Stony Brook University

Career Mobility Patterns of Public School Teachers

A Dissertation Presented

by

Celia Patricia Vera

to

The Graduate School

in Partial Fulfillment of the Requirements

for the Degree of

Doctor of Philosophy

in

Economics

Stony Brook University

May 2013

Stony Brook University

The Graduate School

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Abstract of the Dissertation

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2013

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. I find that a 20 percent raise in teaching wages increases retention 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. The proportion of teachers giving birth to new children decreases by 50% and 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 seems to be positively associated with the impact of the policy in reducing the proportion of individuals who give birth to new children in that sector, reinforcing the view that teachers respond positively to higher wages only if they have fewer children.

On the other hand, 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.

Dedicated to my parents

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Acknowledgements

It would not have been possible to write this doctoral thesis without the help and support of the kind people around me, to only some of whom it is possible to give particular mention here.

I would like to express my deepest gratitude to my advisor, Dr. Silvio Rendon, for his excellent guidance, patience and encouragement throughout my graduate work. The good advice and support of my second supervisor, Dr. Hugo Benitez-Silva is also very much appreciated. Many thanks to Mark Montgomery and Wilbert van der Klaauw for their valuable comments, encouraging words, and time and attention during busy semesters.

In addition, I would like to thank Dr. Michael Zweig for the thoughtful conversations over the past two years and for facilitating financial support to finish my dissertation.

My parents, brother and sister have given me their unequivocal support throughout, as always, for which my mere expression of thanks likewise does not suffice.

Last, but by no means least, I thank my invaluable network of supportive, generous and loving friends without whom I could not have survived the process. Any remaining error is mine.

Chapter 1

Introduction

The 3.1 million elementary and secondary public school teachers in the United States make up 10.6% of all college-educated workers 25-64 years old (National Center for Education Statistics, 2012; U.S. Census Bureau, 2012). Even though the contribution of these teachers to educational outcomes and later economic success is greatly recognized, large gaps exist in our understanding of how teacher labor markets function.

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 (National Center for Education Statistics,

[1]In this thesis, 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, although attrition can be either voluntary or involuntary, most attrition from teaching is voluntary given widespread tenure rates and the prevalence of unionized grievance policies regarding termination.

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 since a teacher who returns to teaching in the future will typically do so without suffering a loss in wages. 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 thesis, 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 sub-

[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.

sidies generate a more attractive teaching sector for individuals with children. As expected, this policy has a positive effect on fertility and thus increases the first teaching spell as more births occur at earlier periods of their careers.

Another way the present thesis 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. 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. An examination of the dynamics of teachers' job changes along their complete career paths will lead to more accurate policy recommendations. Therefore, through this thesis, I quantify the impact of regime changes on both attrition and returning rates. My results show that while wage policies attract former teachers regardless of the exit reason, child care subsidies are only effective on prolonging the first teaching spell, specially if they dropped the workforce altogether. Although attrition rates focused at later periods partially explain why fewer returners are observed,[3] 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

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

have inexperienced teachers who are less effective on average (Rockoff, 2004; Richard Steven G. Rivkin and Kain, 2005; Kane et al., 2006). Second, high turnover creates instability in schools, making it more difficult to have coherent instruction. 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. Third, high turnover can be costly in that time and effort is needed to continuously recruit teachers.

Moreover, 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 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. The resources associated with employing teachers and the strong empirical evidence linking teacher quality to improved student achievement are compelling reasons to have a deep understanding of the two teachers' career persistence outcomes: attrition and retention.

While the fact of having an adequate number of teachers to staff public schools starts with the decision to enter teaching, in this thesis I focus on

labor market choices after a certification decision has been made. Similarly, the retention problem can be addressed from demand, supply, or both perspectives. Researchers usually make a trade-off in the approach they take since data sets do not usually provide combined information about characteristics of students and schools, students' performance, and teachers' characteristics.[4] Considering data constraints and the gap in the literature in jointly modeling labor supply and fertility choices, this thesis addresses the retention problem from a labor supply perspective.[5]

To place the issue of teachers' retention into context, it is important to compare the dynamics of teachers' job changes with those of other college graduates. Stinebrickner (2002), Ingersoll (2002), and Flyer and Rosen (1997) report that teachers have a stronger tendency to leave the job and stay at home longer once they take the leave compared to non-teachers. Flyer and Rosen (1997) found that female teachers do not suffer wage penalties for stopping out of teaching, while women in other careers suffer reentering wage penalties of almost 10% per year of leave. Similarly, Stinebrickner (2002) found that female teachers experience a higher probability of exiting the workforce when a birth occurs than women in other careers (0.60 and 0.41, respectively). Other body of work have compared teachers' job changes with those in similar occupations. These studies have used different measures of turnover, therefore it is difficult to compare numbers across studies. However, taking together, studies suggest that the teaching profession has lower retention rates than the

[4]For instance, if the researcher wants to use students or schools' features, she would have to use administrative data which lack family formation variables and exit destination sector, although have a large sample. This is a problem because teachers who go to teach in a different state are treated as if they quit teaching for ever.

[5]For attrition and students and schools' characteristics see Smith and Ingersoll (2004), Lankford et al. (2002) and Stinebrickner et al. (2006). For attrition and organizational structure of the schools see Ingersoll (2001b,a).

nursing profession (a similar female-dominated profession requiring some degree of higher education) but may not be an outlier among the general group of occupations that employ college graduates. Using data from the Current Population Survey over the period 1992-2001, Harris and Adams (2007) found that the probability that teachers leave the labor force was 4.53%, compared to 3.54%, 2.73% and 2.36% for nurses, social workers, and accountants, respectively. Likewise, Ingersoll (2001b,a) analyzed turnover among teachers using the Schools and Staffing Survey and the Teacher Follow Up Survey during the years 1988-1995. He found that the teacher turnover rate in the range of 13.2-15.0 was relatively high when compared with an 11 percent nationwide turnover rate for employees in all occupations published by Bureau of National Affairs and a 12 percent turnover rate published by a human resource consulting firm for nurses in hospitals in the mid 1990s.[6] Stinebrickner (2002) and Harris and Adams (2007) find that teachers have stronger tendency to leave the job and stay at home longer once they take the leave compared with nurses, accountants and social workers.

With the aim to reinforce the particularity of the teaching occupation, Table 1.1 shows descriptive characteristics of the final sample of teachers and nonteachers obtained from the data set used in this thesis.[7]

[6]Ingersoll's definition of turnover includes job changes among school districts and his comparison of turnover rates from different data sources carries with it some limitations. Harris and Adams (2007) signal that BNA data may not be a nationally representative sample and that its definition of turnover is at the level of the organization whereas Ingersoll's view is at the level of the school. In addition, they point out that the human resource firm's study of turnover in nursing was conducted in a different year than that of the Schools and Staffing Survey used by Ingersoll, thus reducing comparability.

[7]As will be detailed in Chapter 3, the data come from a longitudinal survey of high school graduates in 1972. Although only the sample of teachers is used to estimate the economic model, this survey provides information of nonteachers. The construction of the final sample of teachers will be detailed in the corresponding chapter. The final sample of nonteachers considered those who have not been selected as potential teachers and who have had some job experience after their bachelor graduation date.

Table 1.1: Teachers Vs Nonteachers

Variable	Teachers	Nonteachers
Verbal SAT score	440.4	495.48
Math SAT score	473	535.69
Percent female	72.69	42.55
Marital Status		
Percent married in t=0	45.21	34.46
Percent married last period	79.93	70.11
Percent married at least one period	84.63	77.01
Children		
Percent with at least one child t=0	7.96	6.18
Percent with at least one child last period	65.46	54.28
Number of children in t=0	0.09	0.1
Number of children last period	1.19	0.97
Child care		
Percent with pre-school children rearing at home	93.51	80
Pre school children costs ($ of 1986)	316.39	344.296
Percent with school children rearing at home	96.97	87.06
School children costs ($ of 1986)	74.71	126.93
Occupation changes (percent)		
Individuals with occupation spell uncensored	53	74
Change occupation	41	57
Left workforce altogether	59	43

Table 1.1 shows that teachers have lower math and verbal SAT scores than nonteachers. Evidence provided by Michael Podursky and Watson (2004) confirms that this trend has not changed over time. With a more current data set, they investigate the behavior of college graduates concerning an initial decision to secure certification and teach in a public school, and subsequent decisions as to whether to continue. They find that college graduates with above-average ACT scores are less likely to select into teaching and that at any level of academic achievement, women are more likely than men to teach. Similarly, there is substantial evidence of commensurate declines in teacher test scores. For example, Bacolod (2007) finds that the 41 percent of teachers born 1941-45 had IQ scores in the top quintile, but only 19 percent of those born 1963-64 were drawn from that high in the distribution. Likewise, Corcoran et al. (2004a,b) find that, while mean performance on achievement tests of teachers do not change much between 1964-2000, the proportion of teachers in the top deciles fell significantly.

According to Table 1.1, teachers are also more likely to be female, to be married and to have children than nonteachers, not only at the beginning of the period of analysis but also at the end of the survey. The information regarding children rearing and child care expenditures gives an idea of the individuals' family-oriented decisions. Teachers take care of children at home in a higher proportion that nonteachers do.[8] Probably as a consequence of this result, at the last year of the survey, the average child care expenditures were lower for teachers than for nonteachers. Both patterns can be an outcome of either the

[8]This variable comes from a question in the last follow up survey to teachers who are not working at that period and have children. The teacher is asked if she takes care of children at home or if she sends them to a day care center. The terms "teachers" corresponds to individuals who had teaching training but have not been working in that particular year. Similarly, the term "nonteachers" corresponds to college graduates that did not have teaching training and were not working in the year they were interviewed.

individuals' love to spend time with children or the monetary constraints that impede teachers to afford a day care center.

Concerning career interruptions, Table 1.1 shows that the proportion of teachers with a break in their careers is 53% and the corresponding percentage for nonteachers is 74%.[9] However, teachers are more likely to drop the work force altogether than nonteachers (59% and 43%, respectively) and nonteachers are more likely to change occupations than teachers (57% and 41%, respectively).

The remainder of this thesis is organized as follows. Chapter 2 presents a discussion of the current literature. Chapter 3 introduces the data and describes the salient characteristics of the sample. Chapter 4 describes the dynamic model of teachers' occupational choices and career mobility patterns. The estimation methodology and estimation results are outlined in Chapter 5. The simulations of the two policy experiments are presented in Chapter 6, and Chapter 7 concludes.

[9]The occupation categories considered for nonteachers are managers and administrators, sales workers, clerical workers, craftsmen operatives, transport equipment operatives, laborers, farmers, service workers, accountants, architects, engineers, farm management advisors, foresters and conservationists, home management advisors, lawyers and judges, librarians, archivists, and curators; mathematical specialists; life and physical scientists; operations and systems researchers and analysts; personnel and labor relations workers; physicians, dentists, and related practitioners; nurses, dietitians, and therapists; health technologists and technicians; religious workers; social scientists; social and recreation workers; college professors; engineering and science technicians; technicians except health; vocational and educational counselors; writers, artists and entertainers; other researcher workers.

Chapter 2

Literature Review

The study of labor supply decisions of elementary and secondary school teachers has been focused on explaining teacher attrition[1] and has primarily involved the use of reduced-form duration models. Studies primarily used "teacher-specific" data that were constructed from administrative records of a particular state or school district. Although these data sets have a large sample, they contained no information about the labor force status of individuals after they left teaching, or family formation variables.[2]

2.1 Teachers' Attrition

The starting consensus on the literature is that teachers leave their careers because of the attractiveness of higher paying alternative occupations. In a series of papers, Dolton and van der Klaauw (1995, 1999) investigate the impact

[1]For a review of studies in teacher attrition and retention see Borman and Dowling (2008).

[2]For example, Murnane and Olsen (1989, 1990) and Murnane et al. (1989) used data of North Carolina and Michigan teachers, Gritz and Theobald (1996) used information from the state of Washington, and Dolton and van der Klaauw (1999) analyzed teachers' labor supply with data for United Kingdom.

of alternative opportunities on teacher transitions. They find evidence that opportunity wages affect the probabilities of both entry and exit. Similarly, Gritz and Theobald's (1996) results indicate that female teachers stay longer when local teacher salaries increase relative to salaries available in other local employment. These results are consistent with earlier work by Murnane and Olsen (1989, 1990) and Murnane et al. (1989) which assumed in their theoretical models that teachers who leave their jobs do so to work at the best nonteaching job alternative, and found that opportunity wages affect duration in teaching.

Recent research found strong evidence against this belief and highlighted the relevance of nonpecuniary benefits outside the workforce relative to being in teaching to explain the fact that teachers are more likely to exit the labor market entirely. The use of data that included information about family size and destination sector after leaving the profession were key to these findings.[3] Using a duration model, Stinebrickner's (1998) work was the first study that empirically signaled the importance of marriage and fertility variables in explaining the length of time that teachers remain in the field.[4] Similarly, Stinebrickner (2001a,b) incorporated these variables exogenously and stochastically in a dynamic framework. He found that the marital status and the

[3]Exceptions are Stinebrickner et al. (2006) and Frijters et al. (2004) who constructed unique data sets for the states of Georgia and for England and Whales that did not contain family formation variables. Both studies found that the impact of relative hourly wage rates on teacher retention is small, emphasizing that the majority of quitters leave the labor force altogether, a decision which is strongly influenced by the presence of dependent children under the age of three years old. Similarly, Michael Podursky and Watson (2004) use a longitudinal data set of recent Missouri public college graduates and new public school teachers to analyze teacher labor market dynamics. The data did not have entries of family size but linked the records of exiting teachers to Unemployment Insurance earnings files. They find little evidence that high-ability teachers are leaving for higher pay. Instead, job match quality seems be the driver of female teachers' quits.

[4]In a posterior paper, Stinebrickner (2002) found that the birth of new children instead of the number of children is the most important predictor of female quit behavior.

number of children seem to be the determinants of the teacher decision to exit the labor force.

In a general study of female labor supply, Shin and Moon (2006) examined the effects of fertility and relative wages on occupational choices (narrowed under teaching and nonteaching options) and labor force participation decisions of female college graduates. They found that the presence of a new born baby is not significant in explaining occupational choices but it has a negative effect on female labor force participation, specially among teachers.

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.[5] Stinebrickner (1998), for example, compares survivor functions for individuals who receive the mean wage in each period, with individuals who receive a wage which is one standard deviation above the mean. He finds that the probability that the high wage person will stay in teaching more than five years is about 9% higher than the probability that the person with the mean wage will stay in teaching more than five years. An earlier study by Murnane and Olsen (1989) finds that the median length of time Michigan teachers stay in teaching increases in more than four years after a raise of $1000 in 1967 dollars (approximately $3400 in 1987 dollars) of a school district's salary. Murnane and Olsen (1990) find a similar relationship for teachers in North Carolina. A $1000 increase of an average school district salary ($1987 dollars) is associated with an increase in the median duration of two to three years.

A common discussion in the literature dealing with teacher attrition is that

[5]See Murnane and Olsen (1989, 1990), Gritz and Theobald (1996), Stinebrickner (1998),Lankford et al. (2002) and Dolton and van der Klaauw (1995, 1999) for an examination of the issue in reduced-form models and Stinebrickner (2001a,b) for an overview of teacher attrition in a dynamic setting.

the current wage structure in public schools, only based on teaching experience and academic credentials, does not play a favorable role in retaining teachers. Flyer and Rosen (1997), Stinebrickner (1998, 2001a,b, 2002) and Stinebrickner et al. (2006) suggested that high attrition rates which are often found for females are related to the fact that teachers can interrupt their careers for a period of time to start a family and still be able to return to the profession without great loss of status. In Stinebrickner (2001a,b), the author analyzed the policies of a fixed and flexible wage structure with the same cost but that reward teachers differently according to their academic ability. He found that although both policies have similar positive effects on labor supply, they have different effects on the types of teachers who choose to teach. The effects are bigger for the most able group of teachers under the flexible wage structure suggesting that there may be benefits from deviating from the current, rigid wage structure. For instance, in Stinebrickner (2001b), both policies cause the proportion of aggregate person years that are spent in teaching to increase from 0.50 to 0.80. However, the flexible wage structure has a larger positive effect on the academic ability composition of the teaching workforce.

Although some studies suggest that child care provision may have significant effects in increasing teacher retention, potential initiatives have not been empirically tested. For instance, 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. Stinebrickner et al. (2006) and Frijters et al. (2004) 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. This thesis is the first document that calculates effects of such child care subsidies on retention.

2.2 Returning Decision

Relatively few studies have examined former teachers' reentrance into the public school workforce. Those that have analyzed the issue have used "teacher-specific" data which are constrained by the lack of family size variables, as discussed above. 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 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.

To my knowledge, the only study that discusses the reentry of teachers to public schools after a career interruption with longitudinal data is Stinebrickner (2002). He reports returning rates between 23% and 40% and finds that they do not differ substantially by the exit reason and are lower than returning rates for nonteachers.

Chapter 3

Data and Descriptive Statistics

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. Given that teachers were oversampled in the survey design, the NLS-72 provides a valuable source for the study of teachers' mobility patterns. 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.

Considering the importance of females in the teaching occupation and given that males respond different than females to family formation variables,[1] the

[1]Stinebrickner (2001a) found that although the teaching participation rate decreases over time for both female and male teachers, not only the relative behavior changes but

final sample used to estimate the dynamic model presented in the next section is restricted to females. 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.

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 3.1 presents descriptive statistics of the final sample and indicators of exits and returns.[2]

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also male and female teachers behave differently over time. 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 the 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.

[2]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.

Table 3.1: 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.

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).[3]

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 3.1 shows that 36% of departing teachers return at some point to a teaching job.[4] 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.

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

[4]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).

Chapter 4

The Dynamic Model

In this 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),[1]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:

$$\begin{aligned} k_{t+1} &= k_t + b_t \quad \text{if} \quad 0 \leq k_t \leq 2 \quad \text{and,} \\ &= 3 \quad \text{if} \quad k_t = 3, \end{aligned} \tag{4.1}$$

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

where k_t represents the number of children at the beginning of period t and Equation (4.1) 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 ρ and 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 nonpecuniary 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 component 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:[2]

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

The nonpecuniary utility is given by:

$$Q_t^r = \gamma^r + \alpha_3^r \, k_t + \alpha_4^r \, k_t \, t + \alpha_5^r \, k_t \, t^2 + \alpha_6^r \, k_t^2 + \alpha_7^r \, k_t^2 \, t + \alpha_8^r \, k_t^2 \, t^2, \qquad \text{for r=E,N,H.} \tag{4.2}$$

The first term in (4.2), γ^r, is the occupation-specific part and represents the nonpecuniary utility in teaching and nonteaching jobs relative to the nonpecuniary utility derived from not working when the teacher doesn't have children.[3] 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

[2]CPI is used to deflate nominal wage values into 1986 dollar values.
[3]This is a result of normalizing γ^H to zero.

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. For instance, 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 held 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.

The expected present value of lifetime rewards of a teacher depends on her employment status the previous period and on how many children she enters

the current period with.[4] Particularly, if in period $t-1$ she is employed in a teaching job with ω^E and has accumulated k_{t-1} children, her expected lifetime utility in t is:

$$\begin{aligned} V^E(k_t, \omega^E, t) &= U_t^E + \beta E \max\ [V^E(k_t, \omega^E, t+1),\ V^E(k_t+1, \omega^E, t+1), \\ &\quad V^N(k_t, \omega^N, t+1), V^N(k_t+1, \omega^N, t+1), \\ &\quad V^H(k_t, t+1), V^H(k_t+1, t+1)]. \qquad (4.3) \\ &= U_t^E + \beta \int \max\ [V^E(k_t, \omega^E, t+1),\ V^E(k_t+1, \omega^E, t+1), \\ &\quad V^N(k_t, x^N, t+1), V^N(k_t+1, x^N, t+1),\ V^H(k_t, t+1), \\ &\quad V^H(k_t+1, t+1)]\, dF^N(x^N), \qquad \text{if} \quad k_{t-1} < 3. \end{aligned}$$

and

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

[4]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}.

Similarly, if the teacher is employed in period $t-1$ in a nonteaching job with ω^N, the expected lifetime utility depends on how many children she enters t with. It is given by:

$$\begin{aligned} V^N(k_{t-1},\omega^N,t) &= U_t^N + \beta E \max\ [V^E(k_t,\omega^E,t+1),\ V^E(k_t+1,\omega^E,t+1), \\ &\quad V^N(k_t,\omega^N,t+1),\ V^N(k_t+1,\omega^N,t+1), \\ &\quad V^H(k_t,t+1),\ V^H(k_t+1,t+1)] \qquad (4.4) \\ &= U_t^N + \beta \int \max\ [V^E(k_t,x^E,t+1),\ V^E(k_t+1,x^E,t+1), \\ &\quad V^N(k_t,\omega^N,t+1), V^N(k_t+1,\omega^N,t+1),\ V^H(k_t,t+1), \\ &\quad V^H(k_t+1,t+1)]\, dF^E(x^E), \qquad \text{if} \quad k_{t-1}<3 \end{aligned}$$

and

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

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 :

$$\begin{aligned} V^H(k_{t-1},t) &= U_t^H + \beta \ \{\rho E \max \ [V^E(k_t,\omega^E,t+1),\ V^E(k_t+1,\omega^E,t+1), \\ &\quad V^H(k_t,t+1), V^H(k_t+1,t+1)] + \\ &\quad +(1-\rho)E \max \ [V^N(k_t,\omega^N,t+1),\ V^N(k_t+1,\omega^N,t+1), \\ &\quad V^H(k_t,t+1), V^H(k_t+1,t+1)]\}. \qquad (4.5) \end{aligned}$$

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

and

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

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

Notice that the pair of employment alternatives inside the expectation term in equations (4.3), (4.4) and (4.5) correspond to the options of giving birth or not. Therefore, k_{t+1} has been expressed in terms of k_t, as Equation (4.1) 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.

Chapter 5

Estimation

This chapter presents the estimation method and results. The first section describes the estimation strategy used to recover the parameters of the model presented in Chapter 4. The second section discusses the estimated parameters. The third section compares the moments of the actual and simulated data.

5.1 Methodology

The estimated parameters are:

$$\phi = \{\Theta^r,\ \alpha_3^H,\ \alpha_4^H,\ \alpha_5^H,\ \alpha_6^H,\ \alpha_7^H,\ \alpha_8^H,\ \rho\},\ \text{where}$$

$$\Theta^r = \{\gamma^r,\ \alpha_1^r,\ \alpha_2^r,\ \alpha_3^r,\ \alpha_4^r,\ \alpha_5^r,\ \alpha_6^r,\ \alpha_7^r,\ \alpha_8^r,\ \mu^r,\ \sigma^r\}\ \text{for r=E,N.}$$

The upper bond and lower bond of teaching and nonteaching wages are listed below. The number of grid points used for wages in both employment sectors is 40.

- $\underline{\omega}^E$, the minimum positive teaching wage is $\$1,462.02$.
- $\overline{\omega}^E$, the maximum teaching wage is $\$55,828.24$.
- $\underline{\omega}^N$, the minimum positive non teaching wage is $\$1,179.2$.
- $\overline{\omega}^N$, the maximum non teaching wage is $\$58,195.28$.

The continuous variables of the state spaces are discretized. ω^E is 40×1 vector and ω^N is 40×1 vector.

The densities of teaching and nonteaching wage shocks are also discretized according to their own truncated log normal density functions, F^E and F^N respectively, with gridsize equal to 40. Instead of assuming a functional form on initial condition which might lead to biased estimates of parameters (Heckman and Singer, 1984), the wages, employment and fertility situations replicate the data in the first period.

The estimation strategy is a Simulated Method of Moments (SMM) procedure and its aim is to recover the behavioral parameters of the theoretical model. For each estimated parameter 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. Using numerical methods I minimize the criterion function. The parameter estimates of the theoretical model are the minimizers of the criterion function.[1]

The criterion function is as follows :

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

[1]The method is developed by Pakes and Pollard (1989).

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), $N_{10} = 11$ are the attrition rates (11 moments), $N_{11} = 20$ 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.[2] The function is minimized using Powells method (Powell, 1964), which require function evaluations but not derivatives.

5.2 Estimation Results

Table 5.1 reports coefficient estimates assuming a discount factor, β of .98.

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

Table 5.1: Parameters Estimates

Parameter	Teaching	Nonteaching	Out of the Workforce
Pecuniary Utility			
Mean of log wage dbn: μ^r	5.2471	5.0267	-
St. dev. of log wage dbn: σ^r	0.3430	0.5930	-
Wage growth (linear): α_1^r	0.0017	0.0372	-
Wage growth (quadrat): α_2^r	-0.0007	-0.0054	-
Non-Pecuniary Utility			
Constant: γ^r	-7,867.1289	-15,230.3804	-
Children: α_3^r	213.4316	84.6971	-82.2224
Children growth (linear): α_4^r	32.8257	34.4288	15.2542
Children growth (quadrat):α_5^r	-21.0079	9.4374	73.7082
Children^2:α_6^r	-83.0717	-40.4978	0.6207
Children^2 growth (linear):α_7^r	-5.1551	-10.5826	-4.2249
Children^2 growth (quadrat):α_8^r	4.9765	-4.7833	-21.9534
Labor Market			
Prob offer if out workforce: ρ	0.4060	0.5940	-

The parameters that characterize the pecuniary utility are reported in the upper part of Table 5.1. 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 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.

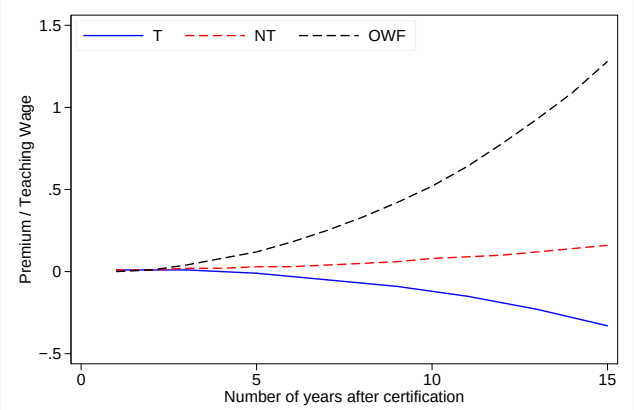
Considering that, in average, the nonteaching wage is always higher than the teaching wage, teachers have monetary incentives to leave teaching for nonteaching jobs. However, Figure 5.6 in the next section shows that the simulated career paths fit well the observed pattern in reality, accurately reflecting that the main exit destination sector is out of the workforce. Therefore, nonpecuniary rewards in the non labor market alternative seem to play an important role.

The estimated parameters of the nonpecuniary utility are reported at the middle of Table 5.1. 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 working in a nonteaching job.

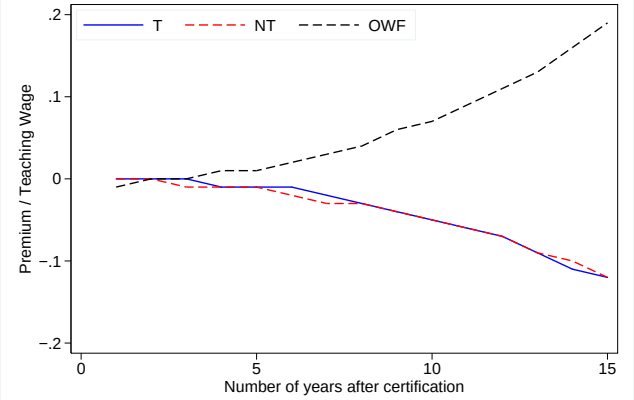
The parameters related to the number of children provide information of the effect that children have on teachers' nonpecuniary utility. An intuitive way to explain the employment flows across teachers' careers is computing and comparing choice premia of several alternatives across time. I present below a discussion of three different premia calculated. They are expressed in terms of the average teaching wage to facilitate an economic interpretation. The corresponding values at every period are presented in Appendix A.

The first exercise was to compute the children premium for every employment option.[3] Figure 5.1 shows children premia for the first, second and third birth.

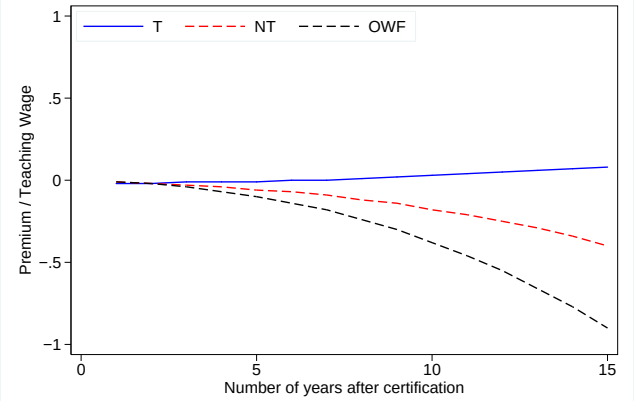
[3]The nonpecuniary gain of increasing the number of children (or children premium) for every employment option has been calculated as $Q_t^r(k+1) - Q_t^r(k)$, for $r = E, N, H$ and $k = 0, 1, 2$.



(a) 1st Child Premium



(b) 2nd Child Premium



(c) 3rd Child Premium

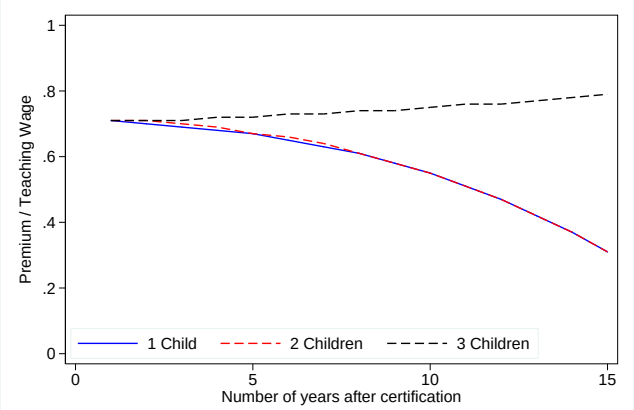
Figure 5.1: Children premia

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. This suggests not only that the individual prefers the non labor market alternative to have her first child, but also that if she 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 holds for the nonteaching and home options.[4] The non pecuniary gain decreases with the number of children if the teacher in employed in the non teaching sector or if she is out of the workforce, but it increases (or becomes less negative) if she is employed in the teaching sector. As a result, the teaching sector is the only employment option generating rewards to give birth to a third child.

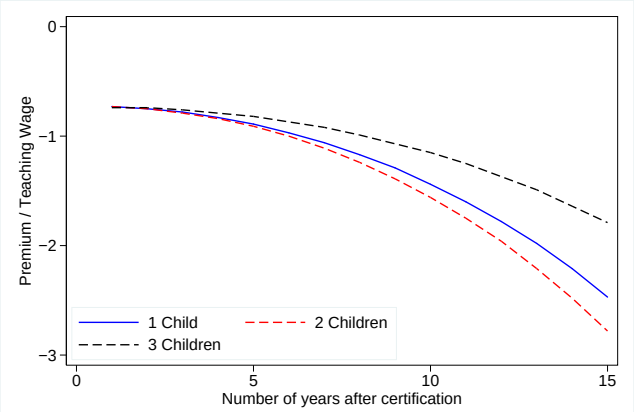
The second exercise was to evaluate occupation premia given the stock of children.[5] Nonpecuniary gains of every employment option are illustrated in the following scheme:

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

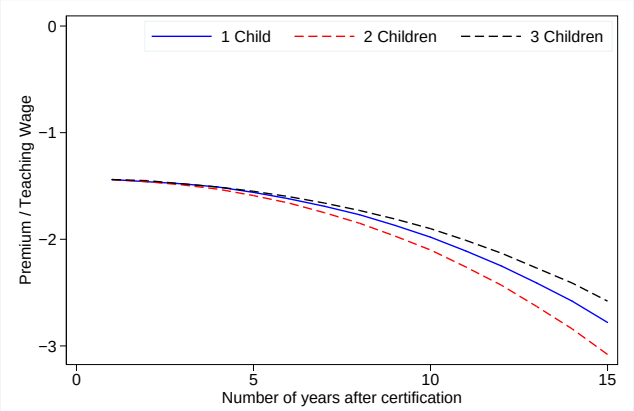
[5]The nonpecuniary gain of teaching relative to nonteaching has been calculated as $Q_t^E(k) - Q_t^N(k)$, for $k = 1, 2, 3$; the nonpecuniary gain of teaching relative to out of the workforce has been calculated as $Q_t^E(k) - Q_t^H(k)$, for $k = 1, 2, 3$; the nonpecuniary gain of nonteaching relative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



(a) T−NT premium



(b) T−OWF premium



(c) NT−OWF premium

Figure 5.2: Occupation Premia

Figure 5.2 shows that the teaching sector is always preferable to the non-teaching sector. Choosing teaching instead of nonteaching with less than three children produces a gain that decreases with time. For instance, in year 3, the nonpecuniary gain of teaching relative to nonteaching with two children is equivalent to 70% of the average teaching wage. This gain declines to 55% in year 10. This pattern is not observed when the occupational decision is made with three children. For the same years, the nonpecuniary premium correspond to 71% and 75%, respectively. This result suggests that given a stock of less than three children, the gain of teaching relative to nonteaching is more important at earlier years.

Figures 5.2(b) and 5.2(c) illustrate that given a positive number of children, the non labor market alternative offers nonpecuniary rewards relative to both teaching and nonteaching employment sectors.[6] Conditioned to 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 current teaching wage in the same period. The fact that the nonteaching loss is greater than the teaching loss complements our understanding of the negative values of γ^E and γ^N shown in Table 5.1. These results suggest that both with and without children, working in teaching is always better than being employed in a nonteaching job.

The third and final exercise was to compute children cross premia across employment options. These are the summation of the children and occupation

[6]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.

premia. They evaluate the nonpecuniary gains of giving birth in the same employment option versus the benefits of switching sectors to give birth to new children.[7] Teaching cross premium for the first, second and third birth are shown below.

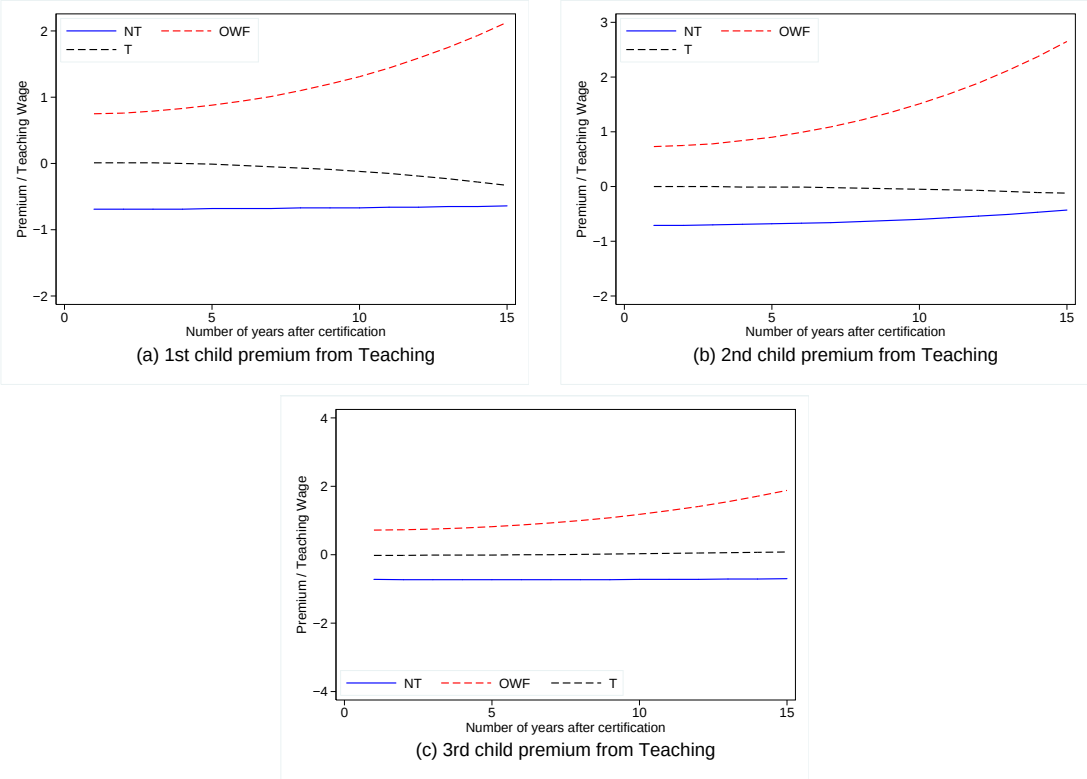


Figure 5.3: Teaching Cross Premia

Regardless of the stock of children, there are nonpecuniary gains to give birth to new children only in the non labor market alternative relative to teaching. In other words, for a teacher employed in a teaching job, it is rewarding to exit the workforce to give birth. The gain in doing so increases with time and

[7]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 $r = E, N, H$.

with 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. The loss is smaller if she stays in teaching rather than if she goes to the nonteaching sector. This result suggests that from the nonpecuniary point of view, even though it is rewarding to drop the workforce altogether to give birth to new children, the teaching sector is more compatible to start a family than the nonteaching option.

Figure 5.4 presents the nonteaching cross premium for the first, second and third child.

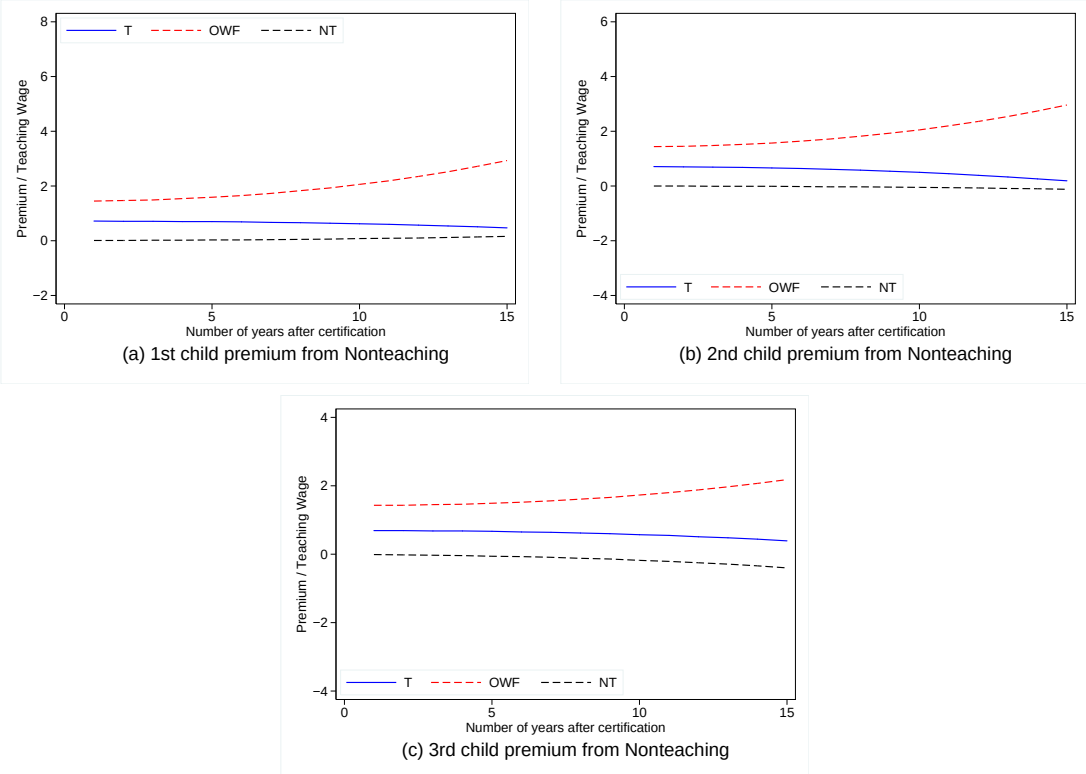


Figure 5.4: Nonteaching Cross Premia

The positive nonteaching cross premia indicate that there are nonpecuniary gains in giving birth to an additional child in all employment sectors and that the gain is greater in the non labor market alternative. In other words, a teacher working in a non teaching job will face the highest nonpecuniary gain by leaving the workforce to give birth. Figure 5.3 and Figure 5.4 indicate that the gain is greater if individuals drop the workforce from nonteaching rather than from teaching, reinforcing the view that the teaching sector offers larger nonpecuniary rewards for having children than the nonteaching sector. For instance, the gain of giving birth to the second child out of the workforce relative to the nonteaching sector in year 3 is equivalent to 1.48 times the average teaching wage and this amount corresponds to 0.78 if the gain is measured relative to the teaching option. Additionally, the gain decreases with the number of children supporting the diminishing returns to children discussed above.

These trends are supported by the out of the workforce cross premium for different number of children presented below.

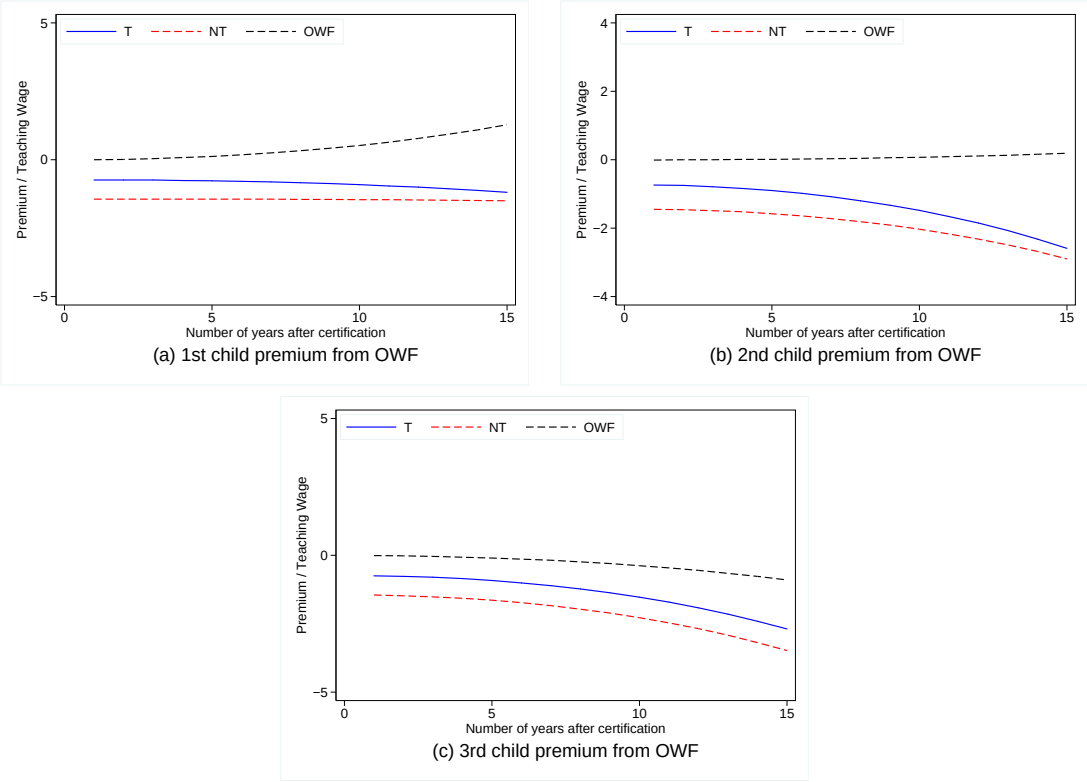


Figure 5.5: Out of the Workforce Cross Premia

Figure 5.5 shows that the non labor market alternative offers nonpecuniary gains of giving birth to the first two children relative to both teaching and nonteaching sectors. The gain decreases with the stock of children consistent the diminishing returns observed in the analysis of children and occupation premia. For instance, the gain of staying out of the workforce and give birth to the first child in year 10 is equivalent to 52% of the teaching wage and to 7% if it is the second birth. An interesting result is that 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.[8]

5.3 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 the methodology section.

[8]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.

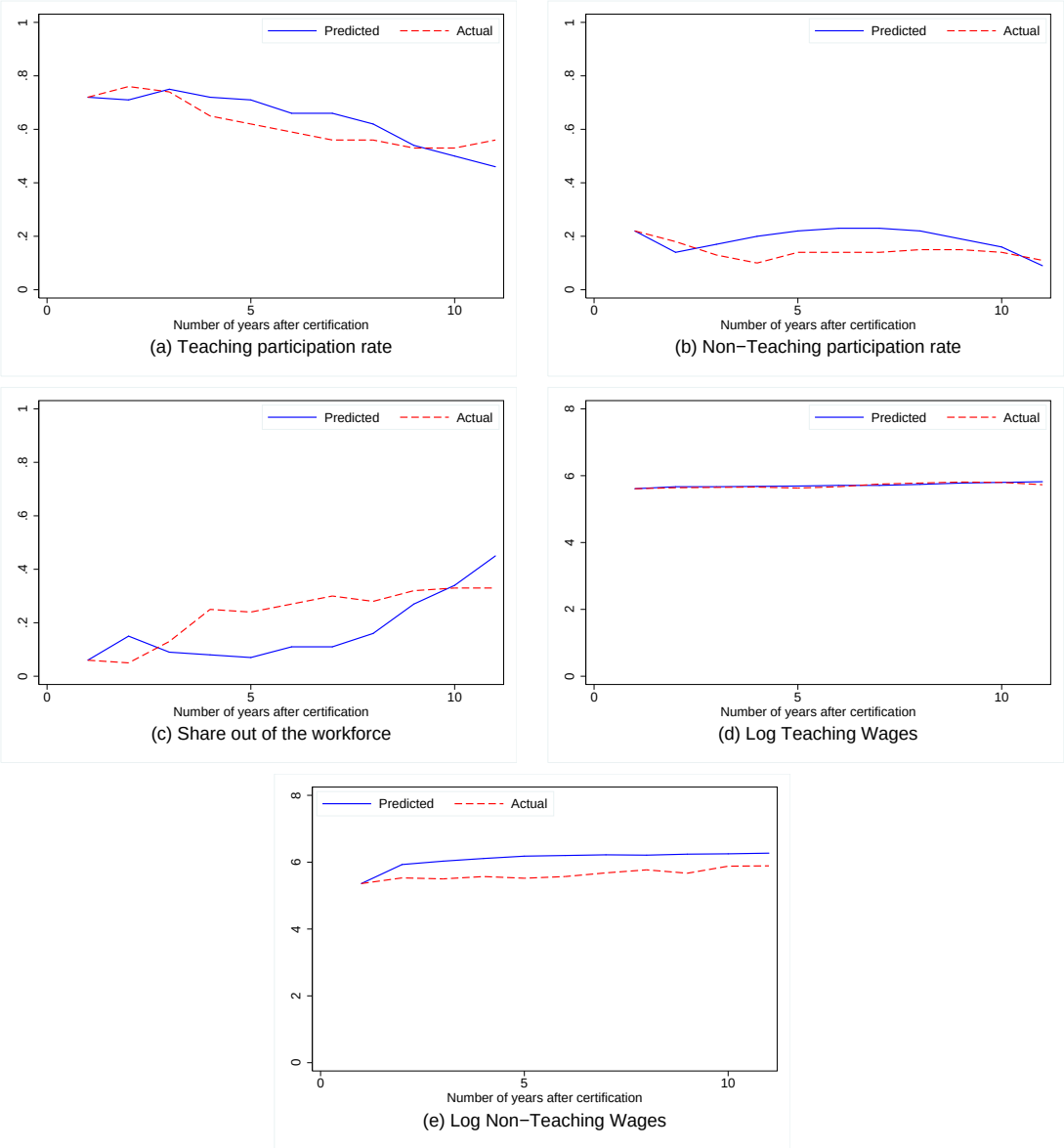


Figure 5.6: Actual and Predicted Employment Distributions and Wages

Figure 5.6 compares actual and predicted employment and wage moments. 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.

Actual and simulated teaching, nonteaching and out of the workforce transitions are illustrated below.

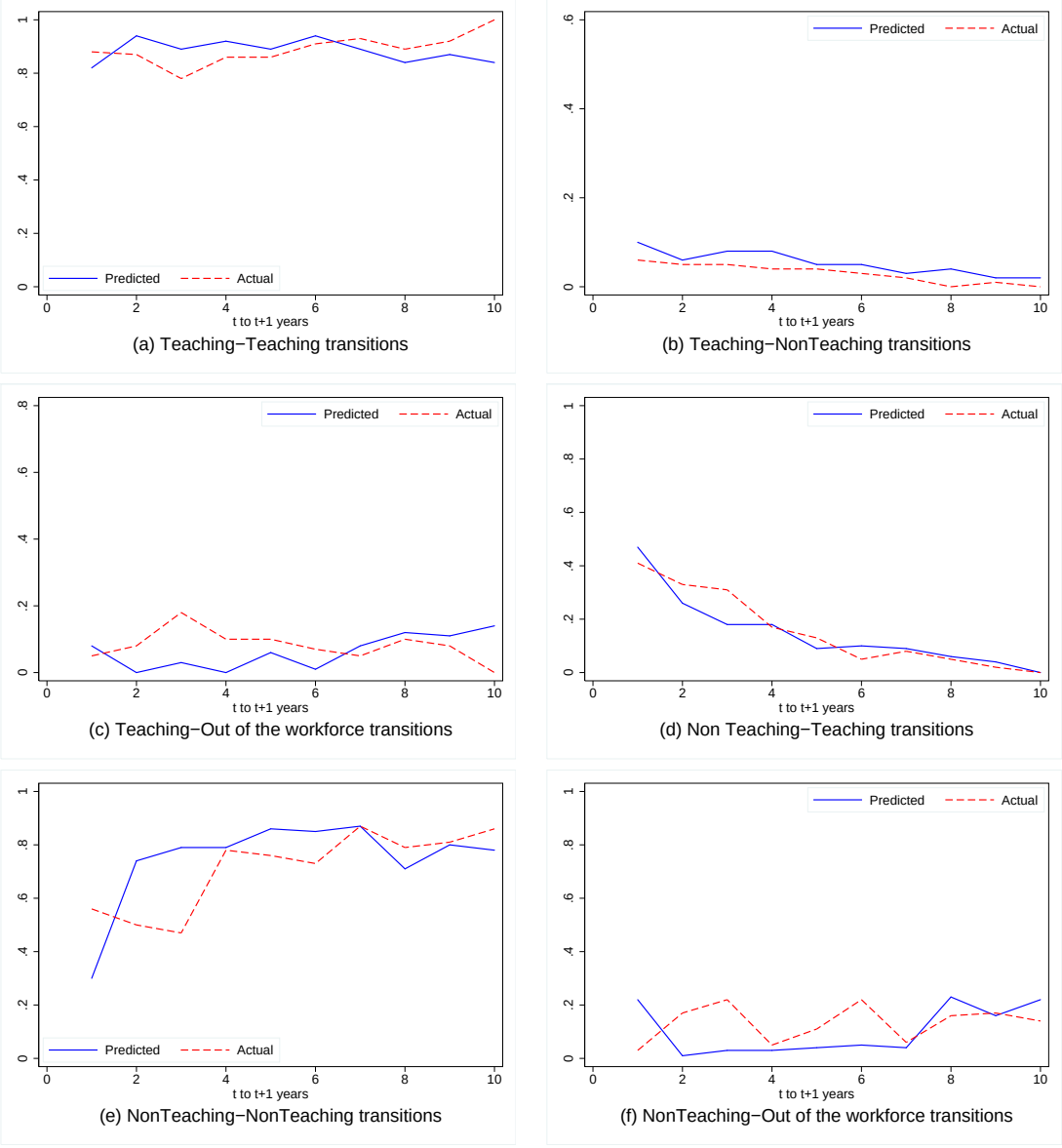


Figure 5.7: Actual and Predicted Employment Transitions

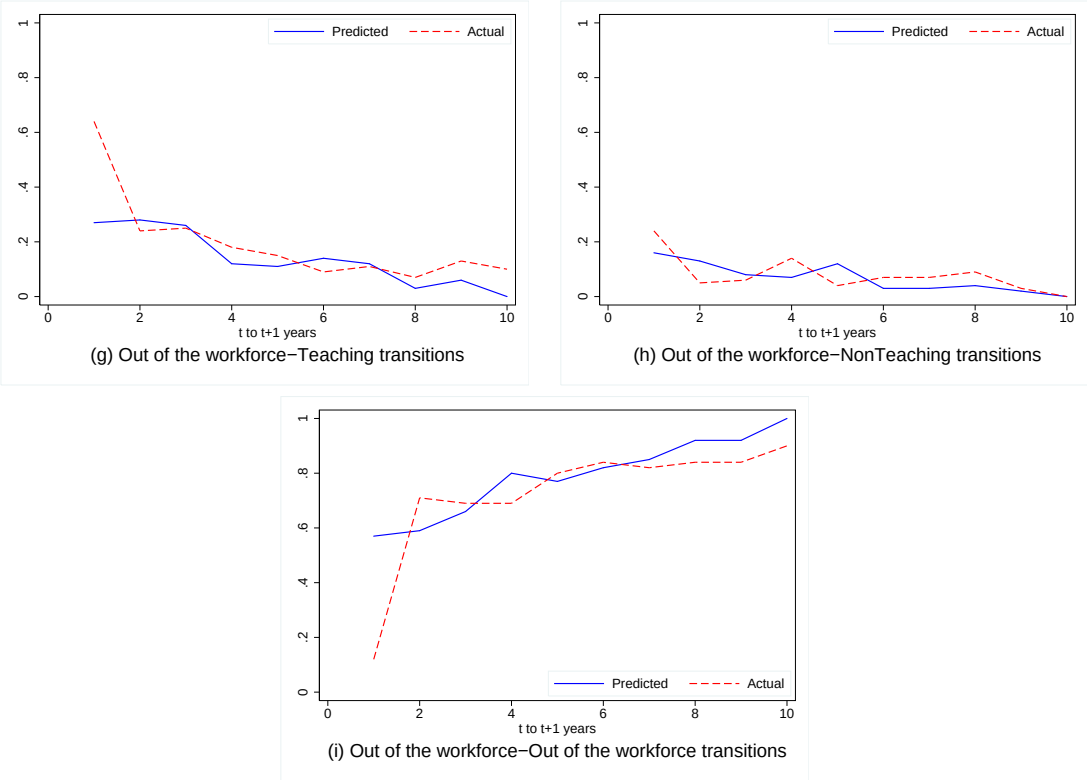


Fig 5.7: Actual and Predicted Employment Transitions (cont.)

Since the analysis time in this thesis is years after certification, transitions shown in Figure 5.7 reproduce how teachers move across employment options and do not necessarily represent exit and return rates.[9] 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

[9]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.

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.

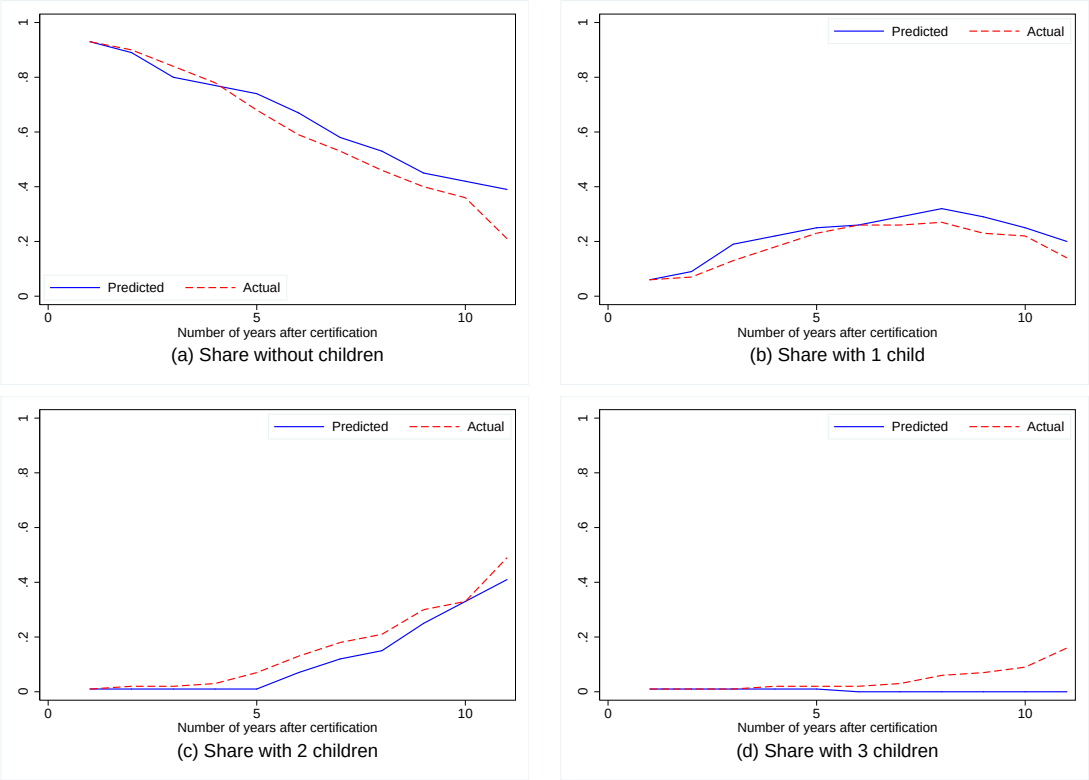


Figure 5.8: Actual and Predicted Children Distributions

Figure 5.8 displays the 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 Chapter 5.2.

Predicted and actual attrition rates at different time periods are presented in Table 5.2.[10]

[10] Attrition rates at time t were calculated as the percentage of teachers who are observed

Table 5.2: Actual and Predicted Attrition Rates

Years	Actual	Predicted
1-3	0.18	0.17
4-5	0.24	0.13
6-7	0.11	0.10
8-11	0.09	0.17

By the third year after certification, 18% and 17% of teachers ended their first teaching spell in the data and in the model, respectively. The model understates attrition rates occurring during years 4 and 5, accurately predicts the percentage of teachers who left teaching during years 6 and 7, and overstates attrition rates at later periods.

Predicted and actual return rates are reported in Tables 5.3 and 5.4.[11]

in teaching jobs until $t-1$. Therefore, t is equivalent to the year after the first teaching spell ended. Consequently, the cumulative attrition at time t will be the sum of attrition rates at previous periods.

[11]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.

Table 5.3: Actual and Predicted Returning Rates if Left to Nonteaching

Years	Actual	Predicted
1	0.27	0.13
2	0.31	0.21
3	0.32	0.28
4	0.30	0.32
5	0.33	0.38
6	0.31	0.38
7	0.41	0.37
8	0.46	0.36
9	0.00	0.31

Table 5.4: Actual and Predicted Returning Rates if Left the Workforce

Years	Actual	Predicted
1	0.17	0.13
2	0.31	0.24
3	0.34	0.31
4	0.34	0.34
5	0.34	0.37
6	0.40	0.38
7	0.48	0.38
8	0.50	0.37
9	0.50	0.33

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 returning

rates for exits out of the workforce reinforce the overall fit of my estimates since the model is especially 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 time but also at returning time.

Chapter 6

Policy Experiments

In this chapter, 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.[1] 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.[2]

[1]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 α_3^E.

[2]The equivalent in dollars for every subsidy level as well as the corresponding change in the children parameter, α_3^E, are presented in Appendix B.

6.1 Policy One: A 20 Percent Increase in Teaching Wages

Figure 6.1 compares predicted and counterfactuals participation rates, wages and children distributions for policy one.

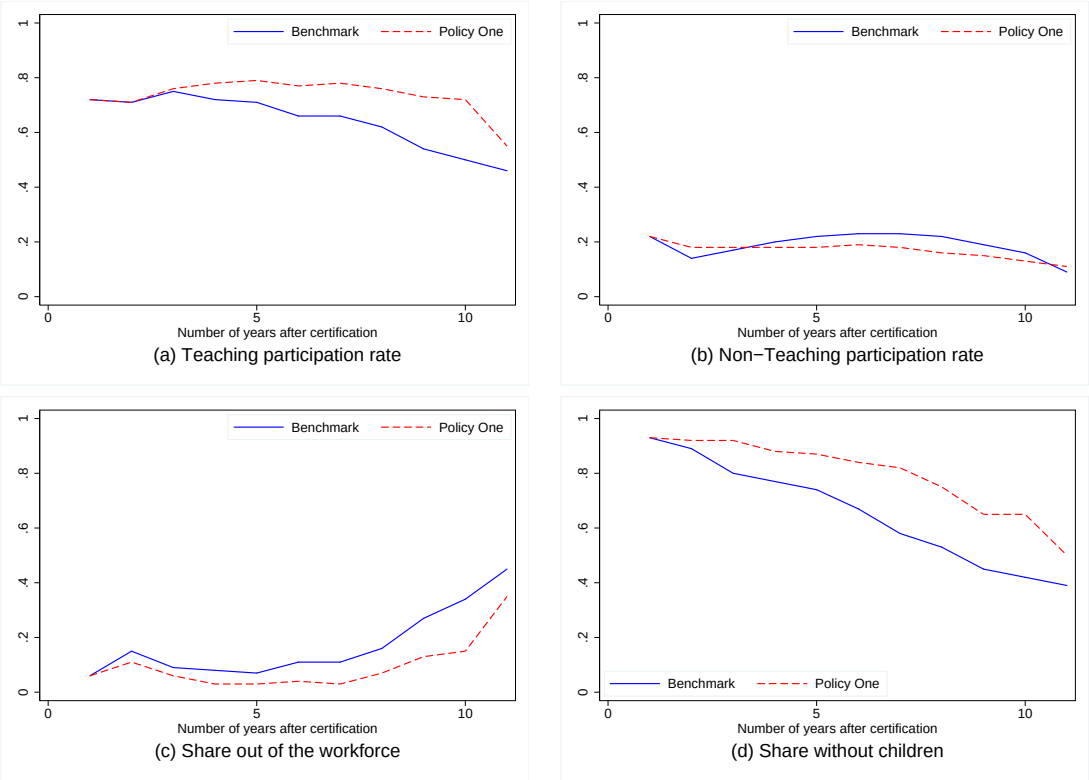


Figure 6.1: Policy One: A 20% Increase in Teaching Wages

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 6.1(c) and 6.1(d) suggest that a large decrease in the proportion of women who are out of the workforce, rather than more individuals leaving nonteaching

jobs, plays the relevant role in the increasing teaching participation rate.

The measure of retention used in this thesis is the percentage of aggregate years spent in teaching.[3] A 20 percent raise in teaching pay increases retention by 14% (from 66% to 75%).[4] 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.[5]

Figure 6.1(d) is illustrative of changes in fertility choices after a 20 percent increase in teaching wages. Over my sample period, the proportion of teachers without children increases from 68% to 82%.[6] 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.[7]

Taking employment and fertility changes together, policy one generates 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.[8]

To understand the dynamics of job changes and its relationship with

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

[4]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.

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

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

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

[8]Lower birth rates are consistent with the negative sign of the substitution effect after an exogenous change that microeconomic theory states. The final outcome indicates that the negative substitution effect offsets the positive income effect after a 20 percent raise in teaching wages.

fertility behavior, I present below indicators of exits and returns for benchmark and policy one scenario.

Table 6.1: Exit and Returning Indicators.
Benchmark and Policy One

	Benchmark	**Policy One**
Type of individuals		
Left	0.56	0.43
Returned	0.32	0.48
LEAVERS		
Exit reason		
Nonteaching	0.55	0.65
Out of the workforce	0.45	0.35
Exit timing		
Years teaching experience	3.94	3.61
Exit timing Nonteaching		
Years teaching experience	3.35	3.23
Exit timing Out of the Workforce		
Years teaching experience	4.67	4.32
Percent with children at exit time[a]	0.16	0.10
Nonteaching	0.11	0.09
Out of the Workforce	0.22	0.10
Avg number of children at exit time[a]	0.18	0.12
Nonteaching	0.13	0.12
Out of the workforce	0.24	0.13
RETURNERS		
Percent with children at returning time[b]	0.50	0.25
Avg number children at returning time[b]	0.67	0.33
Percent give birth during interruption	0.43	0.20
Length of Career Interruption	2.40	2.43

[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 6.1 indicates that 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.[9]

Tables 6.2 and 6.3 compare attrition rates of the benchmark model and policy one for exits to nonteaching jobs and out of the workforce, respectively.

Table 6.2: Attrition Rates if Left to Nonteaching.
Benchmark and Policy One

t	**Benchmark**	**Policy One**
2	6.82	6.73
3	4.01	3.41
4	5.54	4.69
5	4.77	3.58
6	2.90	3.24
7	2.81	2.39
8	1.53	1.71
9	1.62	1.28
10	0.77	0.94
11	0.17	0.17

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

Table 6.3: Attrition Rates if Left the Workforce.
Benchmark and Policy One

t	**Benchmark**	**Policy One**
2	6.05	5.54
3	0.00	0.00
4	1.96	0.00
5	0.00	0.00
6	3.24	1.28
7	0.77	0.00
8	3.84	2.64
9	5.12	3.41
10	3.50	0.68
11	0.77	1.36

Child care subsidies decrease the proportion of teachers who leave teaching at almost every period, regardless of the destination sector.

The bottom part of Table 6.1 depicts fertility behavior of teachers at exiting and returning 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.

Tables 6.4 and 6.5 compare returning rates for exits to nonteaching and out of the workforce under benchmark and policy one scenario, respectively. The discussion of the returning decision is accompanied by an analysis of return indicators presented in Table 6.1.

Table 6.4: 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 6.5: 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 6.1 shows that under the scenario of increasing teaching wages, 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. A more detailed analysis is presented in Table 6.4 and Table 6.5. 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 from 19% to 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 6.4 indicates that the higher returning rates for leavers to the non-teaching 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 6.5 shows.[10] 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 non-teaching jobs is associated with the greatest impact this policy has in reducing the proportion of individuals who give birth to new children in that sector.

6.2 Policy Two: Child Care Subsidies

Figure 6.2 presents the predicted and counterfactuals participation rates and children distributions under policy two scenario, for the three different levels of child care subsidies.

The teaching participation rate increases with the amount of the subsidy. At the fourth period after certification, subsidy "level one" increases the pro-

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

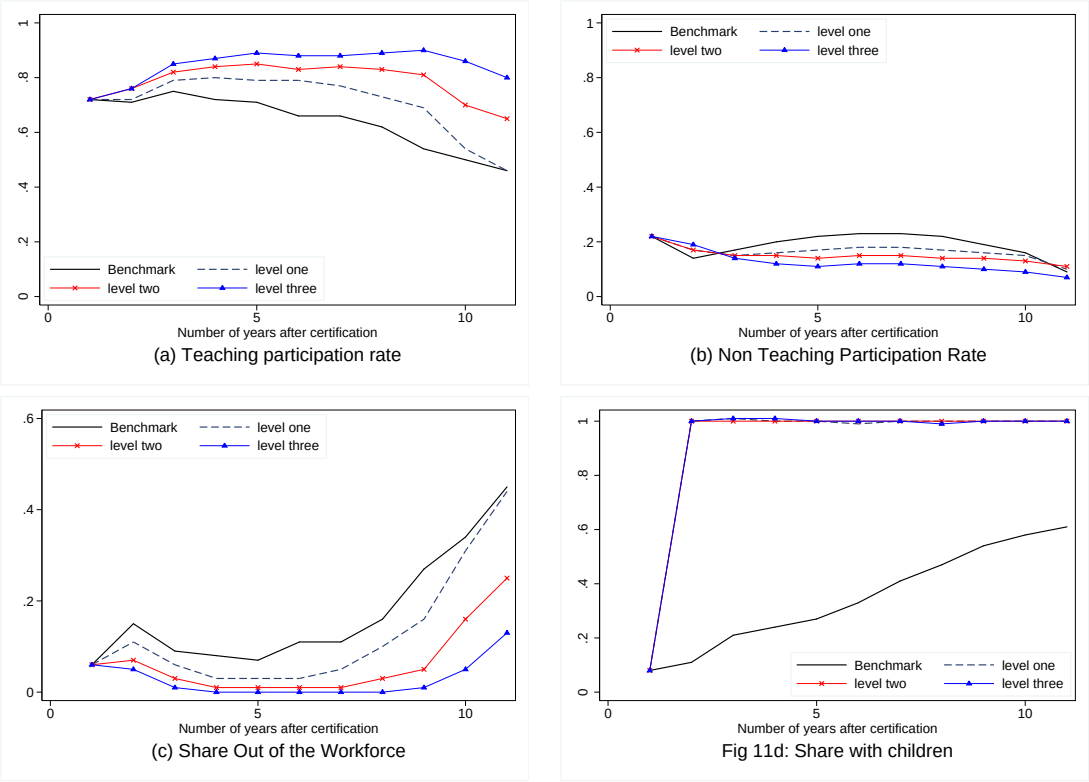


Figure 6.2: Policy Two: Child Care Subsidies

portion of teachers employed in teaching jobs by 11% and subsidy "level two" and "level three" do so by 17% and 21%, respectively. The percentage of individuals employed in nonteaching jobs is more responsive at earlier rather than at later periods and the opposite occurs for the share of individuals out of the workforce. Thus, 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 6.2(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 6.2(d) depicts fertility behavior under policy two. Over my sample period, child care subsidies increase the proportion of teachers with children,[11] outcome mainly attributed to changes in fertility choices occurring in the teaching sector, especially at earlier periods. Whereas the birth rates in the nonteaching and out of the workforce sectors decrease, the average birth 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 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 fertility effect in the non labor market alternative rather than in the nonteaching sector.[12]

To complement our understanding of teachers' family and career choices under policy two, I present below indicators of exits and returns for benchmark and policy two scenario.

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

[12]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.

Table 6.6: Exit and Returning Indicators.
Benchmark and Policy Two

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

According to Table 6.6, child care subsidies decrease the proportion of individuals who leave teaching from 56% to 54% and to 29% with subsidies "level one" and "level three," respectively. Tables 6.7 and 6.8 illustrate attrition rates

under benchmark and the three levels of subsidies for exits to nonteaching and out of the workforce, respectively.

Table 6.7: Attrition Rates if Left to Nonteaching.
Benchmark and Policy Two

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

Table 6.8: Attrition Rates if Left the Workforce.
Benchmark and Policy Two

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

Table 6.8 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 6.7.[13] 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 6.6, 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

[13]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.

is to drop the workforce altogether.[14]

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

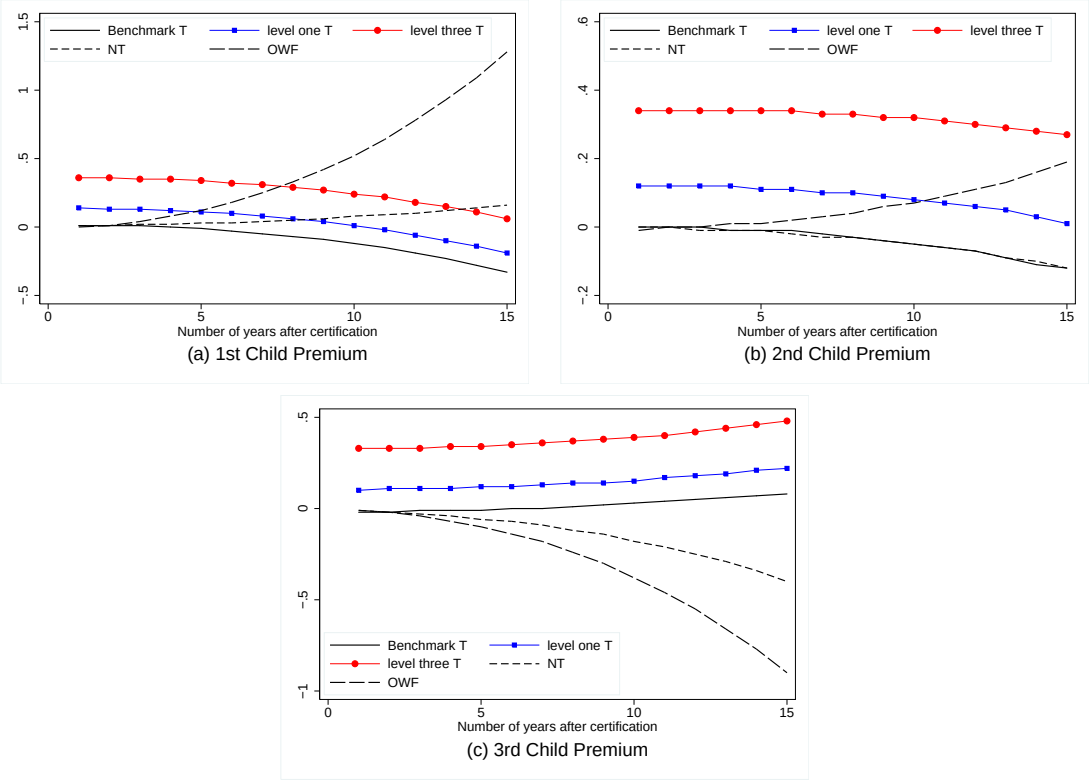


Figure 6.3: Children Premia. Benchmark and Policy Two

Figure 6.3 shows that children premia in the teaching sector increase with

[14]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.

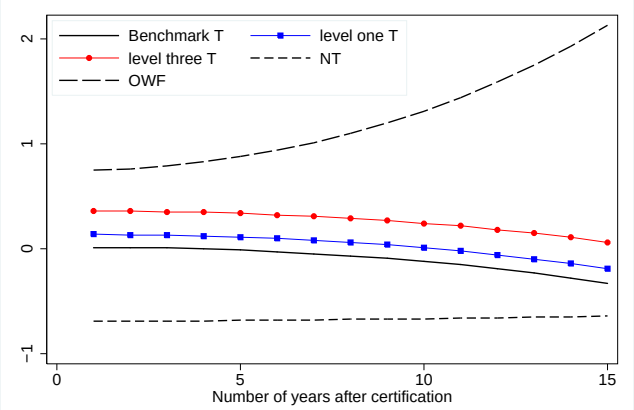
child care subsidies.[15] Higher children premia in the teaching sector now offset the nonpecuniary gains of giving birth in the non labor market alternative at earlier periods and remain lower at later periods. Therefore, the teaching sector is now the employment option that offers the highest nonpecuniary gain of giving birth to the first and second child at earlier periods. This explains the longer first teaching spell observed with child care subsidies: teachers stay longer in the field to start their families. Figure 6.3(c) indicates that giving birth to the third child in the teaching sector is the most rewarding option along the teachers' career paths with all levels of subsidies.

Similarly, teaching premia relative to nonteaching and to the non labor market alternative increase with α_3^E, the parameter used to simulate child care subsidies. Thus, conditioned 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 Figure 5.2) but have higher values.[16] Being in teaching remains not preferred than being out of the workforce with one or two children, but becomes the most rewarding option with subsidy "level three" and three children.

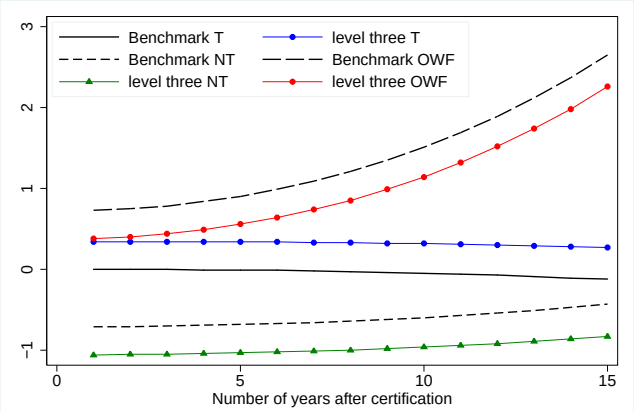
A crucial policy question is to investigate if child care subsidies offset the large nonpecuniary benefits that the non labor market alternative offers in benchmark model (see Figures 5.3-5.5). Cross premia changes from teaching are shown below.

[15]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 α_3^E.

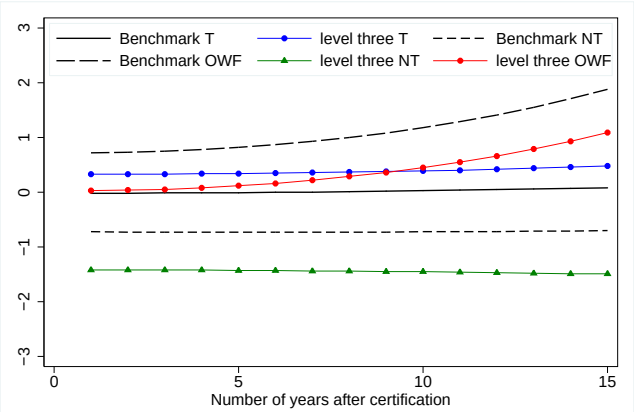
[16]To represent graphically changes in teaching premia will result in unreadable figures since nonpecuniary gains depend also on the stock of children. For instance, to reproduce the effect of child care subsidies on occupation premia presented in Figure 5.2, each figure will have six series, even if I restrict the analysis to only one subsidy level. Appendix C presents the corresponding numerical values.



(a) 1st Child Premium from Teaching



(b) 2nd Child Premium from Teaching

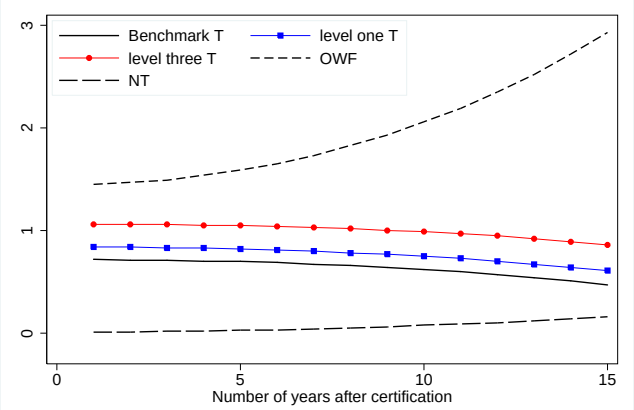


(c) 3rd Child Premium from Teaching

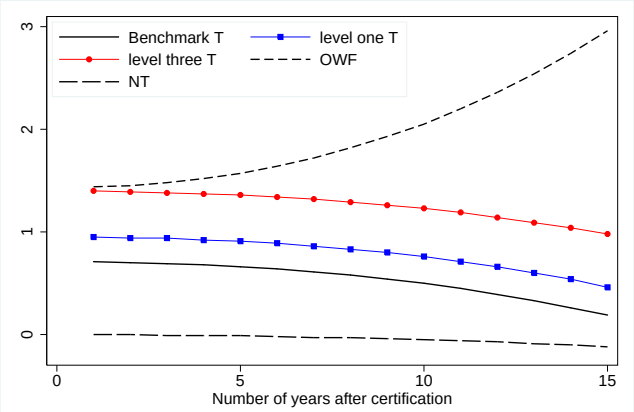
Figure 6.4: Teaching Cross Premia. Benchmark and Policy Two

To forces play a role in Figure 6.4. First, child care subsidies increase the gain of giving birth and staying in teaching (as also shown in Figure 6.3). Second, the nonpecuniary benefit of dropping out the workforce altogether to give birth to new children decreases since doing so implies quitting the employment sector whose nonpecuniary rewards have been raised. According to Figure 6.4, the non labor market alternative remains the sector that offers the highest nonpecuniary gain to give birth to the first child. This relative gain decreases with the number of children and as a result, dropping out the teaching workforce to give birth to the third child offers larger nonpecuniary gains only if the birth occurs after year 8. In other words, staying in teaching to give birth to the third child is the employment option that offers the highest nonpecuniary gain only for the first 8 years.

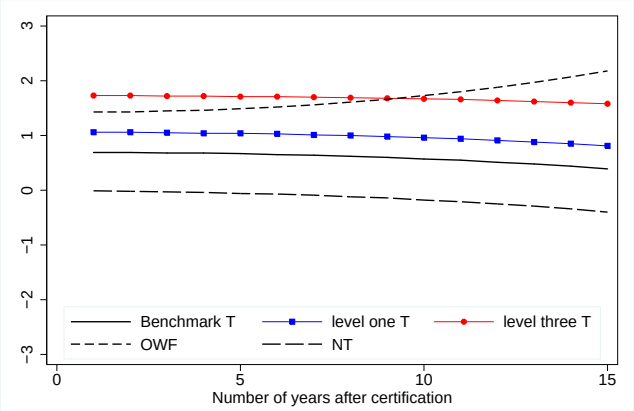
Figure 6.5 presents cross premia changes from nonteaching.



(a) 1st Child Premium from Nonteaching



(b) 2nd Child Premium from Nonteaching



(c) 3rd Child Premium from Nonteaching

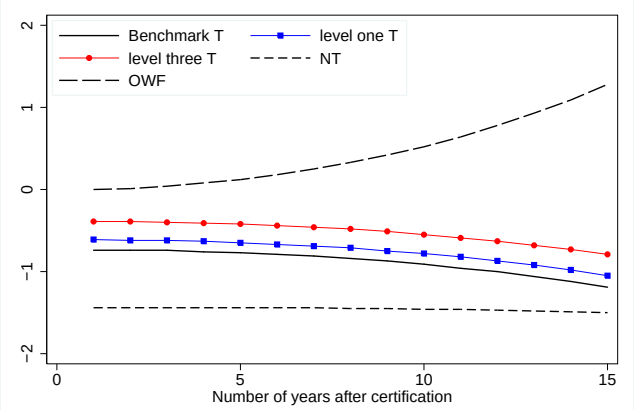
Figure 6.5: Nonteaching Cross Premia. Benchmark and Policy Two

Nonteaching nonpecuniary gains of giving birth to new children as well as the corresponding gain of doing so in a different employment alternative under the scenario of policy two are illustrated in Figure 6.5.[17] The nonpecuniary benefits of leaving nonteaching to give birth in the teaching sector increases with the number of children. For childless teachers employed in nonteaching jobs, the option of dropping out the workforce to give birth to their first child offers the highest gain. However, the attractiveness of the teaching sector starts to play an important role from the second birth. The teaching sector becomes the employment alternative with the highest nonpecuniary gain of giving birth a third child in the first 8 years. Similar to the teaching cross premium analysis, do not switching sectors is the best option for having a third child after year 8.

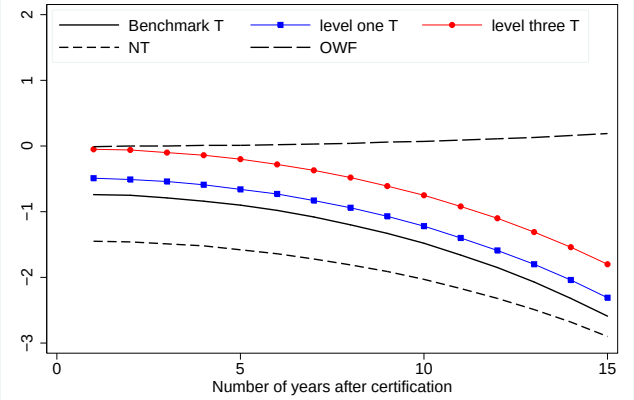
Nonpecuniary gains of giving birth to new children out of the workforce as well as the corresponding gains of reentering the workforce to give birth under the scenario of policy two are shown in Figure 6.6.[18]

[17]Notice that α_3^E belongs only to the nonpecuniary gain of switching from nonteaching to teaching to give birth. Thus, child care subsidies only change the teaching premia relative to nonteaching conditioned on a positive stock of children.

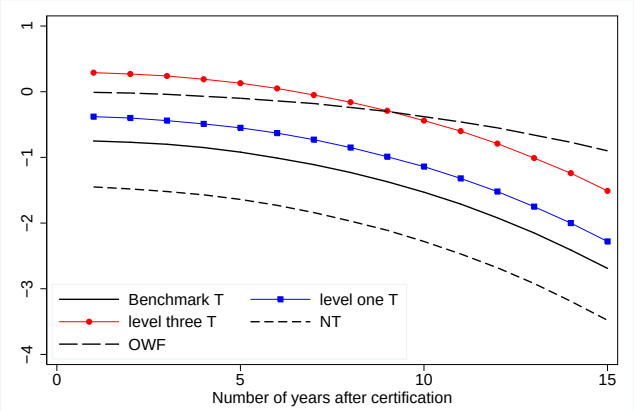
[18]Recall that α_3^E belongs only to the nonpecuniary premium of entering teaching from the non labor market alternative to give birth. Thus, child care subsidies only change the teaching premia relative to out of the workforce conditioned on a positive stock of children.



(a) 1st Child Premium from OWF



(b) 2nd Child Premium from OWF



(c) 3rd Child Premium from OWF

Figure 6.6: Out of the workforce Cross Premia. Benchmark and Policy Two

Child care subsidies increase the gain of reentering teaching to give birth after a career interruption. The nonpecuniary benefits of doing so increase with the number of children. Giving birth to the first child out of the workforce continues to be the most rewarding option. However, the gains of having a second child in the teaching sector or out of the workforce are almost the same for the first four years. Consequently, the teaching sector becomes the employment alternative with the highest nonpecuniary gain of giving birth a third child in the first 8 years. At later periods, the non labor market alternative remains the alternative offering the highest premium.

These trends suggest 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 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 and why it increases if teachers leave the workforce.

The bottom part of Table 6.6 presents fertility behavior of teachers at exiting and returning times. The percentage of teachers with at least one child at the last year of her 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 in-

terruption.[19]

Finally, I analyze reentry decisions using information provided in Table 6.6 and returning rates at different periods for exits to nonteaching and out of the workforce presented in Tables 6.9 and 6.10, respectively. Table 6.6 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.

Table 6.9: Returning Rates if Left to Nonteaching.
Benchmark and Policy Two

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

[19]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.

Table 6.10: Returning Rates if Left the Workforce.
Benchmark and Policy Two

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

Tables 6.9 and 6.10 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" increase the returning rates for teachers observed different periods after dropping out the workforce altogether. In order to have a deeper understanding of the decision process of teachers between exiting and returning time, I present below a detailed construction of the returning rates for exits to nonteaching and out of the workforce and compare them with their corresponding values in benchmark.[20]

[20]I show results for subsidy "level two." Results for subsidy "level one" and "level three" are presented in Appendix D.

Table 6.11: 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

Table 6.12: 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

Table 6.11 and Table 6.12 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. On the other hand, 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 they have left to be observed back into teaching. Exits out of the workforce exhibits the particular feature of being concentrated at later periods as teachers decide to give birth and stay in teaching at earlier years. Therefore, exiting teachers who dropped the workforce altogether are less likely to be observed back in the field given the simulation period in my model. As a result, the number of returners decrease as shown in Table 6.12. 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 becomes 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 accumulated before career interruption.

The positive impact of the highest subsidy in returning rates from the non labor market alternative 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 6.4). 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.[21]

[21] See Table D.4 for details.

Chapter 7

Conclusions

The main purpose of this thesis 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, issue that previous research has not been able to account. 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 as structural approach to understand teachers' mobility patterns. Individuals maximize their life time expected utility which consists on pecuniary and nonpecuniary rewards, 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.

I find that 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 to new children 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. Therefore, higher returning rates for exits to the nonteaching sector respond both to fewer teachers interrupting their careers and to the effectiveness of wage policies in attracting back to the teaching individuals who left teaching for 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. Considering that individuals respond positively to higher teaching wages only if they have fewer children, 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 of the the wage policy in reducing the proportion of individuals who give birth to new children in that sector.

Child care subsidies increase retention by 11%, 21%, and 29% with subsidy "level one," "level two," and "level three," respectively. More teachers simultaneously choose to be employed in teaching jobs and to give birth to new children, especially at earlier periods. As expected, the teaching sector is the employment alternative that drives the increase in the average annual birth rate. Policy simulations of nonpecuniary premia indicate that at earlier periods, gains of giving birth and having children in the teaching sector offset the large benefits that the non labor market alternative offers. As a result, child care subsidies are effective in prolonging the first teaching spell as new births are concentrated during the first four years. At very late periods, large nonpecuniary rewards of the non labor market alternative relative to teaching decrease the likelihood of observing more departing teachers back to the field.

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.

Something important to consider when analyzing policy implications of this work is the global dimension that this thesis assigned to the teacher labor market. In reality, every school district has its own pay scale so that teachers with the same academic credentials and experience can have unequal salaries if they teach in different school districts. By disregarding location choice, this thesis is assuming that policy experiments affect employment and fertility choices independently of the local pecuniary benefits that every school district or state offers. However, it could be that teachers who work in school districts that pay more or that have better local alternative options respond less to

higher teaching wages. Therefore, an important extension to this thesis is to incorporate initial conditions that represent local teaching or alternative incentives. The idea behind this suggestion is to account for the incentives that teachers face according to the school district or state they choose to start their careers in.

These results are encouraging for further applied research based on utility-maximizing job search models applied to public school teachers. First, incorporating other family formation variables like marital status could extend this work. This will allow to assess the importance of monetary constraints on teachers' labor market decisions since the partner's salary will be incorporated in the teachers' utility function. Second, considering the time constraint that women face to give birth could increase accuracy predictions. Restricting fertility choices to the females' fertile stage would probably have an effect of nonpecuniary gains of giving birth in different sectors and at different years. Finally, including in the model the institutional feature of the fixed wage structure in teaching pay will improve the goodness of fit and represent an important methodological contribution. By allowing returner teachers to reentry the sector with the last teaching wage accepted, the model can replicate the low human capital depreciation that is attributed to the teaching occupation.

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Appendix A: Nonpecuniary Premia

This Appendix presents nonpecuniary gains discussed and presented graphically in Chapter 5.2. They are expressed in terms of the average teaching wages. Tables A.1 and A.2 show children and occupation premia, and Tables A.3 - A.5 display children premia across occupations.

Table A.1: Children Premia

	Years														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
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	-0.23	-0.28	-0.33
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	0.12	0.14	0.16
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	0.93	1.09	1.28
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	-0.09	-0.11	-0.12
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	-0.09	-0.10	-0.12
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	0.13	0.16	0.19
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	0.06	0.07	0.08
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	-0.29	-0.34	-0.40
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	-0.66	-0.77	-0.90

Table A.2: Occupation Premia

	Years														
	1	**1**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
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	0.42	0.37	0.31
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	0.42	0.37	0.31
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	0.77	0.78	0.79
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	-1.98	-2.21	-2.47
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	-2.21	-2.48	-2.78
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	-1.49	-1.64	-1.79
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	-2.41	-2.58	-2.78
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	-2.63	-2.84	-3.08
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	-2.27	-2.41	-2.58

Table A.3: Cross Premia from Teaching

	Years														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
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	-0.23	-0.28	-0.33
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	-0.65	-0.65	-0.64
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	1.75	1.93	2.13
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	-0.09	-0.11	-0.12
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	-0.51	-0.47	-0.43
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	2.12	2.37	2.65
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	0.06	0.07	0.08
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	-0.71	-0.71	-0.70
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	1.55	1.71	1.88

Table A.4: Cross Premia from Nonteaching

	Years														
	1	**1**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
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	0.12	0.14	0.16
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	0.54	0.51	0.47
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	2.52	2.72	2.93
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	-0.09	-0.10	-0.12
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	0.33	0.26	0.19
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	2.54	2.74	2.96
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	-0.29	-0.34	-0.40
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	0.48	0.44	0.39
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	1.97	2.07	2.18

Table A.5: Cross Premia from Out of the Workforce

	Years														
	1	**1**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
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	0.93	1.09	1.28
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	-1.06	-1.12	-1.19
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	-1.48	-1.49	-1.50
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	0.13	0.16	0.19
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	-2.07	-2.32	-2.59
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	-2.49	-2.68	-2.90
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	-0.66	-0.77	-0.90
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	-2.15	-2.41	-2.69
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	-2.92	-3.19	-3.48

Appendix B: Child Care Subsidies

I increase the estimated value of α_3^E (presented in Table 5.1), the children-specific component of the nonpecuniary teaching utility, to evaluate three different levels of child care subsidies. The corresponding dollar amounts (in 1986 dollar values) are specified below.

Table B.1: 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

Appendix C: Policy Two and Nonpecuniary Premia

This Appendix presents occupation premia under policy two scenario. Child care subsidies, implemented by increasing α_3^3, only change teaching premia relative to nonteaching and to the non labor market alternative. Table C.1 presents occupation premia for subsidy "level one," Table C.2 and Table C.3 show occupation premia for subsidies "level two" and "level three," respectively.

Table C.1: Occupation Premia, Policy Two (level one)

	Years														
	1	**1**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
T-NT															
1 child	0.83	0.83	0.82	0.81	0.79	0.78	0.76	0.73	0.70	0.67	0.64	0.60	0.56	0.51	0.45
2 children	0.95	0.95	0.94	0.93	0.92	0.90	0.88	0.86	0.84	0.81	0.77	0.73	0.69	0.64	0.58
3 children	1.07	1.08	1.08	1.09	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.18	1.19	1.21
T-OWF															
1 child	-0.61	-0.63	-0.66	-0.71	-0.77	-0.84	-0.93	-1.04	-1.16	-1.31	-1.47	-1.65	-1.85	-2.08	-2.33
2 children	-0.49	-0.51	-0.54	-0.60	-0.67	-0.76	-0.86	-0.99	-1.13	-1.30	-1.49	-1.70	-1.94	-2.20	-2.50
3 children	-0.37	-0.38	-0.39	-0.42	-0.45	-0.50	-0.55	-0.61	-0.68	-0.77	-0.86	-0.97	-1.09	-1.22	-1.37

Table C.2: Occupation Premia, Policy Two (level two)

	Years														
	1	**1**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
T-NT															
1 child	0.93	0.93	0.92	0.91	0.90	0.88	0.86	0.84	0.81	0.78	0.75	0.71	0.67	0.62	0.57
2 children	1.16	1.15	1.15	1.14	1.13	1.11	1.09	1.07	1.05	1.02	0.99	0.95	0.91	0.87	0.82
3 children	1.38	1.38	1.39	1.39	1.40	1.41	1.42	1.43	1.44	1.46	1.47	1.49	1.51	1.53	1.55
T-OWF															
1 child	-0.51	-0.53	-0.56	-0.61	-0.67	-0.74	-0.83	-0.94	-1.06	-1.20	-1.36	-1.54	-1.74	-1.96	-2.21
2 children	-0.28	-0.30	-0.34	-0.39	-0.46	-0.55	-0.65	-0.78	-0.92	-1.08	-1.27	-1.48	-1.71	-1.98	-2.27
3 children	-0.07	-0.07	-0.09	-0.11	-0.15	-0.19	-0.24	-0.30	-0.37	-0.45	-0.54	-0.64	-0.75	-0.88	-1.03

Table C.3: Occupation Premia, Policy Two (level three)

	Years														
	1	**1**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
T-NT															
1 child	1.05	1.05	1.04	1.03	1.02	1.00	0.98	0.96	0.94	0.91	0.88	0.84	0.80	0.76	0.71
2 children	1.40	1.40	1.39	1.38	1.37	1.36	1.34	1.32	1.30	1.28	1.25	1.22	1.18	1.14	1.10
3 children	1.74	1.75	1.75	1.76	1.77	1.78	1.79	1.81	1.83	1.85	1.87	1.89	1.92	1.94	1.97
T-OWF															
1 child	-0.39	-0.41	-0.44	-0.48	-0.54	-0.62	-0.71	-0.81	-0.93	-1.07	-1.23	-1.40	-1.60	-1.83	-2.07
2 children	-0.04	-0.06	-0.10	-0.15	-0.22	-0.30	-0.40	-0.52	-0.67	-0.83	-1.01	-1.21	-1.44	-1.70	-1.99
3 children	0.30	0.29	0.28	0.25	0.22	0.19	0.14	0.08	0.02	-0.06	-0.14	-0.24	-0.35	-0.47	-0.61

Appendix D: Policy Two and Returning Rates

This Appendix presents in detail the impact of child care subsidies "level one" and "level three" on returning rates. Tables D.1 and D.2 present results for exits to nonteaching and out of the workforce with subsidy "level one." Table D.3 and Table C.4 do so with subsidy "level three."

Table D.1: Returning Rates if Left to Nonteaching.
Policy Two (level 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. Two	Bench.	Pol. Two	Bench.	Pol. Two
1	277	251	37	37	0.13	0.15
2	272	246	56	64	0.21	0.26
3	267	237	74	84	0.28	0.35
4	260	228	84	90	0.32	0.39
5	245	213	93	98	0.38	0.46
6	230	201	87	93	0.38	0.46
7	211	188	78	88	0.37	0.47
8	195	177	70	80	0.36	0.45
9	172	157	54	62	0.31	0.39

Table D.2: Returning Rates if Left the Workforce.
Policy Two (level 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. Two	Bench.	Pol. Two	Bench.	Pol. Two
1	237	222	31	30	0.13	0.14
2	213	202	52	47	0.24	0.23
3	205	190	63	55	0.31	0.29
4	199	181	68	57	0.34	0.31
5	189	179	70	61	0.37	0.34
6	185	178	70	61	0.38	0.34
7	175	176	66	61	0.38	0.35
8	171	172	63	58	0.37	0.34
9	150	152	49	39	0.33	0.26

Table D.3: Returning Rates if Left to Nonteaching.
Policy Two (level three)

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	229	37	71	0.13	0.31
2	272	221	56	103	0.21	0.47
3	267	215	74	120	0.28	0.56
4	260	205	84	124	0.32	0.60
5	245	194	93	132	0.38	0.68
6	230	186	87	131	0.38	0.70
7	211	167	78	117	0.37	0.70
8	195	153	70	105	0.36	0.69
9	172	131	54	83	0.31	0.63

Table D.4: Returning Rates if Left the Workforce.
Policy Two (level three)

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	35	31	7	0.13	0.20
2	213	34	52	10	0.24	0.29
3	205	34	63	12	0.31	0.35
4	199	34	68	13	0.34	0.38
5	189	34	70	13	0.37	0.38
6	185	34	70	13	0.38	0.38
7	175	34	66	13	0.38	0.38
8	171	33	63	12	0.37	0.36
9	150	30	49	9	0.33	0.30