.24 |
| **Transitions from NT** | | | | | | |
| NT-T | 33.33 | 25.60 | 12.73 | 9.20 | 5.36 | 5.79 |
| NT-NT | 50.00 | 73.81 | 76.36 | 86.40 | 78.57 | 71.49 |
| NT-OWF | 16.67 | 0.60 | 10.91 | 4.40 | 16.07 | 22.73 |
| **Transitions from OWF** | | | | | | |
| OWF-T | 23.81 | 27.91 | 15.22 | 10.71 | 6.86 | 3.49 |
| OWF-NT | 4.76 | 12.79 | 4.35 | 11.90 | 8.82 | 4.07 |
| OWF-OWF | 71.43 | 59.30 | 80.43 | 77.38 | 84.31 | 92.44 |
| Log Teaching Wages | 9.64 | 9.65 | 9.67 | 9.69 | 9.80 | 9.75 |
| Log Non Teaching Wages | 9.53 | 10.03 | 9.63 | 10.19 | 9.78 | 10.22 |

Table 9: Model Fit: Fertility Moments, selected years

| | Year 3 | | Year 6 | | Year 9 | |
|---|---|---|---|---|---|---|
| | Act | Pred | Act | Pred | Act | Pred |
| **Number of children** | | | | | | |
| No Children | 84.32 | 80.21 | 59.11 | 66.84 | 40.11 | 45.42 |
| 1 Child | 12.60 | 18.77 | 25.78 | 25.69 | 22.80 | 29.30 |
| 2 Children | 2.06 | 0.51 | 13.28 | 7.20 | 29.95 | 25.00 |
| 3 Children | 1.03 | 0.51 | 1.82 | 0.26 | 7.14 | 0.27 |
| Transitions from No Children | | | | | | |
| NK-1K | 7.08 | 10.60 | 13.03 | 10.26 | 10.98 | 13.89 |
| Transitions from 1 Child | | | | | | |
| 1K-2K | 11.11 | 0.00 | 26.97 | 27.02 | 35.00 | 31.23 |
| Transitions from 2 Children | | | | | | |
| 2K-3K | 16.67 | 0.00 | 3.70 | 0.00 | 5.19 | 0.00 |

Table 10: Actual and Predicted Returning Rates

| | To Nonteaching | | To Out of the workforce | |
|---|---|---|---|---|
| Years | Actual | Predicted | Actual | Predicted |
| 1 | 0.27 | 0.13 | 0.17 | 0.13 |
| 2 | 0.31 | 0.21 | 0.31 | 0.24 |
| 3 | 0.32 | 0.28 | 0.34 | 0.31 |
| 4 | 0.30 | 0.32 | 0.34 | 0.34 |
| 5 | 0.33 | 0.38 | 0.34 | 0.37 |
| 6 | 0.31 | 0.38 | 0.40 | 0.38 |
| 7 | 0.41 | 0.37 | 0.48 | 0.38 |
| 8 | 0.46 | 0.36 | 0.50 | 0.37 |
| 9 | 0.00 | 0.31 | 0.50 | 0.33 |

[a] Years observed after departure.

Table 11: Child Care Subsidies Methodology

| Denomination | Parameter change | Annual Cost per Child |
|---|---|---|
| Subsidy "level one" | $\alpha_3^E \times 7$ | 1,494.0212 |
| Subsidy "level two" | $\alpha_3^E \times 12$ | 2,561.1792 |
| Subsidy "level thee" | $\alpha_3^E \times 18$ | 3,841.7688 |

Table 12: Policy Experiments: Attrition Rates if Left to Nonteaching

| $t$ | **Benchmark** | **Policy one** | **Policy two** | | |
|---|---|---|---|---|---|
| | | | level one | level two | level three |
| **2** | 6.82 | 6.73 | 6.73 | 6.91 | 7.50 |
| **3** | 4.01 | 3.41 | 2.98 | 3.41 | 2.64 |
| **4** | 5.54 | 4.69 | 4.60 | 4.77 | 3.92 |
| **5** | 4.77 | 3.58 | 4.09 | 3.24 | 2.64 |
| **6** | 2.90 | 3.24 | 2.56 | 2.90 | 2.56 |
| **7** | 2.81 | 2.39 | 2.47 | 2.22 | 2.30 |
| **8** | 1.53 | 1.71 | 1.79 | 1.45 | 1.19 |
| **9** | 1.62 | 1.28 | 1.45 | 1.45 | 1.28 |
| **10** | 0.77 | 0.94 | 1.11 | 1.19 | 0.77 |
| **11** | 0.17 | 0.17 | 0.17 | 0.09 | 0.00 |

Table 13: Policy Experiments: Attrition Rates if Left the Workforce

| $t$ | **Benchmark** | **Policy one** | **Policy two** | | |
|---|---|---|---|---|---|
| | | | level one | level two | level three |
| **2** | 6.05 | 5.54 | 5.54 | 1.88 | 1.19 |
| **3** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **4** | 1.96 | 0.00 | 0.00 | 0.00 | 0.00 |
| **5** | 0.00 | 0.00 | 0.51 | 0.00 | 0.00 |
| **6** | 3.24 | 1.28 | 0.00 | 0.26 | 0.00 |
| **7** | 0.77 | 0.00 | 2.05 | 0.00 | 0.09 |
| **8** | 3.84 | 2.64 | 3.67 | 1.36 | 0.00 |
| **9** | 5.12 | 3.41 | 3.92 | 2.05 | 0.26 |
| **10** | 3.50 | 0.68 | 9.29 | 6.82 | 2.30 |
| **11** | 0.77 | 1.36 | 0.77 | 0.17 | 0.85 |

Table 14: Policy Experiments: Exit and Returning Indicators

| | **Benchmark** | **Policy one** | **Policy two** | | |
|---|---|---|---|---|---|
| | | | level one | level two | level three |
| **Type of individuals** | | | | | |
| Left | 0.56 | 0.43 | 0.54 | 0.40 | 0.29 |
| Returned | 0.32 | 0.48 | 0.36 | 0.45 | 0.61 |
| **LEAVERS** | | | | | |
| **Exit reasons** | | | | | |
| Non-teaching | 0.55 | 0.65 | 0.52 | 0.69 | 0.84 |
| Out of the workforce | 0.45 | 0.35 | 0.48 | 0.31 | 0.16 |
| **Exit timing** | | | | | |
| Years teaching experience | 3.94 | 3.61 | 4.44 | 4.14 | 3.49 |
| **Exit timing Non-Teaching** | | | | | |
| Years teaching experience | 3.35 | 3.23 | 3.35 | 3.21 | 3.01 |
| **Exit timing Out of the workforce** | | | | | |
| Years teaching experience | 4.67 | 4.32 | 5.63 | 6.17 | 6.02 |
| **Percent with children at exit time**[a] | 0.16 | 0.10 | 0.78 | 0.79 | 0.72 |
| Nonteaching | 0.11 | 0.09 | 0.78 | 0.77 | 0.71 |
| Out of the Workforce | 0.22 | 0.10 | 0.78 | 0.85 | 0.75 |
| **Avg number of children at exit time**[a] | 0.18 | 0.12 | 1.52 | 1.51 | 1.36 |
| Nonteaching | 0.13 | 0.12 | 1.47 | 1.42 | 1.33 |
| Out of the Workforce | 0.24 | 0.13 | 1.57 | 1.70 | 1.49 |
| **RETURNERS** | | | | | |
| Percent with children at returning time[b] | 0.50 | 0.25 | 1.00 | 1.00 | 1.00 |
| Avg number children at returning time[b] | 0.67 | 0.33 | 2.01 | 2.01 | 2.01 |
| Percent give birth during interruption | 0.43 | 0.20 | 0.48 | 0.38 | 0.43 |
| Length of Career Interruption | 2.40 | 2.43 | 2.38 | 2.23 | 2.27 |

[a] Exit time is the last year of the first teaching spell.
[b] Return time is the first year she is observed in a teaching job after a career interruption.

Table 15: Policy Experiments: Returning Rates if Left to Nonteaching

| $t$ | **Benchmark** | **Policy One** | **Policy Two** | | |
|---|---|---|---|---|---|
| | | | level one | level two | level three |
| **2** | 0.13 | 0.17 | 0.15 | 0.24 | 0.31 |
| **3** | 0.21 | 0.30 | 0.26 | 0.37 | 0.47 |
| **4** | 0.28 | 0.42 | 0.35 | 0.46 | 0.56 |
| **5** | 0.32 | 0.47 | 0.39 | 0.51 | 0.60 |
| **6** | 0.38 | 0.54 | 0.46 | 0.56 | 0.68 |
| **7** | 0.38 | 0.57 | 0.46 | 0.57 | 0.70 |
| **8** | 0.37 | 0.58 | 0.47 | 0.57 | 0.70 |
| **9** | 0.36 | 0.56 | 0.45 | 0.56 | 0.69 |
| **10** | 0.31 | 0.52 | 0.39 | 0.52 | 0.63 |

Table 16: Policy Experiments: Returning Rates if Left the Workforce

| $t$ | **Benchmark** | **Policy One** | **Policy two** | | |
|---|---|---|---|---|---|
| | | | level one | level two | level three |
| **2** | 0.13 | 0.20 | 0.14 | 0.17 | 0.20 |
| **3** | 0.24 | 0.32 | 0.23 | 0.27 | 0.29 |
| **4** | 0.31 | 0.37 | 0.29 | 0.28 | 0.35 |
| **5** | 0.34 | 0.45 | 0.31 | 0.28 | 0.38 |
| **6** | 0.37 | 0.49 | 0.34 | 0.29 | 0.38 |
| **7** | 0.38 | 0.50 | 0.34 | 0.30 | 0.38 |
| **8** | 0.38 | 0.50 | 0.35 | 0.30 | 0.38 |
| **9** | 0.37 | 0.49 | 0.34 | 0.29 | 0.36 |
| **10** | 0.33 | 0.41 | 0.26 | 0.25 | 0.30 |

Table 17: Returning Rates if Left to Nonteaching.
Benchmark and Policy One

| Number of years, t | Number of teachers observed t or more years after exit to N | | Number of returners within t years after leaving for N | | Returning Rate | |
|---|---|---|---|---|---|---|
| | Bench. | Pol. One | Bench. | Pol. One | Bench. | Pol. One |
| 1 | 277 | 256 | 37 | 44 | 0.13 | 0.17 |
| 2 | 272 | 251 | 56 | 76 | 0.21 | 0.30 |
| 3 | 267 | 241 | 74 | 101 | 0.28 | 0.42 |
| 4 | 260 | 233 | 84 | 110 | 0.32 | 0.47 |
| 5 | 245 | 219 | 93 | 119 | 0.38 | 0.54 |
| 6 | 230 | 209 | 87 | 119 | 0.38 | 0.57 |
| 7 | 211 | 196 | 78 | 113 | 0.37 | 0.58 |
| 8 | 195 | 185 | 70 | 104 | 0.36 | 0.56 |
| 9 | 172 | 164 | 54 | 85 | 0.31 | 0.52 |

The second and third columns indicate the number of teachers for which $t$ or more years are observed after she leaves for the nonteaching sector. The fourth and fifth columns show the number of those teachers who return to teaching within $t$ years after leaving. The last two columns show the returning rate calculated as the proportion of teachers observed in $t$ or more years who return to teach at some point within $t$ after leaving (for benchmark, the returning rate has been calculated dividing column 4 by column 2 and for policy one, the returning rate has been calculated dividing column 5 by column 3).

Table 18: Returning Rate if Left the Workforce.
Benchmark and Policy One

| Number of years, t | Number of teachers observed t or more years after exit to H | | Number of returners within t years after leaving for H | | Returning Rate | |
|---|---|---|---|---|---|---|
| | Bench. | Pol. One | Bench. | Pol. One | Bench. | Pol. One |
| 1 | 237 | 142 | 31 | 28 | 0.13 | 0.20 |
| 2 | 213 | 133 | 52 | 43 | 0.24 | 0.32 |
| 3 | 205 | 122 | 63 | 45 | 0.31 | 0.37 |
| 4 | 199 | 117 | 68 | 53 | 0.34 | 0.45 |
| 5 | 189 | 114 | 70 | 56 | 0.37 | 0.49 |
| 6 | 185 | 113 | 70 | 56 | 0.38 | 0.50 |
| 7 | 175 | 111 | 66 | 55 | 0.38 | 0.50 |
| 8 | 171 | 107 | 63 | 52 | 0.37 | 0.49 |
| 9 | 150 | 87 | 49 | 36 | 0.33 | 0.41 |

The second and third columns indicate the number of teachers for which $t$ or more years are observed after she leaves entirely the workforce. The fourth and fifth columns show the number of those teachers who return to teaching within $t$ years after dropping out the workforce. The last two columns show the returning rate calculated as the proportion of teachers observed in $t$ or more years who return to teach at some point within $t$ after leaving (for benchmark, the returning rate has been calculated dividing column 4 by column 2 and for policy one, the returning rate has been calculated dividing column 5 by column 3).

Table 19: Returning Rates if Left to Nonteaching.
Policy Two (level two)

| Number of years, t | Number of teachers observed t or more years after exit to N | | Number of returners within t years after leaving for N | | Returning Rate | |
|---|---|---|---|---|---|---|
| | Bench. | Pol. Two | Bench. | Pol. Two | Bench. | Pol. Two |
| 1 | 277 | 250 | 37 | 60 | 0.13 | 0.24 |
| 2 | 272 | 241 | 56 | 90 | 0.21 | 0.37 |
| 3 | 267 | 235 | 74 | 108 | 0.28 | 0.46 |
| 4 | 260 | 226 | 84 | 115 | 0.32 | 0.51 |
| 5 | 245 | 213 | 93 | 119 | 0.38 | 0.56 |
| 6 | 230 | 203 | 87 | 116 | 0.38 | 0.57 |
| 7 | 211 | 183 | 78 | 105 | 0.37 | 0.57 |
| 8 | 195 | 168 | 70 | 94 | 0.36 | 0.56 |
| 9 | 172 | 147 | 54 | 76 | 0.31 | 0.52 |

The second and third columns indicate the number of teachers for which $t$ or more years are observed after she leaves for the nonteaching sector. The fourth and fifth columns show the number of those teachers who return to teaching within $t$ years after leaving. The last two columns show the returning rate calculated as the proportion of teachers observed in $t$ or more years who return to teach at some point within $t$ after leaving (for benchmark, the returning rate has been calculated dividing column 4 by column 2 and for policy one, the returning rate has been calculated dividing column 5 by column 3).

Table 20: Returning Rates if Left the Workforce.
Policy Two (level two)

| Number of years, t | Number of teachers observed t or more years after exit to H | | Number of returners within t years after leaving for H | | Returning Rate | |
|---|---|---|---|---|---|---|
| | Bench. | Pol. Two | Bench. | Pol. Two | Bench. | Pol. Two |
| 1 | 237 | 105 | 31 | 18 | 0.13 | 0.17 |
| 2 | 213 | 96 | 52 | 26 | 0.24 | 0.27 |
| 3 | 205 | 88 | 63 | 25 | 0.31 | 0.28 |
| 4 | 199 | 88 | 68 | 25 | 0.34 | 0.28 |
| 5 | 189 | 87 | 70 | 25 | 0.37 | 0.29 |
| 6 | 185 | 87 | 70 | 26 | 0.38 | 0.30 |
| 7 | 175 | 87 | 66 | 26 | 0.38 | 0.30 |
| 8 | 171 | 85 | 63 | 25 | 0.37 | 0.29 |
| 9 | 150 | 80 | 49 | 20 | 0.33 | 0.25 |

The second and third columns indicate the number of teachers for which $t$ or more years are observed after she leaves entirely the workforce. The fourth and fifth columns show the number of those teachers who return to teaching within $t$ years after leaving. The last two columns show the returning rate calculated as the proportion of teachers observed in $t$ or more years who return to teach at some point within $t$ after leaving (for benchmark, the returning rate has been calculated dividing column 4 by column 2 and for policy one, the returning rate has been calculated dividing column 5 by column 3).

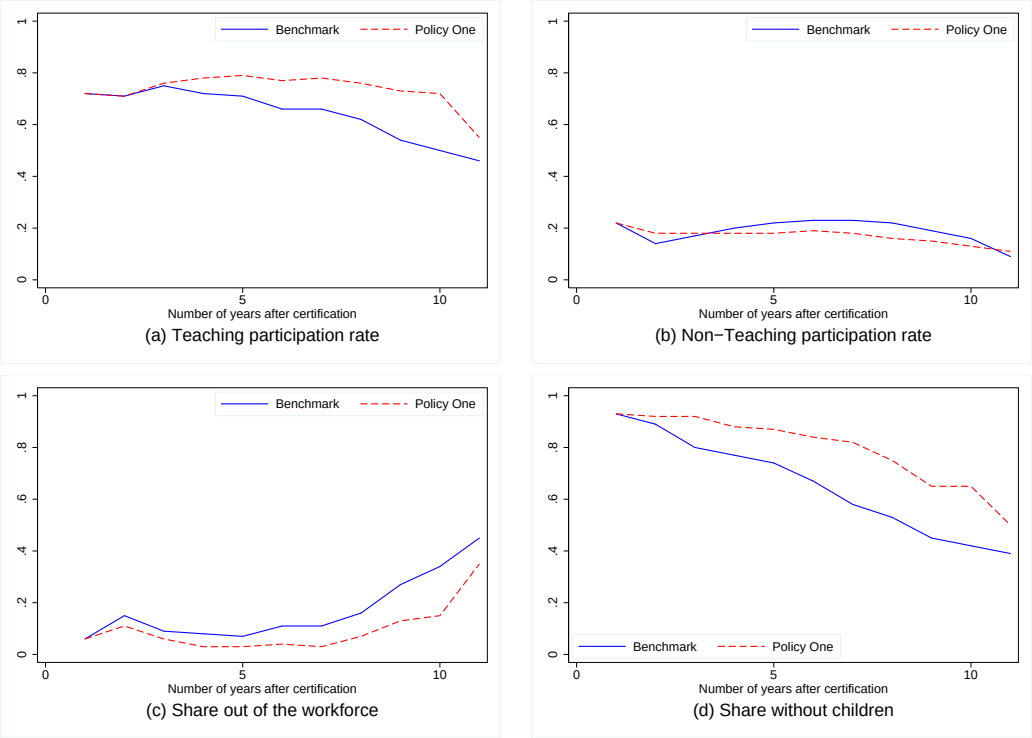


Figure 1: Policy One: A 20% Increase in Teaching Wages

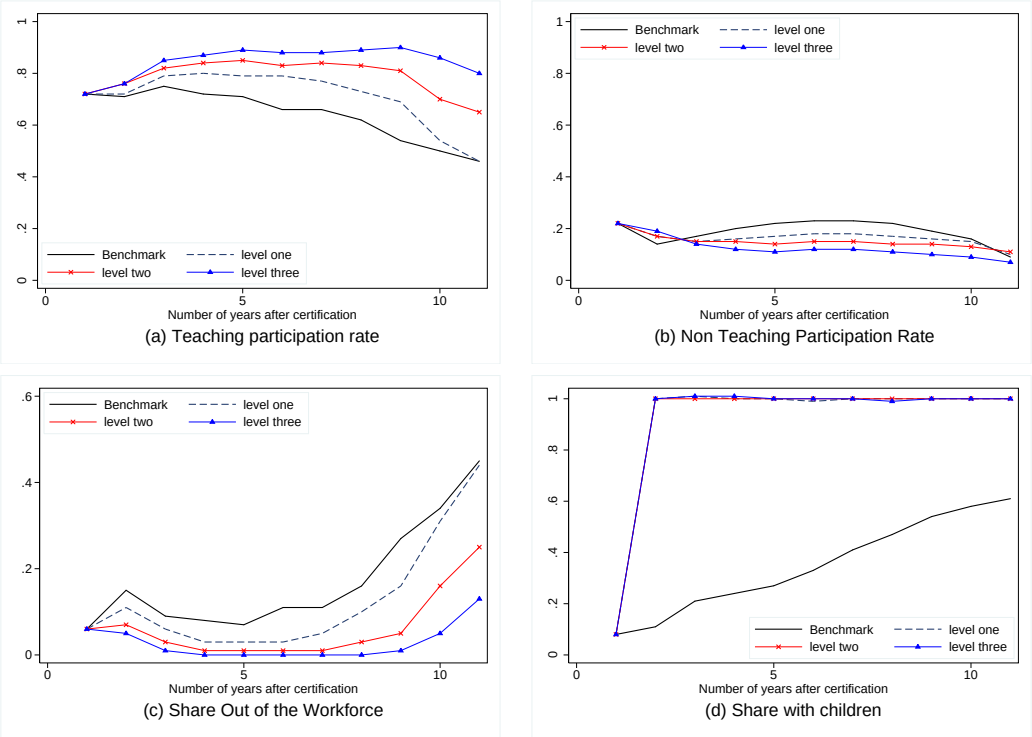


Figure 2: Policy Two: Child Care Subsidies

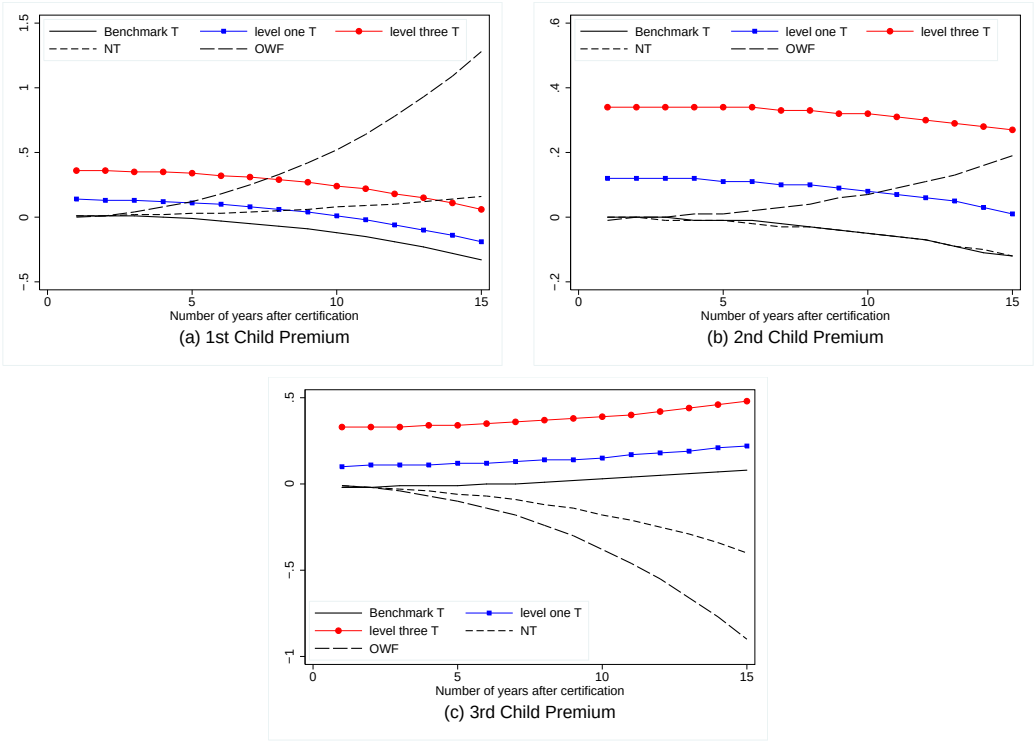


Figure 3: Children Premia. Benchmark and Policy Two

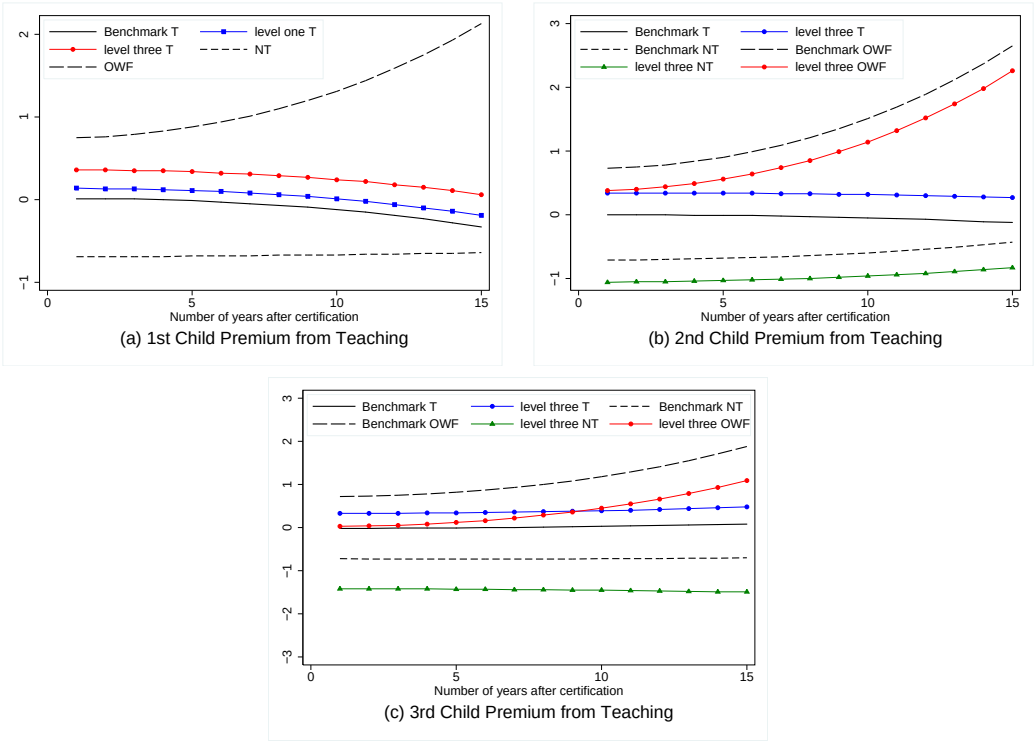


Figure 4: Teaching Cross Premia. Benchmark and Policy Two

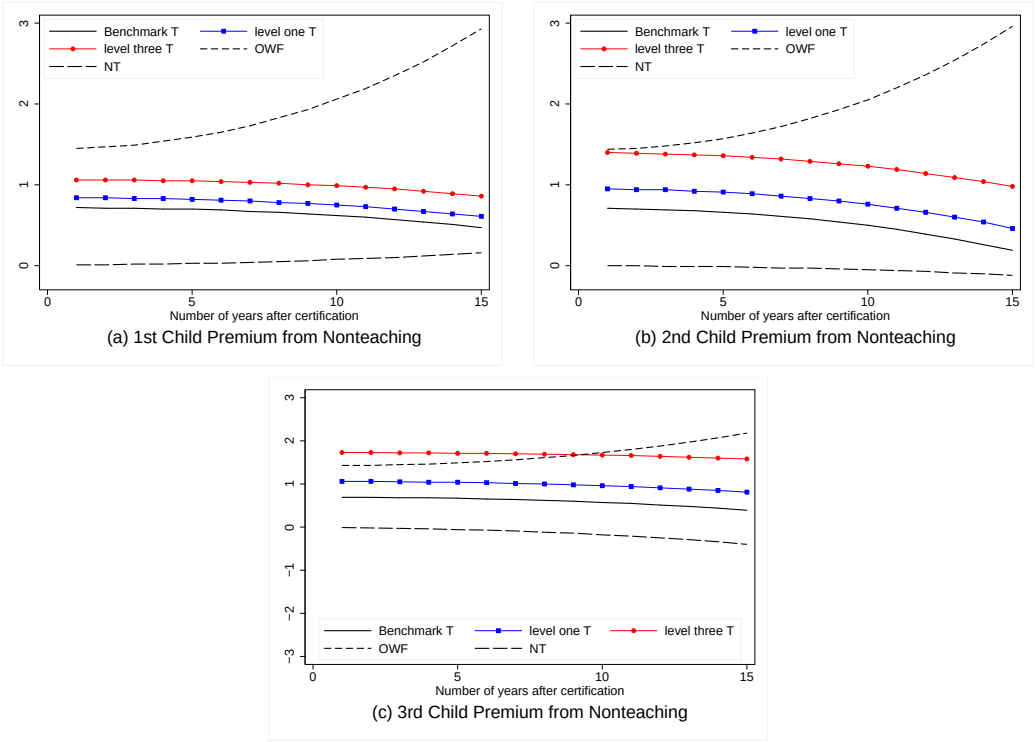


Figure 5: Nonteaching Cross Premia. Benchmark and Policy Two

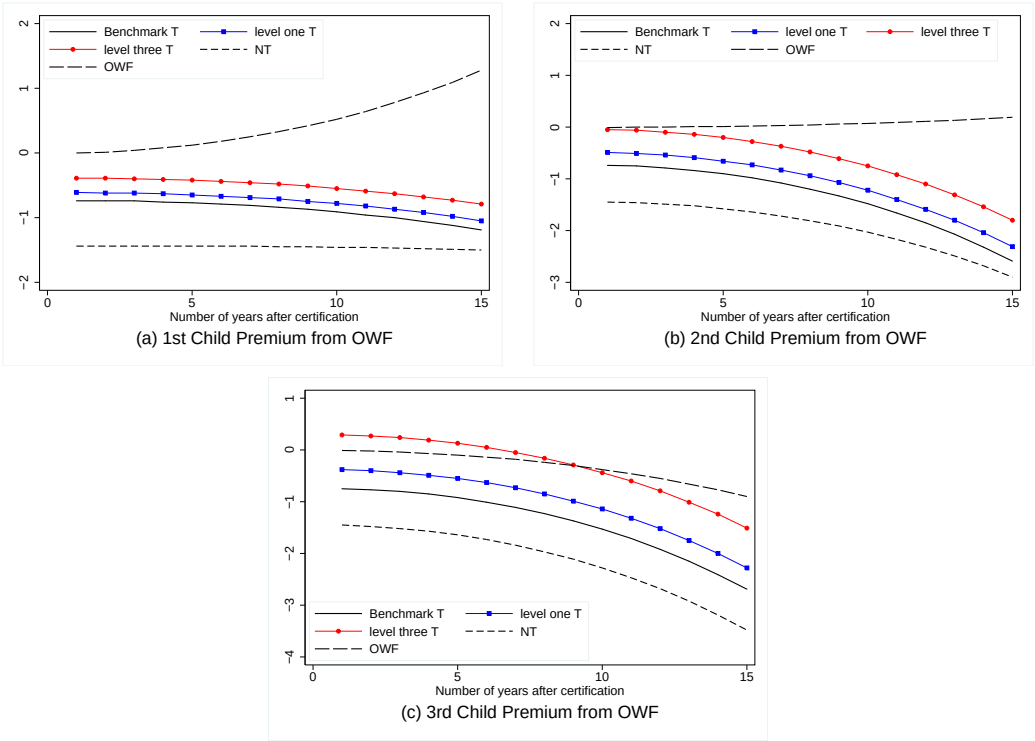


Figure 6: Out of the workforce Cross Premia. Benchmark and Policy Two