TWO ESSAYS IN LABOR AND PUBLIC ECONOMICS

A Dissertation

by

NOELIA RUTH PAEZ HUAROTO

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2010

Major Subject: Economics

Two Essays in Labor and Public Economics

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ABSTRACT

Two Essay in Labor and Public Economics. (August 2010)

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This dissertation studies the effects of female labor market participation on fertility spacing in U.S., and the impact of special language programs on academic achievement of English language learners in Texas public schools.

The first essay studies the relationship between labor market participation and childbirth spacing. I construct a simple dynamic discrete-choice model to theoretically develop several implications. My model's key prediction is that while continuously working women would like to smooth the stream of children (longer spacing), those who transitorily drop out of the labor force would want to do the opposite (shorter spacing). Empirically testing the predictions of the model requires a serious effort to deal with endogeneity of the labor market participation around the time of the births. I propose to use a set of simulated marginal tax schedules and unemployment rate as instruments for labor market participation. Using National Longitudinal Survey Youth (NLSY) data I find that the *current participation effect* is positive and motivates working women to delay the second birth three to five years, while the *future participation effect* is negative and encourages women who transitorily drop out of the labor force due to childbearing to have their second child one to two years earlier.

These participation effects on spacing become stronger with fewer years of education, lower non labor income, lower complete fertility, and early motherhood.

The second essay studies the impact of special language programs on academic achievement of English language learners in Texas public schools. A considerable proportion of Hispanic students are classified as English Language Learners (ELL) and might have difficulty performing ordinary classwork in English. There is evidence that students designated as ELL are considerably behind the rest of the student population with respect to meeting the proficiency requirements under No Child Left Behind. Using student-level TAKS testing data and campus-level data for years 2003-2009, I study the effects of Bilingual and ESL programs on academic achievement of Texas public school students. Program effects are identified by following achievement gains of several cohorts of students across grade, using individual and school fixed effects. Results show that academic performance of ELL students improves with bilingual program participation. Bilingual effects on achievements gains in the reading test are higher for English language learners (between 0.08 and 0.15 standards deviations); bilingual effect in reading is greater than in math; and bilingual effect in sixth grade exceeds the bilingual effect in fourth and fifth grades. There is also evidence that changing programs from bilingual to ESL or from bilingual to regular can result in lower achievements grades.

To Micaela and Valentina

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Li Gan, and professors, Dr. Timothy Gronberg, Dr. Dennis Jansen, Dr. Adalbert Mayer, Dr. Ren Mu, and Dr. Qi Li, for their guidance and support throughout the course of this research.

Thanks also go to my friends and colleagues and the department faculty and staff for making my time at Texas A&M University a great experience. I also want to extend my gratitude to the American Society of Hispanic Economists for their 2008 and 2009 ASHE Summer Dissertation Fellowship Awards, and to the Population Reference Bureau for their 2009-2010 Population Policy Communication Fellowship.

Finally, thanks to my mother and father for their encouragement and to my husband and children for their patience and love.

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CHAPTER I

INTRODUCTION

SPACING OF CHILDREN AND FEMALE LABOR MARKET PERFORMANCE

The time elapsed between two births, or childbirth spacing, has a long-lasting effect on the well-being of households and economies. Shorter childbirth intervals are found to be associated with both higher morbidity and mortality rates for both the mother and her children (Winikoff 1983; Whitworth and Stephenson 2002)[1] and there is also evidence that children's academic achievement and years of schooling are negatively affected by shorter spacing (Pettersson-Lidbom and Skogman Thoursie 2007)[2]. On the other hand, from a macro point of view, longer childbirth spacing is associated with lower total fertility rate. Especially for countries where total fertility rate is less than replacement rate, longer spacing might end up negatively affecting structure of populations, dependency ratio, growth rate, income per capita, and public spending on pensions and health.

A key factor in determining childbirth spacing in developed countries such as U.S., is the mother's labor market participation. In fact, spacing and labor market participation are often jointly determined.

This dissertation follows the style of *Journal of Public Economics*.

[1] Health studies show that serious consequences such as low birth weight (Rawlings, Rawlings, and Read 1995), preterm birth (Basso, Olsen, Knudsen, and Christensen 1998), malnutrition of infants and young children (Mozumder et. al. 2000), and early childhood mortality (Whitworth and Stephenson 2002) are often related to short intervals.

[2] Psychological and biosocial studies point out that families that space further apart enjoy the benefits of a stronger individual parent-child relationship and less sibling rivalry. There is also evidence that close spacing negatively affects self-esteem of later-born children (Pfouts 1980).

This chapter studies the relationship between labor market participation and childbirth spacing. I construct a simple dynamic discrete-choice model to theoretically develop several implications. My model's key prediction is that while continuously working women would like to smooth the stream of children (longer spacing), those who transitorily drop out of the labor force would want to do the opposite (shorter spacing). Empirically testing the predictions of the model requires a serious effort to deal with endogeneity of the labor market participation around the time of the births. I propose to use a set of simulated marginal tax schedules and unemployment rate as instruments for labor market participation. Using NLSY longitudinal data I find that the *current participation effect* is positive and motivates working women to delay the second birth three to five years, while the *future participation effect* is negative and encourages women who transitorily drop out of the labor force due to childbearing to have their second child one to two years earlier. These participation effects on spacing become stronger with fewer years of education, lower non labor income, lower complete fertility, and early motherhood.

Labor market decisions and fertility are two important aspects of the female life cycle. Fertility decisions affect current and future labor market performance of women because childbearing represents an economic and time cost for the mother. Labor withdrawal with the purpose of childbearing imposes several types of costs such as a direct opportunity cost of foregone earnings, a loss of experience on which future wage growth may be conditioned, and a depreciation of the accumulated human capital. It is also possible that women who return to the labor force after a childbearing break may suffer a reduction in their returns to experience (Mincer and Polachek, 1974; Montgomery and Trusell, 1986; Miller, 2005).

Fertility behavior is also affected by the labor market. Labor market conditions and institutions affect fertility through rigidity to entry-exit, instability of contracts, and maternity leave policies. Women who are already committed to professional activities or who look forward to pursuing a career may find it challenging to decide their optimal timing for childbearing. In developed countries, a considerable proportion of women are part of the labor force. It is a fact that in those countries, women not only have fewer children but also delay the births more often than some decades ago. Ward and Butz (1980) show that all economic events—such as an increase in the woman's current wage—may affect both current demand and future demand for children. Miller (2005) observes that fertility delay has been increasing with female education, labor force participation, and earnings in the U.S. since the post-war baby boom. Figure A-1 shows trends of female labor force participation and total fertility rate[3] for U.S. during the period 1954-2006.

Individuals take into account trade-offs between children and labor market performance. Women who eventually want to start a family and do anticipate economic consequences of childbearing may change their behavior in the labor market. They may choose to take only part-time jobs or positions that do not require high responsibility or a lengthy workweek.

One way to deal with endogeneity of fertility and labor market participation is by using dynamic models. Wolpin (1984) studies life cycle fertility within an environment

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[3] Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates.

where infant survival is uncertain. Using Malaysian household data he finds that the replacement effect –the reaction to a realized infant death—is small. Then the survival uncertainty or probability of death would not affect the spacing decision.[4] Hotz and Miller (1988) examine household fertility and female labor supply over the life cycle. They analyze how maternal inputs, market expenditures on offspring, and the benefits children yield their parents vary with ages of offspring and influence female labor supply and contraceptive behavior. Using PSID data they find that even when the timing of births is not perfectly controlled, parents have a contraceptive strategy over their lifetimes and that variations in child care costs do affect the life cycle spacing of births.

Hyslop (1999) analyzes intertemporal labor force participation behavior of married women. He estimates probit models using maximum simulated likelihood. He finds that participation decisions are characterized by significant state dependence, unobserved heterogeneity, and negative serial correlation in the error component. The participation response of women is more strongly related to permanent than to current non labor income. Francesconi (2002) estimates a dynamic model of fertility and work of married women. Using a sample of married women from National Longitudinal Survey (NLS) of Young Women, 1968-1991, he finds that short work interruptions may be more convenient than part-time experience during childbearing/childrearing because this part-time experience substantially depresses the earnings profile of women. He also finds that continuously married women are remarkably similar to ever-married women in their labor market and fertility behavior.

[4] She uses indicators for first pregnancy ending in miscarriage, first pregnancy while using contraception, and years from first attempt to conceive to first birth.

Few studies of spacing behavior are found in economics. Much attention has been directed to complete fertility and lifetime timing of offspring (Hotz and Miller 1988; Francesconi 2002). However, these models that fully characterize fertility sometimes disregard the importance of early fertility behavior in determining the remainder of the childbearing experience (Rodriguez et al. 1984). Subsequent childbearing might be seen as the result of decisions made early in the life cycle (Heckman, Hotz and Walker 1985), and this is why a key element to understanding fertility behavior is the spacing of the first span.

This spacing model includes elements of childbearing-raising production, such as economies of scale, characteristics of the childcare cost, and a wage function that reflects the economic consequences of work interruptions. I find that both current labor force status and expectations about future labor force status affect the optimal spacing. The *current participation effect* on spacing is positive while the *future participation effect* is negative. I also find that working woman would space more if the amount of time she has to spend with each child is high and decreases more slowly with the age of the child. My results support that the out-of-home childcare is relatively more important to a woman who stops working because of childbearing and anticipates coming back to the labor force. I also show that a non-working woman prefers to space relatively less when scale economies are strong and when the effect of leisure on utility is low.

The approach in this paper is similar to Heckman and Walker (1990), who apply dynamic models to obtain several testable hypotheses and use reduced form models to empirically test them[5]. By using instrumental variables I deal with the bidirectional causal effect of spacing and participation. Previous literature on fertility had used IVs to test the effects of fertility on female labor market outcomes, for example whether the number of children affects participation, earnings, and hours worked. Angrist and Evans (1998) use parental preferences for a mixed sibling-sex composition to estimate the effect of childbearing on labor supply. Miller (2005) studies the effect of motherhood timing on female labor market performance. She uses random and unanticipated factors that drive a difference between actual and desired timing of motherhood. I use an IV approach to test the other direction of the relationship: whether labor market behavior affects fertility outcomes. The simulated marginal tax schedule I used as an instrument is also found in a very recent working paper (Powell 2009) which estimates the value of a statistical life (VSL) by using tax schedule as an instrument for occupational risk. Occupational risk is also a labor decision made by individuals and it is endogenous to his problem similar to the way in which labor force participation is endogenous to the problem.

Other macro and demographic concerns support the necessity of the study of spacing as it has economic consequences for the structure of the population, dependency ratio, growth rate, income per capita, and public spending on pensions and health. The U.S. fertility rate has been stable for the last twenty years (Figure A-1) and is almost as high in 2006 as it was in 1972. This fact contrasts the changes in labor market participation, which has dramatically increased 40 percent from 1972 to 2006. In an August 2009 report from

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[5] They study which aspects of life cycle fertility, if any, are sensitive to male income and female wages. Using Swedish longitudinal data they find that economic variables affect both the timing and desired levels of births. While female wages play a strong role in fertility dynamics, male income is important only for the first birth.

the U.S. Department of Health and Human Services, Mathews and Hamilton document important trends in fertility patterns of women in U.S. The average age at first birth has steadily increased in all states and ethnic groups. Changes from 1970 to 2006 are quite considerable: 3.6 years, from 21.4 to 25 years. Even though the U.S. had the youngest average age at first birth in both periods, it ranked near the middle of all developed countries in term of changes. Average age at first birth from 1970 to 2006 in other developed countries ranged between 2.9 (Sweden) and 4.6 (Denmark). This delaying of the first birth has serious consequences in the pattern of cumulative fertility up. In a recent U.S. Census Bureau report, Jane Dye documents that women near the end of childbearing years, 40 to 44 years old in 2006, had an average of 1.9 children. Women of the same age thirty years ago had 3.1 children on average. As a result there was a decline in the number of women having three or more children from 59 percent in 1976 to 28 percent in 2006. Also, since most women end up with at least one child (more than 80 percent of 40-44 years old in June 2006 in U.S.), the subsequent childbearing, two or more children, is what makes a difference in terms of fertility behavior among countries.

This study contributes to both the fertility literature and the labor market literature. Most importantly, what I accomplish gives new insight to the analysis of endogenous fertility that has implications for female labor supply. This paper also contains several policy implications regarding labor market, fertility, health, and demography. The study of spacing decisions contributes to the analysis of the effect of incentives designed by policy makers to affect both childbirth spacing behavior and female labor supply.

SPECIAL LANGUAGE PROGRAMS AND ACADEMIC ACHIEVEMENT

As established by the Texas education code, public schools are responsible for providing a full opportunity for all students to become competent in speaking, reading and writing, and comprehending the English language, which is the basic language of the state. A student of limited English proficiency (ELL) is a student whose primary language is other than English and whose English language skills are such that the student may have difficulty performing ordinary class work in English. Bilingual education and English as a second language (ESL) programs were created to meet the needs of those students.

Although there are several bilingual program models, the main feature of bilingual education is to provide instruction for all subjects in school through two different languages: English and a minority language (e.g. Spanish). In contrast, a program of instruction in ESL is intensively in English from teachers trained to recognize and deal with language differences. Other differences among programs are related in terms of other academic goals, participating students, and number of years students are expected to remain in the program.

Bilingual and ESL programs partly explain differences in academic achievement of ELL students but challenges arise as other observed and unobserved individual and school characteristics confound program effects. There is also a potential selection problem as programs participation is correlated with other factors that might affect achievement. From the demand side, parental approval is necessary for children's program participation, and motivations that drive parents to either accept or reject language services can also be considered as inputs to children's academic performance.

From the supply side, ELL classification and program availability might differ by school districts in ways that may be correlated with academic performance.

I identify bilingual and ESL program effects by following three cohorts of students across grades controlling for students, school and year-by-grade fixed effects. Comparisons of academic performance after exit ELL status and/or special language programs provide evidence of program effects.

Hanushek, Kain, and Rivkin (2002) study the effectiveness of special education program in raising achievement of special education students and the potential effects of this program on academic performance of regular education students. They use a matched panel dataset that combine three successive cohorts of Texas public elementary schools, beginning in 1993. There are three grades of achievement gains for each cohort, and time-invariant individual and school fixed effects are considered. Transitions into and out of special education allow identification of special education effects. Effects for entrants and exiters are study separately. They found that the average effect of special education for all disabilities is positive. Program effects are larger when derived from students entering special education than those who exit. One year of special-education improves performance by 0.1 standard deviations. This represents a movement of 3-4 percentile points. On the other hand, they did not find evidence that special education harms achievement of non-special education students who share classroom and instruction under mainstreaming system. A ten percent increase in the proportion of students classified as disable raises achievement for students not classified as disabled 0.016 standard deviations.

Leigh and O’Brien (1998) study the effects of changes to bilingual programs in a Texas school district. They describe and analyze evolution of programs in time and study factors affecting students classroom placement (bilingual, ESL, or regular). Using eight years of data for five cohorts of students, this study focuses on the impact of grades 1-3 program participation on grades 4-5 TAAS scores. Students participate in different combinations of programs in the first three years. They found that three years in regular classroom, or two years in bilingual classroom followed by a year in a bilingual classroom, has larger effect on reading achievement than three years in bilingual education. This study acknowledges potential bias in the results because of the problem of self-selection. Inevitably, program assignment is influenced by program availability and parental choice. Moreover, additional challenges arise when several programs are available in the school district. The authors mention they would expect students with better English skills would be assigned to ESL or Regular classrooms, while students with better native language pre-reading skills would be more likely to be assigned to Bilingual classrooms.

CHAPTER II

THE EFFECTS OF LABOR MARKET PARTICIPATION ON FERTILITY SPACING

THE BEHAVIORAL MODEL AND ITS IMPLICATIONS

In this section I present a discrete dynamic model of female labor market participation and spacing of childbirths. Each woman has a decision horizon of three periods. Hours of work are constant across jobs hence the labor supply choice concerns whether or not to participate. Since this is a spacing model the first birth is assumed as given and the fertility decision concerns the timing of the second birth[6].

The Model

A. The Timing

At the beginning of period $t=1$ a woman gives birth to her first child and chooses whether or not to participate in the labor market. In period $t=2$ she chooses whether or not to work, and whether or not to have her second birth. The choice made at this second period characterizes childbirth interval. If she has her second childbirth in the second period I say she has chosen a *short spacing*. The choice of no second birth in this period corresponds to the notion of delaying the second birth also known as *long spacing*. In period $t=3$ the participation decision is also available, but there is no fertility choice: If the woman delayed the second

[6] The study of spacing focuses on women who already have at least one child.

birth in the previous period she will have the second child at the current period. See Figure A-2.

Figure A-3 shows this three-period model as a tree featuring all possible paths a woman could follow. Starting from an initial state in the period $t=1$, a woman faces a sequence of sets of states S_1, S_2 where S_t represents the set of states at any particular time period t. Any node on the tree represents a particular state at a particular time, *i.e.* $s_t \in S_t$.

B. The Optimization Problem

Every woman maximizes her lifetime utility. For simplicity, I assume an inter-temporal separable utility function. Instantaneous utility is linear and additive, and depends on goods consumption and leisure time. Previous studies on fertility, such as Wolpin (1984), have assumed that utility—or services parents receive from existing children—are age-invariant, *i.e.,* they only depend upon the number of existing children. Since in this spacing model two children will be born to each woman, I assume utility depends on permanent—as opposed to current—number of children[7].

Instantaneous utility is as follows:

$$u_t = c_t + (l_t)^{\alpha} + f(N), \quad \alpha < 1 \tag{1}$$

where c_t and l_t are consumption and leisure respectively, at time t. N is permanent number of children, homogeneous across women.

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[7] This assumption is just to simplify the model. The first child is born in the first period and the only fertility difference among women is the spacing of the second child (with respect to the first). This spacing is either *short* or *long*. As a result, there is small variation in current number of children each period.

If she participates in the labor market, she earns a wage *w*. Besides that income source, she perceives an exogenous non-labor income $\bar{y}$, representing mostly her husband's income[8].

Equation (3) is the budget constraint. She spends her total income on consumption, and out-of- home childcare cost $D(w, N_t)$, if any. The monetary childcare cost is a function of number of children, and reflects the opportunity cost of her time.

The woman's lifetime optimization problem is the following:

$$\underset{c,l}{Max} \quad \sum_{t=0}^{3} \beta^t u_t = \sum_{t=0}^{3} \beta^t \left(c_t + l_t^{\alpha} + f(N) \right) \tag{2}$$

subject to

$$\sum_{t=0}^{3} (c_t + D(w, N_t)) = \sum_{t=0}^{3} (\bar{y} + w_t P_t) \tag{3}$$

and

$$1 = T_{working} P_t + T_{children} + l_t \tag{4}$$

As equation (4) states, every woman has one unit of time every period. Women's units of time are divided among leisure, time with the children, and time in market work. $T_{working}$ is the amount of time women spend on working, $T_{children}$ is the amount of time spent on children caring, and P_t is an indicator variable for participation at period *t*. Unlike the

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[8] Participation of men in children production is almost confined to provision of monetary resources. As Heckman and Walker (1990) find, while female wages play a strong role in fertility dynamics, male income is significantly important just for the first birth. Similarly, Wolpin (1984) finds that male income effect on fertility is quite small.

monetary budget constraint where one individual can borrow and save in every period, the time constraint must be satisfied in each period.

The inclusion of childcare costs in the optimization problem is motivated by empirical finding that both the number and age distribution of children are important on both labor participation and hours worked (Hotz and Miller, 1988).

I discuss in detail the childcare cost and the wage function in the following subsections.

C. The Childcare Cost

Bringing up children, or children production, requires more time than a working woman could possibly offer. Therefore, if a woman decides to work she has to spend money not only in goods but also in out-of-home childcare services. It is important to point out that in this model, out-of-home childcare services are substitute for mom's care when she happens to be working. Other potential motivations for buying out-of-home services such as the increase of woman's leisure are beyond the scope of this study, as it is the case when a woman completely avoids children caring.[9] To be more precise, I assume that a mother needs and wants to spend some of her time with their children[10].

In the context of this model, out-of-home childcare is provided by day care centers or nursery schools, and the cost depends on the child's age (Leibowitz, Klerman,

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[9] Surrogacy is not allowed in this model.

[10] 2008 results of the American Time Use Survey (Bureau of Labor Statistics) reports that women living in households with children under six years old spent an average of 2.55 hours per day providing primary childcare to household children (primary childcare is childcare that is done as a main activity, such as physical care of children and reading to or talking with children) and 6.8 hours a day caring for household children as a secondary childcare activity.

and Waite 1992). Taking care of very young children is usually more expensive because one caregiver can handle relatively few young children[11]. U.S. States, for instance, regulate child care facilities, the number of children per child care worker, the qualifications of the staff, and the health and safety of the children (Bureau of Labor Statistics, Occupational Outlook Handbook, 2010-11 Edition). To ensure that children in child care centers receive proper supervision, State or local regulations may require a certain ratio of workers to children.[12]

I divide the amount of time each child needs into two components: *basic time* and *extra time*. This is linearly expressed as follows:

$$t_{Child} = t_A + t_B \tag{5}$$

where t_A is *basic* time and t_B is *extra* time.

The *basic* time is provided by the mother; it is a child-exclusive time, an input that a child needs and cannot be avoided. One feature of the *basic time* is that it decreases as the child ages[13]. When the child is zero-periods old, basic time is equal to a_0. As the child grows up, the basic time decreases by a_1.

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[11] Babies require more hands-on care, which means that the center must hire more workers to maintain a low ratio of childcare providers to children

[12] The ratio varies with the age of the children. For infants (children under 1 year old), child care workers may be responsible for 3 or 4 children. For toddler's (children 1 to 2 years old), workers may be responsible for 4 to 10 children, and for preschool-aged children (those between 3 and 5 years old), workers may be responsible for 8 to 25 children. However, these regulations vary greatly from State to State. In before- and after-school programs, workers may be responsible for many school-aged children at a time.

[13] Following Hotz and Miller (1988) we assume that intensity of child care in mother's time—relative to other inputs—declines as children age.

$$t_A = a_0 - a_1 \, child \, age \qquad (6)$$

where $t_A > 0$, $a_0 \geq 0$, and $a_1 \geq 0$.

The *extra* time is the remaining necessary time, also input for children production. This component could either be *bought* in the market as daycare services or it can be provided by the woman with economies of scale. As I mentioned above, out-of-home childcare services consumption come along with working decisions: If the mother works, she have to buy daycare services, and will pay a higher fee the younger the child. Out-of-home childcare prices are as follow:

$$\lambda_0 > \lambda_1 > \lambda_2 \qquad (7)$$

where λ_t is the monetary cost of sending a t-period-old child to the out-of-home childcare center.

On the other hand, if the mother does not work, she will provide childcare during the *extra* time. If this is the case, she will benefit from economies of scale as taking care of two children is less costly than two times the first child's care cost. This condition is expressed as follows:

$$\varphi_{1st} < \varphi_{1st} + \varphi_{2nd} < 2\varphi_{1st} \qquad (8)$$

where φ_{1st} and φ_{2nd} are the first and the second child's time cost, respectively.

The lower cost is translated into more hours of leisure or more hours available to work in the labor market.

D. The Wage Function

In her making decision process, a woman takes into account her future wage and job opportunities. Those depend on her endogenous accumulated work experience (Francesconi, 2002), human capital level, and number of children at every period. Labor market absences for one period or more result in several penalties for a woman in the labor market such as foregone wages, lower returns to experience, and a cost associated with the depreciation of her human capital.

I propose a wage function that reflects economic consequences of work interruptions. At every period the base wage—wage earned during the last period worked—is affected by a depreciation rate (d) if dropping out of the labor market. Number of periods out of the labor force translates into forgone wages and lower returns.

E. Optimal Spacing

Due to this simple model specification, I am able to calculate lifetime utilities for all 16 possible paths or cases-scenario. Tables A-1, A-2, A-3, and A-4 show components of lifetime utility. Table A-5 shows lifetime utilities. Elements that characterize the model are as follow: allocation of time between work and children—which ultimately determines leisure time, childcare expenditure, labor income, and depreciation rate of human capital. As mentioned in the subsection 2.4, the opportunity cost of childbearing is expressed in terms of forgone wages and depreciation of human capital.

There are three different participation behavior patterns of interest. The first pattern is characterized by non-stop participation. Women have children, take several months off as part of their maternity leave plan, and come back to work again once their leave has ended. In terms of labor market participation I consider them to be continuously working women.

The second participation pattern is characterized by permanent dropout from the labor market due to childbearing. The first child sets a threshold, and after this threshold I do not observe labor market participation.

The third behavioral pattern is given by women who transitorily drop out of the labor force and return after childbearing.

I combine these three different patterns of participation behavior with different patterns of fertility spacing. I am able to compare lifetime utility of those participation-spacing combinations and obtain clear conclusions regarding the optimal spacing conditional to labor behavior.

In the following subsections I provide evidence that a continuously working woman has incentives to space longer. On the other hand, a woman who transitorily drops out of the labor force has incentives to space shorter.

Implications of the Model

A. Childbirth Spacing of a Continuously Working Woman

A non-stop working woman prefers to space longer if and only if her lifetime utility derived from a longer spacing is greater than lifetime utility when spacing is shorter, all else equal.

From Figure A-3, longer spacing is preferred to shorter spacing if and only if

$$U_3 \geq U_1 \tag{9}$$

Plugging lifetime utility's values of paths 3 and 5 (see Table A-5), it follows that longer spacing is preferred to shorter spacing if and only if the following condition holds:

$$(1 - T_w - a_0 + a_1)^\alpha + (1 - T_w - 2a_0 + 2a_1)^\alpha \geq$$

$$-\lambda_2 + (1 - T_w - 2a_0 + a_1)^\alpha + (1 - T_w - 2a_0 + 3a_1)^\alpha \tag{10}$$

Let's consider the difference between parameters of the *basic time* function, *i.e.* the amount of time a mother has to spend with each child. Since this difference is exactly the amount of time a one period-old child spend with her mother, I can be certain that this difference is greater than zero:

$$\Delta = a_0 - a_1 \geq 0 \tag{11}$$

Plugging (10) into (9), the condition (8) transforms into the following equation:

$$(1 - T_w - \Delta)^\alpha + (1 - T_w - 2\Delta)^\alpha$$
$$\geq -\lambda_2 + (1 - T_w - a_0 - \Delta)^\alpha + (1 - T_w + a_1 - 2\Delta)^\alpha$$

This equation is equivalent to

$$(1 - T_w - \Delta)^\alpha + (1 - T_w - 2\Delta)^\alpha$$
$$\geq -\lambda_2 + (1 - T_w - a_0 - \Delta)^\alpha + (1 - T_w + a_0 - 3\Delta)^\alpha$$

For simplicity, I specify new variables *p*,*q*,*r*, and *s*:

$$p^\alpha = (1 - T_w - \Delta)^\alpha$$

$$q^\alpha = (1 - T_w - 2\Delta)^\alpha$$

$$r^\alpha = (1 - T_w - a_0 - \Delta)^\alpha$$

$$s^\alpha = (1 - T_w + a_0 - 3\Delta)^\alpha$$

Then, $r < q < s < p$. I can show that

$$(p^\alpha - r^\alpha) - (s^\alpha - q^\alpha) \geq -\lambda_2 \tag{12}$$

By concavity, left hand side of equation (11) is positive. The right hand side $-\lambda_2$, is a negative number since it is the negative of the monetary out-of-home childcare cost of caring a two periods-old child. I conclude that this condition is satisfied. This means that a continuously working woman prefers longer spacing to shorter spacing. This conclusion remains unaltered even when monetary childcare cost is zero. Therefore, the first hypothesis to be tested is the following:

Hypothesis 1: Women who continue working just after the first birth are willing to wait longer to have the second child (i.e. current labor participation is positively related to spacing).

To understand the intuition of this hypothesis, let us consider a working woman. She is more affected by the time constraint because she divides her time between children, leisure and work. Even when she does buy childcare services, she still has to spend certain amount of time with her children. I previously assumed that she spends at least certain amount of time with each child. The amount of time depends on her children's age. Also, working women would like to smooth the stream of children because they are less likely to exploit scale economies

B. Childbirth Spacing of a Woman Who Transitorily Drops Out of the Labor Force Due to Childbearing

I study the case where a woman drops out of the labor force when her first child is born, and returns to work one period after the birth of her second child. Childbearing is the reason to drop out; therefore the end of childbearing period is also the end of the labor market absence.

To fully understand motivations to space longer or shorter when being out of the labor force is a transitory state, we need to take into account two important elements. First, the number of periods out of the labor force matters because depreciation of human capital depresses potential wages. Second, the number of periods left after childbearing matters as we can only observe consequences of this depreciation in future wages.

In this model I assumed that the first child is born in the first period. The second child is born either in the second period (short spacing) or third period (long spacing). When we consider only a three period horizon, we can observe participation in the third period only in the case of short spacing. Unfortunately, for the case of long spacing, it is not that simple. We would observe participation in the fourth period, if it were ever considered.

To overcome this problem I artificially add T periods to this three-period model. During these T periods we observe participation because I said women will work after childbearing. If we are to compare lifetime utilities of long-spacing versus short-spacing, the only difference between these T-period-long-spacing and T-periods-short-spacing is given by the wage differential due to depreciation. Shorter spacing means less depreciation of human capital, hence higher future wages.

Shorter spacing is preferred to longer spacing if and only if:

$$U_{13} + \sum_{t=1}^{T} W_{0t}(1-d)^2 \geq U_{16} + \sum_{t=1}^{T} W_{0t}(1-d)^3 \qquad (13)$$

$\Leftrightarrow$

$$W_0(1-d)^2 - (\lambda_2 + \lambda_3) + (1 - 2a_0 + a_1 - \varphi_1 - \varphi_2)^\alpha + (1 - T_w - 2a_0 + a_1)^\alpha + \sum W_0(1-d)^2 \geq (1 - a_0 + a_1 - \varphi_1)^\alpha + (1 - 2a_0 + 2a_1 - \varphi_1 - \varphi_2)^\alpha + \sum W_0(1-d)^3$$

For simplicity, I specify new variables *p*,*q*,*r*, and *s*:

$$p^{\alpha} = (1 - 2a_0 + a_1 - \varphi_1 - \varphi_2)^{\alpha}$$

$$q^{\alpha} = (1 - T_w - 2a_0 + 3a_1)^{\alpha}$$

$$r^{\alpha} = (1 - a_0 + a_1 - \varphi_1)^{\alpha}$$

$$s^{\alpha} = (1 - 2a_0 + 2a_1 - \varphi_1 - \varphi_2)^{\alpha}$$

Then shorter spacing is preferred to longer spacing if and only if

$$W_0(1-d)^2[1+dT] - (\lambda_2 + \lambda_3) \geq (r^{\alpha} - q^{\alpha}) + (s^{\alpha} - p^{\alpha}) \qquad (14)$$

I conclude that shorter spacing is more likely to be preferred than longer spacing when the horizon after childbearing is long[14], the base wage rate is high[15], and monetary childcare during child's early years is low. The depreciation rate makes being out of the labor force expensive when T ≥2/(1+d).

The second hypothesis to be tested is as follows:

Hypothesis 2: Women who stop working just after the first birth –and look forward to future participation—would want to have the second child as soon as possible (i.e. future participation is negatively related to spacing).

The intuition behind this hypothesis is simple: Non-working mothers divide their time between children and leisure, and are more likely to spend more time with their

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[14] This is more likely for younger women, all else equal.
[15] It is more likely that more educated women will have a higher base wage.

children than their working peers. They could take advantage of scale economies in childbearing production hence they have more incentives to close their births.

One more reason supports the idea of short spacing. As I assumed, being out of the labor force causes a depreciation of human capital. If these women expect to work sometime in the near future, they will try to avoid long periods of time out of the labor market.

C. Childbirth Spacing of a Woman Who Permanently Drops Out of the Labor Force Due to Childbearing

Longer spacing is preferred than shorter spacing if and only if

$$U_{16} \geq U_{14} \tag{15}$$

$\Leftrightarrow\ (1 - a_0 + a_1 - \varphi_1)^{\alpha} + (1 - 2a_0 + 2a_1 - \varphi_1 - \varphi_2)^{\alpha}\ \geq\ (1 - 2a_0 + a_1 -$

$\varphi 1 - \varphi 2 \alpha + (1 - 2a0 + 3a1 - \varphi 1 - \varphi 2) \alpha$

It is easy to prove that

$$1 - 2a_0 + a_1 - \varphi_1 - \varphi_2 < 1 - 2a_0 + 2a_1 - \varphi_1 - \varphi_2 <$$

$$1 - 2a_0 + 3a_1 - \varphi_1 - \varphi_2 < 1 - a_0 + a_1 - \varphi_1$$

By concavity this condition (12) is satisfied. We conclude that $U_{16} \geq U_{14}$ which means that a woman who permanently drops out of the labor force due to childbearing of the first child prefers to space longer. A woman who does not work divides her time between time her children and leisure. Longer spacing means more leisure, which ultimately increases her utility.

Therefore the third hypothesis to be tested is as following:

Hypothesis 3: Women who never participated after childbearing space more than those who stop working but look forward to returning to the labor force.

This means that no one has more incentive to space two births close together than those women who expect to work in the near future. There is no longer a trade-off between childbearing and participation for continuously non-working women. There is also an incentive to smooth out the leisure time for nonworking women.

THE DATA

I use the NLSY 1979-2006. This is a nationally representative sample of 12,686 young men and women who were 14-22 years old when they were first surveyed in 1979. These individuals were interviewed annually through 1994 and are currently interviewed on a biennial basis. This survey gathers information in an event history format, in which dates are collected for the beginning and ending of important life events.

Out of 12,686 individuals from the original representative sample, 6,283 correspond to female observations and 3,428 correspond to ever married women with at least two children, twins cases excluded. The design of the survey allows us to construct a detailed history of each respondent's fertility and labor market performance.

Figure A-5 depicts spacing distribution of first and second births and second and third births. Distributions are positive skewed as the mass of the distribution is concentrated on shorter spacing values. The highest frequencies are between one and two-and-a-half years of spacing. 51 percent of women waited less than three years before having the second child while 27 percent waited between three to five years. One feature of interest is that shape of the distribution of spacing between first and second child is comparable to the distribution between second and third child. The distribution of time elapsed between the second and third birth has more extreme values than the same for first and second births. More recurrences are found in either less than 24 months or more than 72 months.

Most of the work is based on either the full sample of women or one of the two subsamples: ever married women with at least two children, and ever married women with two children (see Table A-6).

The sample of women with two children started their first marriage at age 22 and childbearing at age 23. The number of months between the first and second child is on average 47.9 months.

As for the group of women with at least two children, the average age they began marriage and childbearing decreases by 6 and 18 months respectively. Women who ended up bearing several children started marriage and childbearing at a young age. The spacing between the first and second child drops by almost 53 months with respect to the group of women with only two children.

Women with just two children have on average more chances of being ever married, having the first child in wedlock and having the second child in a second marriage. They are also on average more educated than women with more than two children.

Participation of these women in the labor market depends on the number of children they have and the timing of the births. Participation of women around the time of the first birth will affect spacing decisions. On one hand women tend to delay children as they represent a cost in the labor market; on the other hand it is possible to make the most of the time out of the labor force when there is more than one child and there is a chance of exploiting economies of scale.

Figures A-6 and A-7 depict the percentage of women with two children working at least 30 hours a week in the labor market about the time of the first and second birth. Women increase their participation during the year before a birth. The participation rate drops as women leave the market due to this birth. As a few months pass, some women return to the labor force. However, participation rate of women after a birth will permanently decrease by one-fourth. Changes in participation are very dramatic when it is the first birth (as opposed to the second birth), and also when woman will just have two children (as opposed to at least two children). As a general observation women who will end up with more than two children behave differently than women who will just have two children, even before childbearing. Their participation in the labor market is lower, before and after children. This appears to be consistent to Mincer's finding that women who expect to spend less time in the labor force are discouraged from investing in working experience and human capital.

Tables A-7 and A-8 show spacing of children according to women's behavior in the labor market. Women who always work wait around 51 months to have their second child[16]. In contrast, women who never participate space their children 37 months. Other

[16] Spacing's means remain relatively unaltered when definition of participation changes. Tables 7-10 define participation as working at least 30 hours a week during one month (Table 7), two months (Table 8), three months (Table 9), four (Table 10) or five months (Table 11).

lifecycle participation patterns are also relevant to this analysis. The longest overall spacing is found among women that entered to the labor force after childbearing and continuously worked since then. They space their children on average 64 months apart. The shortest spacing is found among women who permanently dropped out of the labor force due to childbearing. On average they waited just 28 months before having the second child.

THE EMPIRICAL STRATEGY

I test the hypotheses regarding spacing and expect spacing to be positively affected by current participation and negatively affected by future participation. As I argued above, a woman who wants to continue working in the labor market will try to space more her childbirths in order to have more time available to work in the labor market. In contrast, a woman who has already left the labor force due to childbearing of the first child, and expects to return in the future, would want to space less in order to reduce the impact of economic penalties due to longer labor market interruptions.

I use instrumental variables to analyze the effect of participation on childbirth spacing. A longitudinal set of simulated marginal tax schedules as well as other macro variables that characterize labor market conditions are proposed as instruments for labor participation.

I observe participation around the time of the first and second birth. I have information regarding the timing—month and year—of first and second birth; and 27 years of weekly labor history (1978-2004).

First, I construct several indicator variables representing current and future participation. *Current* and *future* are two terms that characterize the timing of participation into fertility stages. There are three important fertility stages regarding the first child: 1) the period of time before the childbirth; 2) the *childbearing period*; and, 3) the period of time after childbearing. I define the childbearing period as the period that includes the last stage of pregnancy, the birth, and early nursing period. See Figure A-4.

A great proportion of women do not work during this childbearing period, but once this period has passed several women gradually return to work. I allow few months of childbearing according to what will be considered as a maternity leave period. Figures A-6 and 7 depict the pattern of participation around the time of the first birth and second birth. According to the observation of the data, I define the childbearing period as two months before the birth, plus four months after the birth. If women are not working during this childbearing period I will not make any preliminary conclusions regarding their participation. The periods *before* and *after* the childbearing period are critical for the analysis. We can conclude that they definitely dropped out of the labor force if we do not observe participation after a few months of what it would be considered a maternity leave period. A considerable percentage of women will actually do so.

Since the key of spacing analysis concerns about the timing of first and second births, we need to visualize the second childbearing process as overlapping the first one. One childbearing period close to the next one seems to be a good choice for mothers who can spend a relatively high amount of time caring their children when they are very young. This closer spacing makes the most of the mother's time when she is out of the labor force, especially if she manages to rear more than one child at a time. This last scenario is rather implausible for a woman who is in the labor force and finds already quite difficult to balance childbearing and work.

I define *current* participation as participation during childbearing interval—the period of time between the first and the second birth. I define *future* participation as participation after childbearing period of the second child. Since we have both fertility and labor force histories of women, we can observe whether she works before, during, and after childbearing period. The fact that a considerable number of women do not work before childbirth of the first child is explained by both fertility and non-fertility reasons. As mentioned above, a group of women do not work even before childbearing because they anticipate future conflict between work and family, which discourage investments and accumulation of labor market experience.

The Need for a Simulated Marginal Tax Schedule

As mentioned earlier, labor participation and fertility spacing are two decisions that affect each other simultaneously. Hence, it is necessary to find instrumental variables that affect fertility spacing only through labor market participation.

The marginal tax rate is the amount of taxes paid on the next dollar earned, the most relevant tax rate when making an economic analysis regarding decisions about working, saving, and investing. For example, a worker considering whether to work overtime or to take a second job will be most concerned about what percentage of the extra money he will earn will be paid in taxes. This rate has been used to study the behavioral price effects of taxation on topics such as charitable giving, labor supply and sheltering income from taxation (Feenberg and Coutts 1993).

The marginal tax rate depends on individual characteristics, income, and a variety of nonlinear deductions, exemptions, and credits[17]. State tax regimes differ from federal tax structure, and from one another. They all change in time.

This marginal tax rate has two features that might harm its chances of becoming a suitable instrument for participation. First, the marginal tax rate depends on income. Income is a function of numbers of hours worked, not exogenous to fertility decisions. I explain how I deal with this issue later, when I present the procedure to construct the simulated marginal tax rate. Second, the marginal tax rate has the property of affecting fertility through two channels: Aid to Families with Dependent Children (AFDC) and Earned Income Tax Credit (EITC). I explain this relationship below.

A. The Link between AFDC and Fertility

The largest literature on the fertility impacts of income support programs focuses on Aid to Families with Dependent Children (AFDC). Eligibility for AFDC was contingent upon having at least one child with the absence of at least one parent, providing strong incentive for an unmarried woman to have her first child. Welfare seems to have a larger effect on fertility for white women than black women. Beyond the eligibility for AFDC that came with the birth of the first child, welfare benefits typically increased with the birth of each additional child. Several papers find that these incremental benefits have no effect on the

[17] Childcare credits, rent credit, property tax credit, general credits, various elderly and pension credits, etc.

probability of additional births, conditional on having at least one child (Fairlie and London 1997).

Gogger and Bronars (2001) find no relationship between incremental welfare benefits and the timing of subsequent births. However, there seems to be a relationship between base welfare generosity and subsequent fertility for initially unwed black mothers. Due to the welfare cap benefits are denied for children born while their mothers are receiving welfare.

B. The Link between EITC and Fertility

The Earned Income Tax Credit (EITC) may encourage childbearing (Baughman and Dickert-Conlin, 2006). Expansions in the EITC at the state and federal levels 1980s and 1990s led to an increase in the birth rate among targeted low-skill families. However, expanding the credit produced only extremely small reductions in higher order fertility[18] among white women. In any case, higher levels of the EITC are associated with higher first birth rates among married women and lower first births among unmarried women. EITC encouraged marriage among single women.

On the other hand Hotz, Mullin and Scholz (2006) examine the effect of the EITC on the Labor market participation of families on welfare, and assume the presence of a child is exogenous to the value of the EITC.

[18] Three children or more

C. Simulated Marginal Tax Schedule

As mentioned above actual marginal tax rate is a function of income, which is a function of wages and hours worked. Wages are exogenous to our problem, but number of hours worked is a decision based on taxes and current number of children. At the same time, various welfare and credits are children related, and this would disqualify the simulated marginal tax schedule as a suitable instrument if not taken into account.

I use NBER's TAXSIM[19] program to calculate marginal tax schedule series. I propose the following procedure to capture non-fertility individual characteristics, and variations in federal and state laws across states and years.

1. Construct three time series of simulated income for each individual. Rather than using actual number of hours worked—which varies by individual at different tax schedules and current number of children—I use actual wages and three homogeneous number of hours worked patterns: zero hours worked, twenty hours worked and forty hours worked, a week. This simulated income series will be used as the gross income needed to calculate simulated marginal tax schedule.
2. Calculate taxable income subtracting deductions and exemptions that do not provide fertility incentives. Also, income after credits must just include non-fertility credits (no EITC).
3. Calculate marginal tax schedules for each individual using federal and state tax schedule.

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[19] TAXSIM is a set of programs for calculating liabilities under US Federal and State Income tax laws from individual data. Its utilization allows us to correct after-tax prices for models of economic behavior

4. Average rates according to stages of fertility lifecycle: before the first birth, during childbirth interval, and after the second birth.

Inputs used were tax year, state, and marital status; and all taxable simulated income that comes from wages, business and self employment of taxpayer and spouse. I assume single women file as single while married women filed as joint (marital status does change in time). Since there are three homogeneous patterns of hours worked and three stages of fertility lifecycle each individual ends up with nine sets of simulated marginal tax schedule outcomes at different period.

The set of variables I use as instruments then includes effective federal marginal rate, effective state marginal rate, federal and state income tax liability, FICA, and FICA rate (all variables are over time). The average of these variables around the time of the first and second birth serves as instruments for current and future participation. See descriptive statistics of in Tables A-9, A-10 and A-11.

Empirical Specifications

I estimate the effect of labor market current participation (cp) and future participation (fp) on first span fertility spacing.

$$Spacing_i = \alpha + \beta_1(cp_i) + \beta_2(fp_i) + \gamma X_i + \epsilon_i \qquad (16)$$

As pointed out in previous sections, current and future participation are defined as working during the childbirth interval and after the second birth, respectively. Following the main results from the theoretical model, I expect current participation to positively affect spacing ($\beta_1 > 0$) and future participation to negatively affect it ($\beta_2 < 0$).

Several control variables are considered. I expect that women who start childbearing at an older age will feel pressured to space their children closer because their fertility horizon is shorter. Marital status, before and after the first birth, imposes restrictions on the timing of the second birth. Variables characterizing education and wealth will also affect fertility decisions as the income effect induces individuals to have more children. Since this is a study of the timing of the second birth, labor market circumstances of women after the first birth are relevant to determine the opportunity cost and substitution effect of an increase in the number of children from one to two. A vector of controls (X_i) includes age at first birth, indicator for marriage before birth, indicator for second birth during the second marriage, among others.

A second specification deals with the fact that future participation behavior is actually conditional on current participation status. Two women might have the same expectation about coming back to the labor force in the future, but the one who transitorily dropped out of the labor force due to childbearing has much more incentive to space her births closer together. As mentioned earlier, being out of the labor force for a shorter period of time reduces economic penalties such as depreciation of human capital.

I estimate the effect of future participation conditional on non-participation in the current period.

$$Spacing_i = \alpha + \beta_3(cp_i) + \beta_4(1 - cp_i) * (fp_i) + \gamma X_i + \epsilon_i \qquad (17)$$

I expect β_4 to be negative because future participation motivates women to space shorter. I also expect that $\beta_4 > \beta_2$ because the future participation effect will be stronger for women who transitorily drop out than for women who currently work.

Also, I identify the effects of labor force participation on spacing for women with more years of schooling.

$$\text{Spacing}_i = \alpha + \delta_1(\text{cp}_i \times \text{schooling}) + \delta_2(\text{fp}_i \times \text{schooling}) + \gamma X_i + \epsilon_i \quad (18)$$

A different perspective is given by the level of income, but since female income is endogenous to our problem I consider husband's income instead.

$$\text{Spacing}_i = \alpha + \delta_3(\text{cp}_i \times \text{income}) + \delta_4(\text{fp}_i \times \text{income}) + \gamma X_i + \epsilon_i \quad (19)$$

Interactions of variables that characterize fertility are also considered. I test whether women who were relatively young at the time of the first birth will delay the second child more often than older women, as their fertile horizon is longer.

$$\text{Spacing}_i = \alpha + \sigma_1(\text{cp}_i \times \text{age1birth}) + \sigma_2(\text{fp}_i \times \text{age1birth}) + \gamma X_i + \epsilon_i \quad (20)$$

At the same time, complete fertility plays a role because women who desire to have more than two children might decide shorter childbirth spacing than those women who will want to have just two kids. The spacing equation including number of children becomes as follows

$$\text{Spacing}_i = \alpha + \sigma_3(\text{cp}_i \times (N = 2)) + \sigma_4(\text{fp}_i \times (N > 2)) + \gamma X_i + \epsilon_i \quad (21)$$

where N is the number of children.

Since number of children is endogenous I use as an instrumental variable the mixed sibling sex-composition proposed by Angrist and Evans (1998).

CHAPTER III

THE IMPACT OF BILINGUAL AND ENGLISH AS A SECOND LANGUAGE PROGRAMS ON ACADEMIC ACHIEVEMENT OF ENGLISH LANGUAGE LEARNERS

IDENTIFICATION OF ELLS AND PLACEMENT DECISIONS

The Texas education agency has established a procedure for identifying school districts that are required to offer bilingual education and ESL programs. If a district or charter school has at least one English Language Learner (ELL) student, the district must provide ESL services. On the other hand, the state education agency requires offering a bilingual program if there are 20 or more ELL students of the same language classification at any one grade level district wide[20].

Each school district that implements a Bilingual or ESL program is required to establish and operate a language proficiency assessment committee (LPAC)[21].

Responsibilities of the LPAC are to identify ELL students, make recommendations regarding the best instructional setting to place them into, and monitor their progress until two years after the student has left the ELL classification. For the ELL identification the LPAC considers the home language survey (HLS), and the

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[20] Each district shall offer: bilingual education in kindergarten through the elementary grades; bilingual education, instruction in ESL, or other transitional language instruction approved by the agency in post-elementary grades through grade 8; and instruction in ESL in grades 9 through 12.

[21] The Bilingual LPAC committee shall have four members: a professional bilingual educator, a professional transitional language educator, a parent of a limited English proficiency student, and a campus administrator. The ESL committee membership includes one or more professional personnel (campus administrator and/or a certified ESL teacher), and a parent of a ELL student participating in the program.

performance of the student in two different tests: the English language proficiency test, and the proficiency test in the primary language. Students are classified as ELL if the score on the English proficiency test is below the levels established by the agency and/or the score on the primary language proficiency test is greater than the score on the English test[22]. Identification and placement occur within the first four weeks of the student enrollment.

Once identification has been accomplished, LPAC recommends the appropriate educational program (ESL/Bilingual) for each ELL student[23]. Parental approval is required[24]. The student's parent must approve the student's entry into the program, exit from the program, and placement in the program. If a parent denies the placement decision, then the student is identified in the public education information management system (PEIMS)[25] as a "ELL with a parent denial" until the student meets exit criteria and the student is then reclassified as non-ELL[26].

The change of ELL to non-ELL status is a school district decision. In order to exit ELL status a student must score advanced (high) in the TELPAS test and also should pass the ITBS or TAKS in English. Additionally evaluations of the student's

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[22] Grade PK-1 students are identify ELL if their oral language proficiency test (OLPT) in English and primary language (for bilingual programs) scores indicate limited English proficiency. Grades 2-12 students are identified ELL if OLPT does not meet the criteria necessary condition; and/or if they score below the 40th percentile on the reading and/or language arts sub-test of the state-approved norm-referenced standardized achievement test (even if their OLPT score indicates English proficiency).

[23] Placement depend on: Bechmarks, tests (TAKS, ITBS, SAT, Oral language proficiency, etc), grades, etc

[24] Parental notification includes information regarding the English proficiency level of the student and a description of the program as well as the benefits of the program.

[25] The public education information management system (PEIMS) is the system used to report to the state the progress of ELL students.

[26] The date that the parent notification form is signed is the date the student's official status becomes ELL, regardless of permission or denial.

teacher and parents opinions might also count. Students who are at lower grades and therefore not taking TAKS tests should score 40% or above in the reading agency approved norm-referenced standardized achievement test. Students exit out the Bilingual or ESL program if the student is able to participate equally in a regular all English instruction program as determined by meeting the standards of assessments[27].

Students in Pre-K and Kindergarten may not exit from a bilingual education or ESL program and in general ELL students cannot be reclassified as non-ELL at these grade levels.

One important role of LPAC is to ensure that exit decisions are appropriate for students as reclassification as ELL and re-entry to a bilingual or ESL program is not recommended by the agency.

Once LPAC reclassifies a student as non-ELL parents will be notified and the student will be monitored for two years

As described above, ELL status is determined by an assessment of the current state of English and primary language skills. While this assessment process is grounded in objective measures of language proficiency, there are subjective and, possibly, strategic factors that could influence the school's classification decisions. There are potential supplier selection issues associated with ELL designation.

Participation in the ESL/Bilingual programs is also subject to the parents preferences. Since the final decision is made by the parents, participation in the

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[27] Oral (agency approved English OLPT), reading /ELA (Norm Referenced Achievement Test or English TAKS test) and writing (TELPAS Advanced High or English TAKS test).

bilingual or ESL programs have an intrinsic endogenous character. Self-selection issues arise from the nature of choices made by parents, and make the analysis of the impact of several variables on student's performance difficult to disentangle.

Even though identification of ELLs as well as program recommendations to those students follows a general procedure established by Texas Education Agency, the implementation of this procedure might differ by district. Districts might face incentives to either expand the population of ELL students or to reduce the population according to not only student's characteristics but also own district and schools' characteristics. The number of ELLs in the school district is a key variable to determine if the district must offer special language programs and what type of programs. Districts with at least one ELL student must offer ESL instruction to those students. But if the district has at least 20 students in the same grade and language classification, then the district is obliged to implement a bilingual program. Also, participation in Bilingual and ESL programs is one necessary condition to qualify for ELL-exception from the TAKS assessment. Then the district might have incentives to implement and recommend special language programs to target students, especially if they are low-performing students, as results of TAKS are important for school and districts in determining rating classification.

TEXAS ACCOUNTABILITY SYSTEM

Students in Texas public schools take standardized state-specific tests. The intent of the standardized tests is to assess students' attainment of the knowledge and skills at each tested grade level as required by the education standards articulated in state academic objectives guidelines. Relevant to my research, eligible students may take a Spanish version of the state test. This option is available in mathematics at grades 3-6, in reading at grades 3-6, in writing at grade 4, and in science at grade 5.

The tests are scored as scale scores, with the scaling offering comparability of exams for the same grade level across test administrations. The scores are not, however, vertically aligned across grade levels.

Student performance on the statewide tests is a key determinant of the accountability ranking for schools. The annual report cards for schools assign a rating to each campus, with annual state test performance for all students and for several subgroups of students (subject to a minimum subgroup size requirement), including Hispanic students as a major ranking factor (along with completion rate and dropout rate). The performance standards are set in terms of percentage of eligible students passing the test. Accountability systems built on threshold measures of this type may create unintended incentives for schools to focus resources on “bubble kids” (see Reback (2008)).

The LPAC is also responsible for facilitating ELL student’s participation in other programs such as special education, when required. The student is not referred to special education unless there is information that indicates a disability. If the ELL student does not appear to have any disability, the student will be served by the Bilingual/ESL program. If evidence suggests disability, the student can be served by both: the special education program and the bilingual/ESL education program.

It is mandatory that a LPAC member be present at the admission, review, and dismissal (ARD)[28] of any ELL student. On the other hand, an ARD committee member does not need to be present at an LPAC, but it is encouraged to do so.

Test Administration Decision

In early spring, before the state assessment, LPAC determines the best state testing option for each ELL student. The assessment options are: Administration of the English version criterion-referenced test, administration of the Spanish version criterion-referenced test; or exemption from the criterion-referenced test [29]. In order to make a decision, the LPAC considers information of each student: academic program participation (bilingual education or ESL) and language of instruction, language proficiency in English and/or Spanish, number of years enrolled in U.S schools, previous testing history, level achieved in the state reading proficiency test in English (RPTE), consecutive years of residence outside the 50 U.S. states, and schooling outside the U.S.

Most ELL students take TAKS in either English or Spanish. Exemptions from TAKS test focus especially on immigrants students. Rules are as follow: Spanish TAKS may be taken for up to three years of TAKS administrations[30], and years of ELL exception plus Spanish TAKS may not exceed 3 years.

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[28] The admission, review, and dismissal (ARD) committee for special education is the responsible to place students into the Special Education program

[29] Exemption is an option for ELL students in grades 3 through 10. Postponement is also a valid choice for students who have to meet the exit requirement.

[30] Years when TAKS is administered (third and after)

Bilingual Education Exceptions/Waivers for English as a Second Language

Districts must report to the TEA the status of their teacher recruitment effort for the bilingual education and/or ESL programs. The district must submit at least one of the following three forms: Assurance of Bilingual/ESL Program Compliance, Request for Exception to the Bilingual Education Program along with the Assurance Form and/or Request for Waiver for English as a Second Language Program along with the Assurance Form.

Funding of Bilingual and ESL Programs

Bilingual and ESL programs are funded with federal, state and local funds. The state's general education fund provides a basic allotment for teachers, textbooks, classrooms, etc; and additional funding to implement special language programs. The Bilingual/ESL allotment to school districts is equal to the adjusted basic allotment multiplied by 0.1.

Title III, Part A provides supplemental resources to local education agencies to help ensure ELL and immigrant students meet state achievement performance standards though high quality and effective language instruction. The U.S. Department of Education distributes Title III, Part A funds to states based on the number of ELL enrolled in the district. Funding formula that takes into account district size, the number of immigrant students and the percentage increase over two years.

THE DATA AND EMPIRICAL STRATEGY

I combine student-level and campus-level data for the years 2003-2009. The student-level data consist of the test scores for the subjects of Reading and Mathematics, grades 3 through 6; and several indicators and demographics for all students in the public education system. I identify bilingual and ESL program effects by following three cohorts of students across grades controlling for students, school and year-by-grade fixed effects. Comparisons of academic performance after exit ELL status and/or special language programs provide evidence of program effects.

I divided the cohort of students into two groups: students who took English versions of the test in grades 3 through 6; and students who took Spanish version of the test in grades 3-5 and English version in grade 6. Most students who took Spanish version of the test are bilingual program participants; and for most schools, bilingual programs do not necessarily have to be offered are in grade 6[31]. Table B-1 shows the samples used in this study. There are four samples considered: Reading and Mathematics samples of students who took English version of the test (a.k.a. English samples); and Reading and Mathematics samples of students who took Spanish version of the test in grades 3-5 and English version of the test in grade 6 (a.k.a. Spanish samples).

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[31] School districts must provide bilingual program to elementary school children if there is at least 20 ELL students in the same grade and language classification. Services can be provided as early as kindergarten up to 5th grade. Also 6th graders must be participants, if services are available in the campus. Nevertheless, most ELL exit bilingual program by 5th grade or before. Most students who take Spanish version of the test are bilingual program participants.

ELL students in Texas are around 10 percent of the population of students, and the vast majority of them are Hispanic (95 percent). In order to serve the language needs of these students, most school districts offer special programs for English Language Learners, such as ESL and Bilingual. For the population in this study, approximately half of the Hispanic ELL students attend either bilingual or ESL classrooms. The other 50 percent go to regular classrooms. This proportion of ELL students attending regular classrooms—instead of Bilingual or ESL classrooms—is explained by both the demand and the supply side: On one hand, parents of students who are offered a special language classroom option for their child (bilingual/ESL) may reject the placement and prefer the regular classroom. In other settings the school-districts fail to offer a full set of special language services to ELL students. This last outcome is possible due to the bilingual Education exceptions and waivers for ESL.

The data include information on raw scores and scale scores, and whether or not the student counts as passing. Other indicators and demographics include student's campus, grade, ethnicity, migrant status, and free and reduce lunch qualifications. Some variables describing English language skills and special language program participation are: ELL status, ever ELL status, bilingual program and ESL program participation, one or two years exited ELL status, and Spanish or English version of the test. The campus-level data consist of campus indicators on enrollment and passing rate in reading and mathematics of All Students and the following student groups: African American, Hispanic, White, and Economically Disadvantaged; and some variables describing special language program campus characteristics such as percentage of full time workers serving bilingual an ESL programs. Table B-2 and Table B-3 show summary statistics of the students in all four samples of study. Raw and scale scores are higher in the English samples, for both Reading and Mathematics. Also, the percentage of students who met the standard established by the Texas Education Agency is higher for students who took English versions of the test (91.7 in Reading and 87.1 in Mathematics). As we observe in Table B-3, almost all students in the Spanish sample are both Hispanic (99.8 percent for both reading and math samples) and English language learners (98.3 and 97.9 percents respectively). The percentage of economically disadvantage students is considerably higher in the Spanish samples (71 and 72.2 percent versus 42.5 and 42.7 percent).

Table B-4 shows the cohorts of Texas elementary school students who took English versions of the Reading test as they progress in school. Tables B-5 and B-6 provide information regarding the distribution of ELL students in Texas by classroom type and grade level. Between 42 percent and 45 percent of students receive either bilingual or ESL instructions in grades fourth and five. We observe a dramatic change in those percentages in grade 6 as most students must leave bilingual program due to unavailability of the program. On the other hand, most of the students in the Spanish sample received bilingual instruction (more than 98 percent) and also most of them had to switch to ESL programs as bilingual program became unavailable.

I use a value-added model that considers grow in achievement or gains in achievement as measure of academic performance. The dependent variable is based on one-year improvements in student-level test scores. Working with gains instead of levels helps controlling for cumulative effects of elements from the past parental and school inputs and students abilities. As measure of academic achievement I use gains in standardize scores (mean of zero and variance equal to one), and following Reback's methodology I adjusts for the possibility that one-year differences in test scores might signify more or less substantial gains at different points in the test score distribution. As Reback's procedure indicates, instead of using the difference between the current and prior year's scores, I transform these gains to allow for comparability in improvements across the entire test score distribution. Z-score is based on the performance of students with identical prior year's scores in identical grades. Each Z-score represents the place in the standard normal distribution for the current year's score based on similar performance in the prior year. One may interpret a coefficient estimate as how the independent variables relates to achievement gains "compared to typical gains at this place in the test score distribution"

I estimate several variations of the following model:

$$Z^{score} = \alpha_0 + \sum_{\substack{j=1 \\ j \neq 25}}^{36} (\, path_j) + \varphi X + \gamma W + \delta_s + \theta_i + \omega_{gst} + \epsilon_{igst} \qquad (1)$$

This equation models achievement gains for student i in grade g and school s at time t as a function of paths regarding ELL status and Bilingual and ESL participation in periods *t-1* and *t* as shown in Table B-7; vector of individual (X) and school (W) characteristics; and four error components: individual factor (θ_i), school fixed effects (δ_s), school-by-grade-by-year fixed effects (ω_{gst}), and a random error (ϵ_{igst}) .

Individual characteristics include ethnicity, migrant status and economically disadvantage status. The vector of school characteristics includes mobility percent, enrollment count, percent of students in bilingual education programs, percent of economically disadvantaged students, percent of ELL students, and proportions of black, Hispanic, and white students.

CHAPTER IV

CONCLUSIONS

ESTIMATION OF EFFECTS OF LABOR MARKET PARTICIPATION ON FERTILITY SPACING

I estimate the effect of current and (conditional and unconditional) future participation on fertility spacing.

Tables A-12, A-13, and A-14 show the first-stage regressions of instruments on past experience, current participation, and future participation respectively. Since left-hand side participation is discrete, I use logit estimations to predict probabilities of being in the labor force. The instrumental variables used are contemporaneous for past participation, and contemporaneous and past for current and future participation. Eight different specifications are used. Husband's income is measured by permanent income from wages and other sources, and by transitory income around the time of the births.

Table A-15 shows results using OLS estimation, but since participation is endogenous I expected these results to be biased. Current participation increases spacing by 15 months, while the effect of future participation is almost negligible as it decreases spacing in less than one month. Working labor experience also decreases spacing, and the effect seems to be stronger than future participation.

Instruments that are significant for current participation are FICA rate, simulated federal income tax liability when she works part-time (20 hours), and contemporaneous simulated effective state and federal marginal tax schedules. Instruments significant for future participation are unemployment rate before and after childbearing, federal income tax liability before childbearing, simulated effective state marginal tax schedule before second birth, FICA rate before and after births, and contemporaneous federal tax rate.

The second stage shows the effects of participation on spacing. I consider two variations for the second stage. In the first, I control for number of children ever, as it is observed that women who end up with more children at the end of the fertility horizon tended to space them closer. In the second variation, I acknowledge the fact that number of children is endogenous to the problem; thus I use and instrument for number of children. The instrument used is the Angrist and Evans (1998) mixed sibling-sex composition.

Table A-15 shows the results when I use the first variation (i.e. controlling for number of children) and different controls and specifications for first stage. Results regarding current and future participation on spacing confirm conclusions found in our theoretical model. Women who work increase their spacing (positive sign), while women who expect to work in the future decrease their spacing (negative sign). I present evidence that working women delay the second child in a magnitude that varies between 49 and 54 months. Future participation has a smaller impact but is still important. Women who expect to work in the future will want to decrease their spacing by one year magnitude. Present and the future participation play opposite effects in determining the optimal spacing between the first and second child. Present conditions seem to be more relevant.

When I use an instrument for number of children ever, I find a positive current participation effect and a negative future participation effect. Women who participate in the labor market increase their spacing by 53 to 57 months, while women who expect to work in the future decrease their spacing by 13 months. These results that account for endogeneity in number of children—as opposed to ignoring the endogeneity—give same effects to future participation and less variation in the effects of current participation.

Table A-18 tests robustness to changes in husband's income. Instead of using a proxy for permanent income as I did in Table A-15, I use now a proxy to transitory income, by looking at the income around the time of first and second births. Once again women space longer when currently working and shorter when they intent to participate in the labor market in the future. Current participation increases spacing by 49 to 62 and future participation decreases spacing by 12 to 30 months.

Thus far I have discussed results concerning unconditional future participation; i.e., when there is no previous condition regarding current participation status. However it is interesting to know how the future effect changes—in terms of sign and magnitude—for women who transitorily drop out of the labor force due to childbearing. I said earlier that this group of women must have stronger incentives to space their children closer together. Table A-16 shows the first stage for variable "future participation given no current participation." Instruments that are significant here are contemporaneous and past FICA rate, effective state marginal rate during childbirth interval, federal income tax liability during child interval, effective state marginal rate, and several interactions of these variables. As for the second stage, the effect of current participation on spacing is still positive, although magnitude is smaller than in previous regressions (33 to 39 months). On the other hand, the future participation effect was never as big as it is now (22 to 23 months). This supports the idea that conditional on not working in the present, future participation gives extra incentives to decrease spacing between the first and second child.

When I examine heterogeneity of the effect of labor market participation on spacing I find that women with more years of schooling and higher husband's income experience weaker current and future labor participation effects on their childbirth spacing (see table A-17). The current participation effect for women with more than 12 years of schooling decreases by 16 months, and the future participation effect decreases by 31 months. Women with fewer years of schooling increase their spacing by 59 months when they have a working status, and decrease their spacing by 32 months when they are not working. On the other hand, women with more years of schooling either increase their childbirth spacing by 43 (if working) or decrease it by 1 month (if not working).

Heterogeneity by husband's income produces comparable results. Effects become stronger for lower income households. Differences in spacing due to differences in transitory income provide evidence on the importance of variations of non-labor income on fertility. When I focus on non-labor income at the time of the first birth, women with higher non-labor income (above median) increase their spacing by 40 months if currently working, and decrease their spacing by 7 months if not working. On the other hand, women with low non-labor income increase their spacing by 69 months if currently working and decrease their spacing by 26 months if not working.

With respect to heterogeneity of the effects of participation on spacing by complete fertility, women with only two children space 62 months longer if currently working, and 20 months shorter if not working. Women with more than two children space 33 months longer if working and 7 shorter if not working.

I also find heterogeneity in the effects of participation on spacing by age of the first birth. Effects are considerably higher for women younger than 25 at the time of first birth, followed by women older than 30. Women who started motherhood between 25 and 30 experience less intensive effects than the rest of the age groups. Working women increase spacing by 75 months (if age at first birth is less than 20 years old), 53 months (if age at first birth is between 21 and 25 years old) or 32 months (if age at first birth is between 26 and 30 years old). Women who dropped out of the labor force decrease spacing by 30 months (if age at first birth is younger than 20), 14 months (if age at first birth is between 21 to 25 years old), or increase spacing by two months (if age at first birth is between 26 to 30 years old). Older women (older than 30) experience a current participation effect of 37 months and positive future participation effect of 6 months. This last result is very intuitive as older women might prefer relatively shorter spacing as their fertile horizon becomes shorter in time.

ESTIMATION OF IMPACT OF BILINGUAL AND ESL PROGRAMS ON ACADEMIC ACHIEVEMENT

Tables B-8, B-9, B-10, and B-11 show estimations of bilingual and ESL program effects by measuring the impact of ELL and program participation paths of three cohorts of students across grades, controlling for students, school, and year-by-grade fixed effects. Table B-8 uses as reference group the group of students who were non-ELL and attended regular classrooms in both t-1 and t periods. Differentials in paths' estimations provide evidence of bilingual and ESL programs as well as program continuity effects and program changing effects.

Table B-9 shows the estimated effects of language programs on Reading and Mathematics test score gains by ELL status, for students who take English version of the tests. I consider estimations for the group of students who are ELL status during t-1 and t (non-exiters) and the group of students who are ELL in t-1 and non-ELL in t (exiters). Both bilingual and ESL programs have a positive effect on Reading academic gains for students in grades 4 through 6. Bilingual program improves academic gains in Reading 0.141 standard deviations (grade 4 and 5) and 0.28 standard deviations (grade 6) while ESL program improves academic gains in Reading 0.061 standard deviations (grade 4 and 5) and 0.136 standard deviations (grade 6). For the Mathematics sample, results for the bilingual program are not conclusive. I got a negative effect for grades 4 and 5, and a positive effect for grade 6. ESL effect continues to be positive for the all grades.

For the same group of non-exiters, both bilingual and ESL effects are positive when students continue in the same program during t-1 and t. On the other hand, if the student remains in the program during t-1 and exit the program in t, bilingual and ESL effects are negative for all grades and all subjects (between 0.004 and 0.317 standard deviations). This provide evidence of the importance of the continuity of the programs treatment to students who are ELL.

Changing programs from bilingual to either ESL or regular program, or from ESL to either bilingual or regular program, has negative effects on Reading and Mathematics achievement gains for all grades (Table B-9). However as a general result, it is better to change toward bilingual program as the negative effect is smaller in magnitude.

For students who exited ELL status during t (exiters), results are not conclusive. Bilingual effect is negative for students in Reading, but only for sixth graders in Mathematics. ESL effect is negative for all groups but for sixth graders in Mathematics.

Table B-11 shows the result for students who took the Spanish version of the test in grades 3-5 and English version of the test in grade 6. Due to the small sample size of students in different paths, I can only obtain conclusion regarding the effects of changing programs. As a general result it is better to change from ESL to bilingual programs, and from bilingual to regular program.

REFERENCES

Angrist, Joshua, Evans, William, 1998. Children and their parents' labor supply: Evidence from exogenous variation in family size. American Economic Review 88 (3), 450-477.

Basso, Olga, Olsen, Jorn, Knudsen, Lisbeth, Christensen, Kaare, 1998. Birth weight and preterm birth after short interpregnancy intervals. American Journal of Obstetrics and Gynecology 178 (2), 259-263.

Baughman, Reagan, Dickert-Conlin, Stacy, 2003. Did Expanding the EITC Promote Motherhood?. American Economic Review Papers and Proceedings 93(2), 247-250.

Bureau of Labor Statistics, Occupational Outlook Handbook, 2010-11 Edition. Labor Dept., U.S. Bureau of Labor Statistics, Washington, DC.

Fairlie, Robert, London, Rebecca, 1997. The effect of incremental benefit levels on births to AFDC recipients . Journal of Policy Analysis and Management 16 (4), 575-597.

Francesconi, Marco, 2002. A joint dynamic model of fertility and work of married women. Journal of Labor Economics 20 (2), 336-380.

Feenberg, Daniel, Coutts, Elizabeth, 1993. An introduction to the TAXSIM model. Journal of Policy Analysis and Management 12(1), 1989-1994.

Grogger, Jeff, Bronars, Stephen, 2001. The effect of welfare payments on the marriage and fertility behavior of unwed Mothers: Results from a twins experiment. Journal of Political Economy 109(3), 529-545.

Hanushek, Eric, Kain, John, Rivkin, Steven, 2002. Inferring program effects for special populations: Does special education raise achievement for students with disabilities? The Review of Economics and Statistics 84(4), 584-599.

Heckman, James, Hotz, V Joseph, Walker, James, 1985. New evidence on the timing and spacing of births. American Economic Review, American Economic Association 75(2), 179-84.

Heckman, James, Walker, James, 1990. The relationship between wages and income and the timing and spacing of births: Evidence from Swedish longitudinal data. Econometrica 58 (6), 1411-1441.

Hotz, V. Joseph, Miller, Robert, 1988. An empirical analysis of life cycle fertility and female labor supply. Econometrica 56 (1), 91-118.

Hotz, V. Joseph, Mullin, Charles, Scholz, John, 2005. Examining the effect of the earned income tax credit on the labor market participation of families on welfare. NBER Working Paper 11968.

Hyslop, Dean, 1999. State dependence, serial correlation and heterogeneity in inter temporal labor force participation of married women. Econometrica 67 (6), 1255-1294.

Leibowitz, Arleen, Klerman, Jacob, Waite, Linda, 1992. Employment of new mothers and child care choice: Differences by children's age. The Journal of Human Resources 27 (1), Special Issue on Child Care, 112-133.

Leigh, Sharon, O'Brien, Daniel, 1998. An assessment of bilingual education programs for a large Texas school district. Political Economy Program, The University of Texas at Dallas.

Mincer, Jacob, Polachek, Solomon, 1974. Family investments in human capital: Earnings of women. Journal of Political Economy LXXXII. S76–S108.

Miller, Amalia, 2005. The Effects of Motherhood Timing on Career Path. Department of Economics, University of Virginia. forthcoming in Journal of Population Economics.

Montgomery, Mark, Trussel, James, 1986. Models of marital status and childbearing. In: Ashenfelter, Orley, Layard, Richard (Eds) Handbook of Labour Economics, vol 1. Elsevier.

Mozumder, Khorshed, Khuda, Barkat, Kane, Thomas, Levin, Ann, Ahmed, Shameem, 2000. The effect of birth interval on malnutrition in Bangladeshi infants and young children. Journal of Biosocial Science 32 (3), 289-300.

Pettersson-Lidbom, Per, Skogman Thoursie, Peter, 2007. Does Child Spacing Affect Children's Outcomes? Evidence from a Swedish Reform. Institute for Labor Market Policy Evaluation. Working paper 2009 (7).

Pfouts, Jane, 1980. Birth order, age spacing, IQ differences, and family relationships. Journal of Marriage and the Family (42), 517-531.

Powell, David, 2009. Estimating the value of a statistical life using income tax changes. MIT Department of Economics. Unpublished manuscript.

Rawlings, James, Rawlings, Virginia, Read, John, 1995. Prevalence of low birth weight and preterm delivery in relation to the interval between pregnancies among white and black women. The New England Journal of Medicine 332 (2), 69-74.

Reback, Randall, 2008. Teaching to the rating: School accountability and the distribution of student achievement. Journal of Public Economics 93, 352-353.

Rodriguez, German, Hobcraft, John, McDonald, John, Menken, Jane, Trussell, James, 1984. A comparative analysis of determinants of birth intervals. WFS Comparative Study 30, International Statistical Institute: Voorburg Netherlands.

Ward, Michael, Butz, William, 1980. Completed fertility and its timing. The Journal of Political Economy 88 (5), 917-940.

Whitworth, Alison, Stephenson, Rob, 2002. Birth spacing, sibling rivalry and child mortality in India. Social Science & Medicine 55, 2107–2119.

Winikoff, Beverly, 1983. The effects of birth spacing on child and maternal health. Studies in Family Planning 14 (10), 231-245.

Wolpin, Kenneth, 1984. An estimable dynamic stochastic model of fertility and child mortality. Journal of Political Economy 92 (51), 852-874.

Other documents used:

Arroyo, Cristino, Zhang, Junsen,1997. Dynamic microeconomic models of fertility choice: A survey. Journal of Population Economics 10, 23-65.

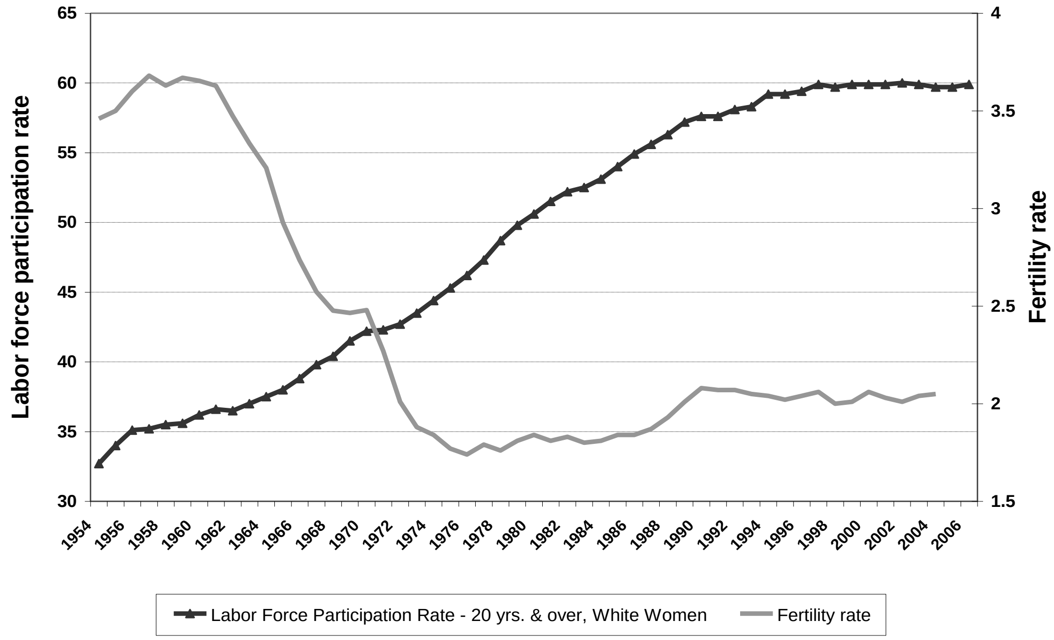
Butz, William, Ward, Michael, 1979. The Emergence of Countercyclical U.S. Fertility. The American Economic Review 69 (3), 318-328.

Language Proficiency Assessment Committee Process Manual 2008.

TAKS Data File Format with Students Item Analysis, 2004-2009.

Title III, Part A English Language Acquisition, Language Enhancement, and Academic Achievement Act.

APPENDIX A



Source: IMF Statistical Databases; Montly Labor Review (Feb 2007)

Fig. A-1. United States: Female labor force participation and total fertility rate, 1954-2006.

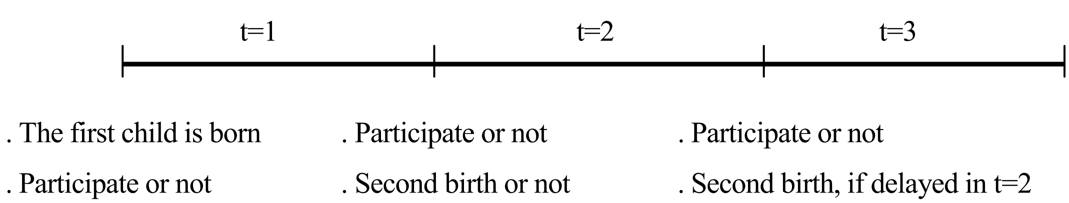


Fig. A-2. The timing of the model.

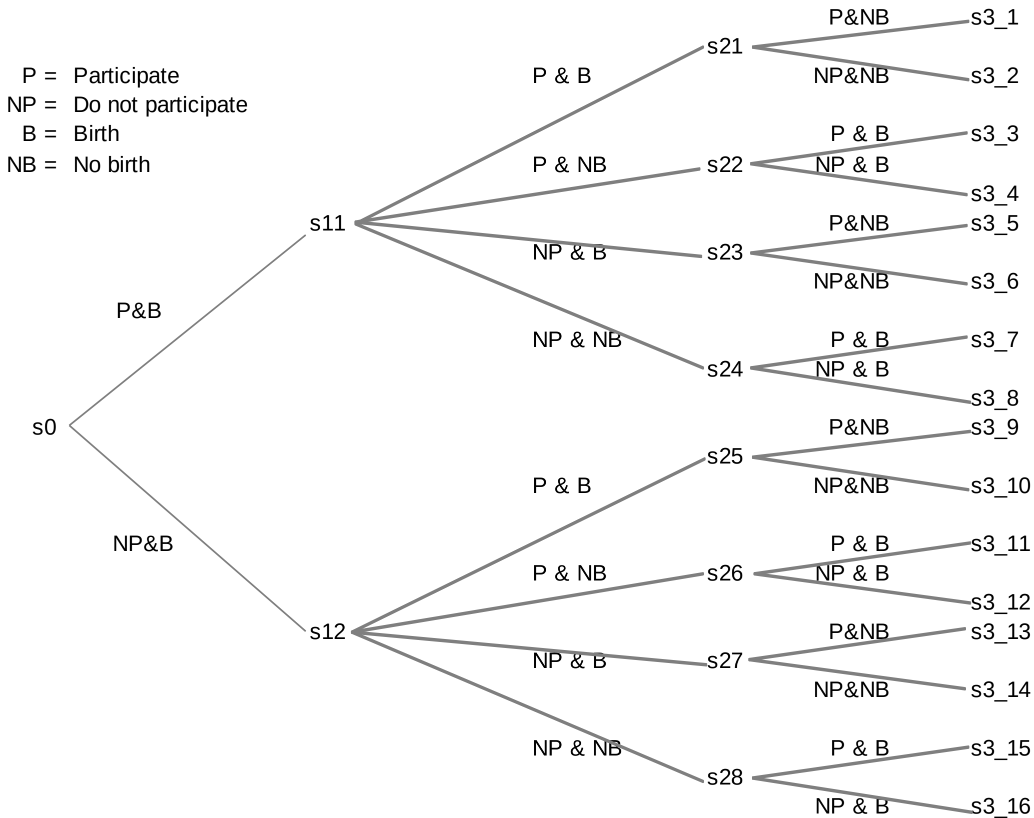


Fig. A-3. Three-period model as a tree.

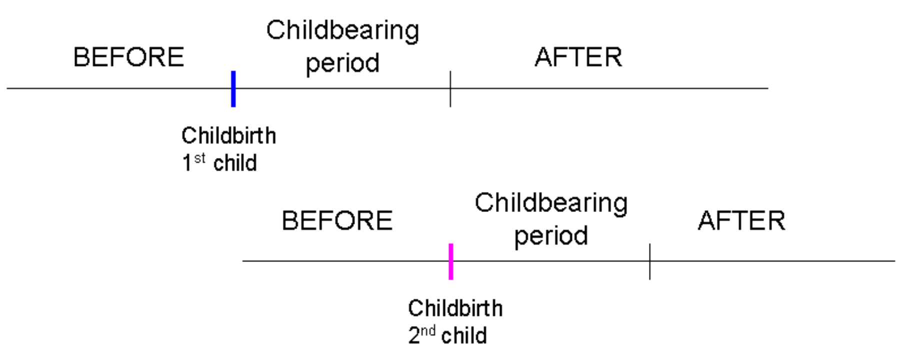


Fig. A-4. The childbearing period.

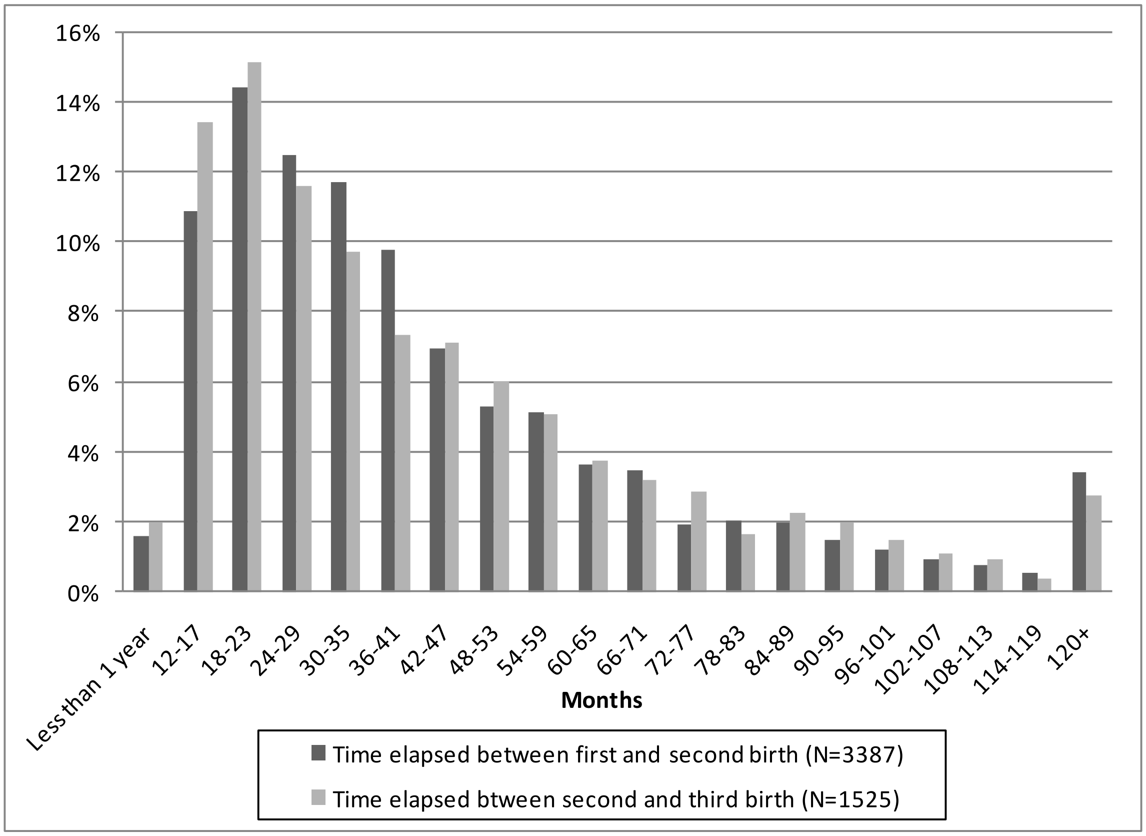


Fig. A-5. Spacing of births.

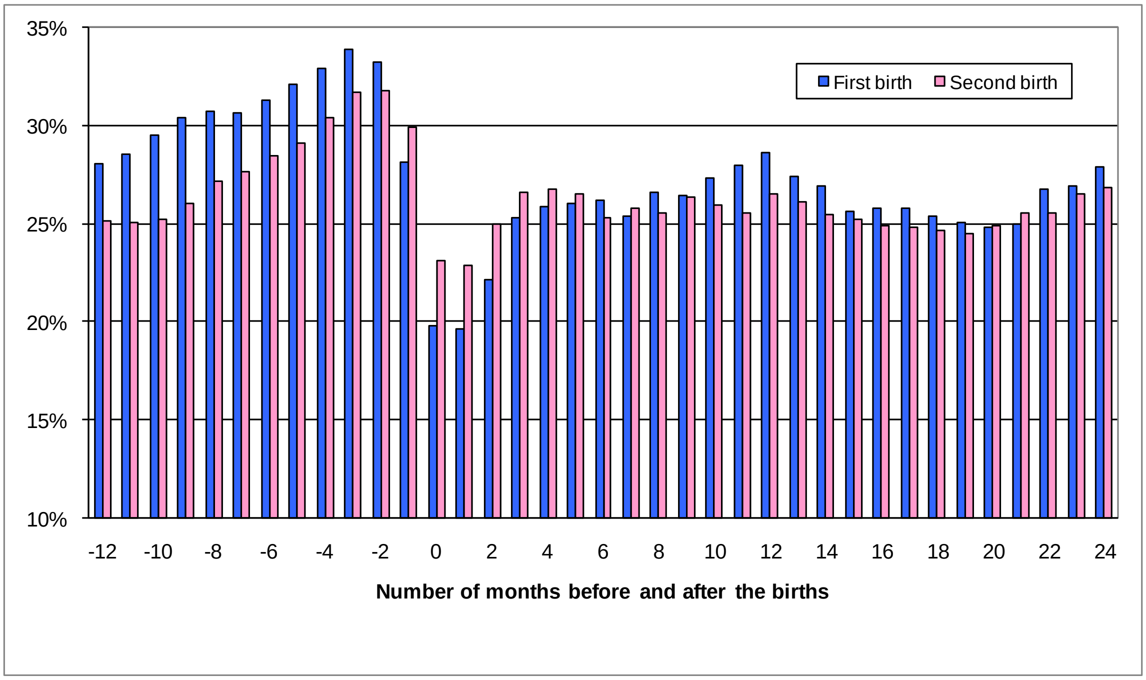


Fig. A-6. Percentage of women with two children working at least 30 hours a week in the labor market, about the time of the births.

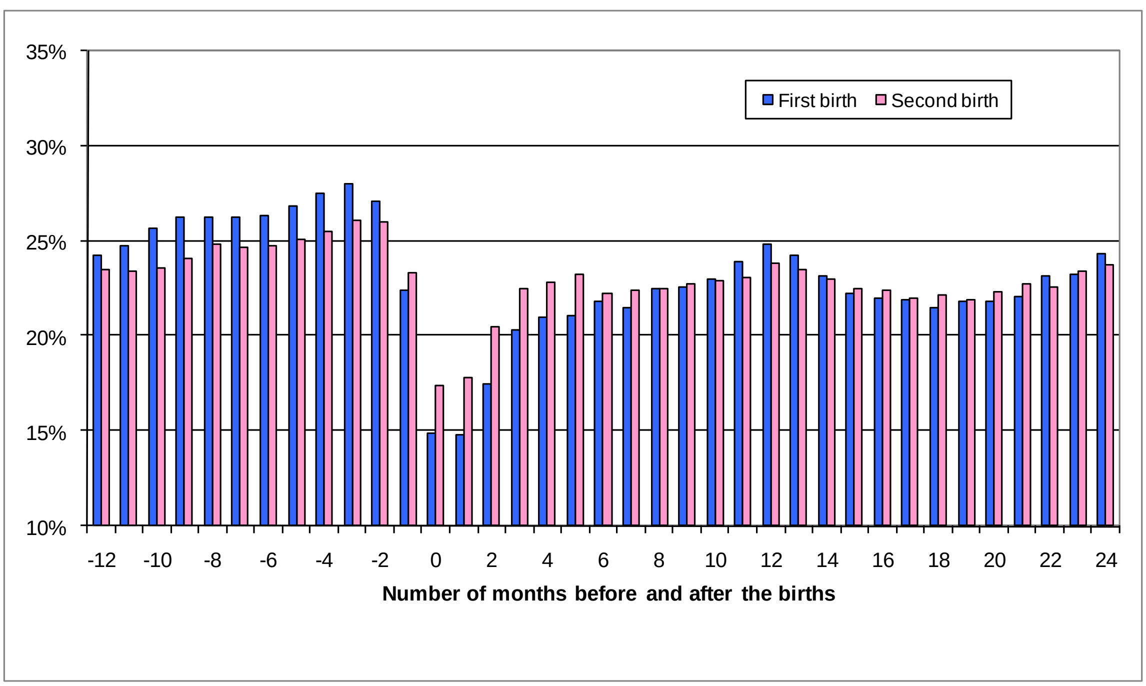


Fig. A-7. Percentage of women with at least two children working at least 30 hours a week in the labor market, about the time of the births.

Table A-1
Time with the children

Case-scenario	Participation and Fertility Behavior*			Basic time $T_A = a_0 - a_1(age)$						Extra time $T_B = \varphi_1 + \varphi_2(N-1)$		
	t=1	*t=2*	*t=3*	*t=1*		*t=2*		*t=3*		*t=1*	*t=2*	*t=3*
				Child 1	Child2	Child 1	Child2	Child 1	Child2			
1	*P&B*	*P&B*	*P&NB*	a_0	0	a_0-a_1	a_0	a_0-2a_1	a_0-a_1	0	0	0
2	*P&B*	*P&B*	*NP&NB*	a_0	0	a_0-a_1	a_0	a_0-2a_1	a_0-a_1	0	0	$\varphi_1+\varphi_2$
3	*P&B*	*P&NB*	*P&B*	a_0	0	a_0-a_1	0	a_0-2a_1	a_0	0	0	0
4	*P&B*	*P&NB*	*NP&B*	a_0	0	a_0-a_1	0	a_0-2a_1	a_0	0	0	$\varphi_1+\varphi_2$
5	*P&B*	*NP&B*	*P&NB*	a_0	0	a_0-a_1	a_0	a_0-2a_1	a_0-a_1	0	$\varphi_1+\varphi_2$	0
6	*P&B*	*NP&B*	*NP&NB*	a_0	0	a_0-a_1	a_0	a_0-2a_1	a_0-a_1	0	$\varphi_1+\varphi_2$	$\varphi_1+\varphi_2$
7	*P&B*	*NP&NB*	*P&B*	a_0	0	a_0-a_1	0	a_0-2a_1	a_0	0	φ_1	0
8	*P&B*	*NP&NB*	*NP&B*	a_0	0	a_0-a_1	0	a_0-2a_1	a_0	0	φ_1	$\varphi_1+\varphi_2$
9	*NP&B*	*P&B*	*P&NB*	a_0	0	a_0-a_1	a_0	a_0-2a_1	a_0-a_1	φ_1	0	0
10	*NP&B*	*P&B*	*NP&NB*	a_0	0	a_0-a_1	a_0	a_0-2a_1	a_0-a_1	φ_1	0	$\varphi_1+\varphi_2$
11	*NP&B*	*P&NB*	*P&B*	a_0	0	a_0-a_1	0	a_0-2a_1	a_0	φ_1	0	0
12	*NP&B*	*P&NB*	*NP&B*	a_0	0	a_0-a_1	0	a_0-2a_1	a_0	φ_1	0	$\varphi_1+\varphi_2$
13	*NP&B*	*NP&B*	*P&NB*	a_0	0	a_0-a_1	a_0	a_0-2a_1	a_0-a_1	φ_1	$\varphi_1+\varphi_2$	0
14	*NP&B*	*NP&B*	*NP&NB*	a_0	0	a_0-a_1	a_0	a_0-2a_1	a_0-a_1	φ_1	$\varphi_1+\varphi_2$	$\varphi_1+\varphi_2$
15	*NP&B*	*NP&NB*	*P&B*	a_0	0	a_0-a_1	0	a_0-2a_1	a_0	φ_1	φ_1	0
16	*NP&B*	*NP&NB*	*NP&B*	a_0	0	a_0-a_1	0	a_0-2a_1	a_0	φ_1	φ_1	$\varphi_1+\varphi_2$

*Participation behavior: P=Participate, NP=Do Not participate;
Fertility behavior: B=Birth, NB=No Birth

Table A-2
Time allocated to leisure and participation in the labor market

Case-scenario	Participation and Fertility Behavior*			Working time (T_w *P)			Leisure ($1-T_w-T_{children}$)		
	t=1	*t=2*	*t=3*	*t=1*	*t=2*	*t=3*	*t=1*	*t=2*	*t=3*
1	*P&B*	*P&B*	*P&NB*	T_w	T_w	T_w	$1-T_w-a_0$	$1-T_w-2a_0+a_1$	$1-T_w-2a_0+3a_1$
2	*P&B*	*P&B*	*NP&NB*	T_w	T_w	*0*	$1-T_w-a_0$	$1-T_w-2a_0+a_1$	$1-2a_0+3a_1-\varphi_1-\varphi_2$
3	*P&B*	*P&NB*	*P&B*	T_w	T_w	T_w	$1-T_w-a_0$	$1-T_w-a_0+a_1$	$1-T_w-2a_0+2a_1$
4	*P&B*	*P&NB*	*NP&B*	T_w	T_w	*0*	$1-T_w-a_0$	$1-T_w-a_0+a_1$	$1-2a_0+2a_1-\varphi_1-\varphi_2$
5	*P&B*	*NP&B*	*P&NB*	T_w	*0*	T_w	$1-T_w-a_0$	$1-2a_0+a_1-\varphi_1-\varphi_2$	$1-T_w-2a_0+3a_1$
6	*P&B*	*NP&B*	*NP&NB*	T_w	*0*	*0*	$1-T_w-a_0$	$1-2a_0+a_1-\varphi_1-\varphi_2$	$1-2a_0+3a_1-\varphi_1-\varphi_2$
7	*P&B*	*NP&NB*	*P&B*	T_w	*0*	T_w	$1-T_w-a_0$	$1-a_0+a_1-\varphi_1$	$1-T_w-2a_0+2a_1$
8	*P&B*	*NP&NB*	*NP&B*	T_w	*0*	*0*	$1-T_w-a_0$	$1-a_0+a_1-\varphi_1$	$1-2a_0+2a_1-\varphi_1-\varphi_2$
9	*NP&B*	*P&B*	*P&NB*	*0*	T_w	T_w	$1-a_0-\varphi_1$	$1-T_w-2a_0+a_1$	$1-T_w-2a_0+3a_1$
10	*NP&B*	*P&B*	*NP&NB*	*0*	T_w	*0*	$1-a_0-\varphi_1$	$1-T_w-2a_0+a_1$	$1-2a_0+3a_1-\varphi_1-\varphi_2$
11	*NP&B*	*P&NB*	*P&B*	*0*	T_w	T_w	$1-a_0-\varphi_1$	$1-T_w-a_0+a_1$	$1-T_w-2a_0+2a_1$
12	*NP&B*	*P&NB*	*NP&B*	*0*	T_w	*0*	$1-a_0-\varphi_1$	$1-T_w-a_0+a_1$	$1-2a_0+2a_1-\varphi_1-\varphi_2$
13	*NP&B*	*NP&B*	*P&NB*	*0*	*0*	T_w	$1-a_0-\varphi_1$	$1-2a_0+a_1-\varphi_1-\varphi_2$	$1-T_w-2a_0+3a_1$
14	*NP&B*	*NP&B*	*NP&NB*	*0*	*0*	*0*	$1-a_0-\varphi_1$	$1-2a_0+a_1-\varphi_1-\varphi_2$	$1-2a_0+3a_1-\varphi_1-\varphi_2$
15	*NP&B*	*NP&NB*	*P&B*	*0*	*0*	T_w	$1-a_0-\varphi_1$	$1-a_0+a_1-\varphi_1$	$1-T_w-2a_0+2a_1$
16	*NP&B*	*NP&NB*	*NP&B*	*0*	*0*	*0*	$1-a_0-\varphi_1$	$1-a_0+a_1-\varphi_1$	$1-2a_0+2a_1-\varphi_1-\varphi_2$

Table A-3
Out-of-home childcare cost

Case-scenario	Participation and Fertility Behavior*			Out-of home childcare $\lambda_1 > \lambda_2 > \lambda_3$			
	t=1	*t=2*	*t=3*	*t=1*	*t=2*	*t=3*	Lifetime
1	*P&B*	*P&B*	*P&NB*	λ_1	$\lambda_2+\lambda_1$	$\lambda_3+\lambda_2$	$2\lambda_1+2\lambda_2+\lambda_3$
2	*P&B*	*P&B*	*NP&NB*	λ_1	$\lambda_2+\lambda_1$	*0*	$2\lambda_1+\lambda_2$
3	*P&B*	*P&NB*	*P&B*	λ_1	λ_2	$\lambda_3+\lambda_1$	$2\lambda_1+\lambda_2+\lambda_3$
4	*P&B*	*P&NB*	*NP&B*	λ_1	λ_2	*0*	$\lambda_1+\lambda_2$
5	*P&B*	*NP&B*	*P&NB*	λ_1	*0*	$\lambda_3+\lambda_2$	$\lambda_1+\lambda_2+\lambda_3$
6	*P&B*	*NP&B*	*NP&NB*	λ_1	*0*	*0*	λ_1
7	*P&B*	*NP&NB*	*P&B*	λ_1	*0*	$\lambda_3+\lambda_1$	$2\lambda_1+\lambda_3$
8	*P&B*	*NP&NB*	*NP&B*	λ_1	*0*	*0*	λ_1
9	*NP&B*	*P&B*	*P&NB*	*0*	$\lambda_2+\lambda_1$	$\lambda_3+\lambda_2$	$\lambda_1+2\lambda_2+\lambda_3$
10	*NP&B*	*P&B*	*NP&NB*	*0*	$\lambda_2+\lambda_1$	*0*	$\lambda_1+\lambda_2$
11	*NP&B*	*P&NB*	*P&B*	*0*	λ_2	$\lambda_3+\lambda_1$	$\lambda_1+\lambda_2+\lambda_3$
12	*NP&B*	*P&NB*	*NP&B*	*0*	λ_2	*0*	λ_2
13	*NP&B*	*NP&B*	*P&NB*	*0*	*0*	$\lambda_3+\lambda_2$	$\lambda_2+\lambda_3$
14	*NP&B*	*NP&B*	*NP&NB*	*0*	*0*	*0*	*0*
15	*NP&B*	*NP&NB*	*P&B*	*0*	*0*	$\lambda_3+\lambda_1$	$\lambda_1+\lambda_3$
16	*NP&B*	*NP&NB*	*NP&B*	*0*	*0*	*0*	*0*

Table A-4
Lifetime wages

Case-scenario	Participation behavior			Wage			Lifetime wages
				t=1	*t=2*	*t=3*	
1	*P*	*P*	*P*	w_0	w_0	w_0	$3w_0$
2	*P*	*P*	*NP*	w_0	w_0	*0*	$2w_0$
3	*P*	*P*	*P*	w_0	w_0	w_0	$3w_0$
4	*P*	*P*	*NP*	w_0	w_0	*0*	$2w_0$
5	*P*	*NP*	*P*	w_0	*0*	$w_0(1\text{-}d)$	$w_0(2\text{-}d)$
6	*P*	*NP*	*NP*	w_0	*0*	*0*	w_0
7	*P*	*NP*	*P*	w_0	*0*	$w_0(1\text{-}d)$	$w_0(2\text{-}d)$
8	*P*	*NP*	*NP*	w_0	*0*	*0*	w_0
9	*NP*	*P*	*P*	*0*	$w_0(1\text{-}d)$	$w_0(1\text{-}d)$	$2w_0(1\text{-}d)$
10	*NP*	*P*	*NP*	*0*	$w_0(1\text{-}d)$	*0*	$w_0(1\text{-}d)$
11	*NP*	*P*	*P*	*0*	$w_0(1\text{-}d)$	$w_0(1\text{-}d)$	$2w_0(1\text{-}d)$
12	*NP*	*P*	*NP*	*0*	$w_0(1\text{-}d)$	*0*	$w_0(1\text{-}d)$
13	*NP*	*NP*	*P*	*0*	*0*	$w_0(1\text{-}d)^2$	$w_0(1\text{-}d)^2$
14	*NP*	*NP*	*NP*	*0*	*0*	*0*	*0*
15	*NP*	*NP*	*P*	*0*	*0*	$w_0(1\text{-}d)^2$	$w_0(1\text{-}d)^2$
16	*NP*	*NP*	*NP*	*0*	*0*	*0*	*0*

Table A-5
Lifetime utility

Case-scenario	Participation and Fertility Behavior $[(p_t,b_t),(p_{t+1},b_{t+1}),(p_{t+2},b_{t+2})]$	Lifetime Utility
1	[(1,1),(1,1),(1,0)]	$U_1 = 3\bar{y} + 3w_0 - (2\lambda_1 + 2\lambda_2 + \lambda_3) + (1 - T_w - a_0)^\alpha + (1 - T_w - 2a_0 + a_1)^\alpha + (1 - T_w - 2a_0 + 3a_1)^\alpha$
2	[(1,1),(1,1),(0,0)]	$U_2 = 3\bar{y} + 2w_0 - (2\lambda_1 + \lambda_2) + (1 - T_w - a_0)^\alpha + (1 - T_w - 2a_0 + a_1)^\alpha + (1 - 2a_0 + 3a_1 - \varphi_1 - \varphi_2)^\alpha$
3	[(1,1),(1,0),(1,1)]	$U_3 = 3\bar{y} + 3w_0 - (2\lambda_1 + \lambda_2 + \lambda_3) + (1 - T_w - a_0)^\alpha + (1 - T_w - a_0 + a_1)^\alpha + (1 - T_w - 2a_0 + 2a_1)^\alpha$
4	[(1,1),(1,0),(0,1)]	$U_4 = 3\bar{y} + 2w_0 - (\lambda_1 + \lambda_2) + (1 - T_w - a_0)^\alpha + (1 - T_w - a_0 + a_1)^\alpha + (1 - 2a_0 + 2a_1 - \varphi_1 - \varphi_2)^\alpha$
5	[(1,1),(0,1),(1,0)]	$U_5 = 3\bar{y} + w_0\,(2 - d) - (\lambda_1 + \lambda_2 + \lambda_3) + (1 - T_w - a_0)^\alpha + \left(1 - 2a_0 + a_1 - \varphi_1 - \varphi_2\right)^\alpha + (1 - T_w - 2a_0 + 3a_1)^\alpha$
6	[(1,1),(0,1),(0,0)]	$U_6 = 3\bar{y} + w_0 - (\lambda_1) + (1 - T_w - a_0)^\alpha + \left(1 - 2a_0 + a_1 - \varphi_1 - \varphi_2\right)^\alpha + \left(1 - 2a_0 + 3a_1 - \varphi_1 - \varphi_2\right)^\alpha$
7	[(1,1),(0,0),(1,1)]	$U_7 = 3\bar{y} + w_0\,(2 - d) - (2\lambda_1 + \lambda_3) + (1 - T_w - a_0)^\alpha + \left(1 - a_0 + a_1 - \varphi_1\right)^\alpha + (1 - T_w - 2a_0 + 2a_1)^\alpha$
8	[(1,1),(0,0),(0,1)]	$U_8 = 3\bar{y} + w_0 - (\lambda_1) + (1 - T_w - a_0)^\alpha + \left(1 - a_0 + a_1 - \varphi_1\right)^\alpha + (1 - 2a_0 + 2a_1 - \varphi_1 - \varphi_2)^\alpha$
9	[(0,1),(1,1),(1,0)]	$U_9 = 3\bar{y} + 2w_0\,(1 - d) - (\lambda_1 + 2\lambda_2 + \lambda_3) + (1 - a_0 - \varphi_1)^\alpha + (1 - T_w - 2a_0 + a_1)^\alpha + (1 - T_w - 2a_0 + 3a_1)^\alpha$
10	[(0,1),(1,1),(0,0)]	$U_{10} = 3\bar{y} + w_0(1 - d) - (\lambda_1 + \lambda_2) + \left(1 - a_0 - \varphi_1\right)^\alpha + (1 - T_w - 2a_0 + a_1)^\alpha + (1 - 2a_0 + 3a_1 - \varphi_1 - \varphi_2)^\alpha$
11	[(0,1),(1,0),(1,1)]	$U_{11} = 3\bar{y} + 2w_1(1 - d) - (\lambda_1 + \lambda_2 + \lambda_3) + (1 - a_0 - \varphi_1)^\alpha + (1 - T_w - a_0 + a_1)^\alpha + (1 - T_w - 2a_0 + 2a_1)^\alpha$

12	[(0,1),(1,0),(0,1)]	$U_{12} = 3\bar{y} + w_0(1-d) - (\lambda_2) + \left(1 - a_0 - \varphi_1\right)^{\alpha}$ $+ (1 - T_w - a_0 + a_1)^{\alpha}$ $+ (1 - 2a_0 + 2a_1 - \varphi_1 - \varphi_2)^{\alpha}$
13	[(0,1),(0,1),(1,0)]	$U_{13} = 3\bar{y} + w_0(1-d)^2 - (\lambda_2 + \lambda_3) + (1 - a_0 - \varphi_1)^{\alpha}$ $+ \left(1 - 2a_0 + a_1 - \varphi_1 - \varphi_2\right)^{\alpha}$ $+ (1 - T_w - 2a_0 + 3a_1)^{\alpha}$
14	[(0,1),(0,1),(0,0)]	$U_{14} = 3\bar{y} + (0) - (0) + \left(1 - a_0 - \varphi_1\right)^{\alpha}$ $+ \left(1 - 2a_0 + a_1 - \varphi_1 - \varphi_2\right)^{\alpha}$ $+(1 - 2a_0 + 3a_1 - \varphi_1 - \varphi_2)^{\alpha}$
15	[(0,1),(0,0),(1,1)]	$U_{15} = 3\bar{y} + w_0\,(1-d)^2 - (\lambda_1 + \lambda_3) + (1 - a_0 - \varphi_1)^{\alpha}$ $+ \left(1 - a_0 + a_1 - \varphi_1\right)^{\alpha} + (1 - T_w - 2a_0 + 2a_1)^{\alpha}$
16	[(0,1),(0,0),(0,1)]	$U_{16} = 3\bar{y} + (0) - (0) + \left(1 - a_0 - \varphi_1\right)^{\alpha} + \left(1 - a_0 + a_1 - \varphi_1\right)^{\alpha}$ $+(1 - 2a_0 + 2a_1 - \varphi_1 - \varphi_2)^{\alpha}$

Table A-6
Summary statistics

	Women with two children			Women with at least two children		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Number of children	1962	2.0	0.0	3748	2.8	1.0
Number of children expected	1955	2.5	1.5	3733	2.6	1.5
Number of children desired	1946	2.2	1.3	3707	2.2	1.5
Age in 1979	1962	17.9	2.3	3748	17.9	2.3
Age began first marriage	1770	22.3	4.7	3355	21.8	4.8
Age at first birth	1961	23.4	5.1	3747	22.0	4.9
Age at second birth	1960	27.7	5.4	3746	25.8	5.4
Age at third birth	-	-	-	1786	27.7	5.2
Months between first marriage and first birth	1769	40.6	43.0	3354	39.4	46.1
Months between first and second birth	1692	47.9	32.1	3426	43.5	31.0
Months between second and third birth	-	-	-	1558	42.2	29.3
First child is male	1957	49.8%	0.5	3740	50.3%	0.5
Second child is male	1960	50.9%	0.5	3742	51.6%	0.5
First two children same gender	1955	55.3%	0.5	3734	51.3%	0.5
Ever married	1962	92.4%	0.3	3748	91.8%	0.3
Marriage before first birth	1769	82.1%	0.4	3354	75.1%	0.4
Second birth after second marriage	1962	10.3%	0.3	3748	8.7%	0.3
Years of schooling	1962	13.2	2.4	3748	12.9	2.5
Catholic	1962	33.3%	0.5	3748	33.1%	0.5

Table A-7
Spacing by participation status during different stages of the childbearing period, 1 period worked

At least one period worked			Prediction on spacing		All women at least two children, no twins		All women with two children, no twins	
P_0	P_1	P_2	Based on H1	Based on H2	%	Spacing (mean)	%	Spacing (mean)
0	0	0	-	-	15.1%	37.50391	19.0%	32.83589
0	0	1	-	Less	5.8%	30.32653	7.0%	26.97925
0	1	0	More	-	9.9%	55.28743	11.3%	51.69948
0	1	1	More	-	14.4%	64.46721	14.3%	58.38037
1	0	0	-	-	6.3%	28.75701	6.1%	27.55024
1	0	1	-	Less	5.6%	32.44681	5.9%	28.14428
1	1	0	More	-	8.9%	50.19205	8.2%	48.24286
1	1	1	More	-	34.0%	51.91478	28.3%	49.24587

P_0: Before first birth

P_1: Childbirth interval

P_2: After second birth

Table A-8

Spacing by participation status during different stages of the childbearing period, 5 periods worked

At least five periods worked			Prediction on spacing		All women at least two children, no twins		All women with two children, no twins	
P_0	P_1	P_2	Based on H1	Based on H2	%	Spacing (mean)	%	Spacing (mean)
0	0	0	-	-	26.0%	36.94091	31.6%	33.10517
0	0	1	-	Less	6.6%	32.58929	7.7%	28.32197
0	1	0	More	-	15.7%	58.46617	16.3%	56.25448
0	1	1	More	-	16.4%	63.94604	15.0%	58.63883
1	0	0	-	-	5.0%	29.89412	4.8%	28.27273
1	0	1	-	Less	2.8%	29.70833	2.9%	27.37374
1	1	0	More	-	8.1%	50.83212	6.4%	49.41096
1	1	1	More	-	19.3%	51.92945	15.2%	49.54023

P_0: Before first birth

P_1: Childbirth interval

P_2: After second birth

Table A-9

Instruments for past, current and future participation, zero hours worked

		Variable	Name	Obs	Mean	Std. Dev.	Median	Min	Max
Zero hrs worked	Before first birth	State	v3_0_0	5004	25.20	14.44	25.31	1	50
		Federal income tax liability	v4_0_0	5004	627.8	2,167.2	0.0	-165.2	64,343.1
		State income tax liability	v5_0_0	5004	114.4	463.0	0.0	-667.7	14,792.9
		FICA (OADSI and HI, employee and employer)	v6_0_0	5004	626.0	1,121.5	0.0	0.0	9,905.5
		Effective federal marginal rate	v7_0_0	5004	2.31	5.52	0.00	-3.55	47.08
		Effective state marginal rate	v8_0_0	5004	0.66	1.33	0.00	-1.02	11.00
		FICA rate	v9_0_0	5004	13.55	0.90	13.48	12.26	14.70
	During childbirth interval	State	v3_0_1	4503	25.22	14.96	26.00	1	51
		Federal income tax liability	v4_0_1	4503	2,039.2	5,644.2	374.0	-335.4	153,858.1
		State income tax liability	v5_0_1	4503	415.1	1,196.9	0.0	-831.1	21,155.9
		FICA (OADSI and HI, employee and employer)	v6_0_1	4503	2,018.4	2,637.1	1,059.7	0.0	23,719.5
		Effective federal marginal rate	v7_0_1	4503	7.91	9.71	6.45	-7.65	49.00
		Effective state marginal rate	v8_0_1	4503	1.69	2.36	0.00	-2.26	15.00
		FICA rate	v9_0_1	4503	14.20	1.00	14.43	12.26	15.30
	After second birth	State	v3_0_2	3738	24.93	14.89	25.00	1	50
		Federal income tax liability	v4_0_2	3738	3,386.0	7,886.6	1,034.1	-324.0	139,412.3
		State income tax liability	v5_0_2	3738	762.9	1,698.5	130.9	-962.9	21,155.9
		FICA (OADSI and HI, employee and employer)	v6_0_2	3738	3,369.2	3,546.0	2,435.1	0.0	25,114.7
		Effective federal marginal rate	v7_0_2	3738	7.61	10.11	7.98	-7.65	36.28
		Effective state marginal rate	v8_0_2	3738	2.11	2.33	1.36	-1.82	10.18
		FICA rate	v9_0_2	3738	15.11	0.20	15.18	14.70	15.30

Table A-10
Instruments for past, current and future participation, twenty hours worked

Variable				Obs	Mean	Std. Dev.	Median	Min	Max
20 hrs worked	Before first birth	State	v3_20_0	5004	25.20	14.44	25.31	1	50
		Federal income tax liability	v4_20_0	5004	1,952.5	3,684.2	799.4	-165.2	72,043.3
		State income tax liability	v5_20_0	5004	367.7	784.2	89.4	-667.7	16,033.3
		FICA (OADSI and HI, employee and employer)	v6_20_0	5004	1,732.4	1,876.7	1,120.1	0.0	15,518.7
		Effective federal marginal rate	v7_20_0	5004	11.32	8.74	12.02	-3.55	50.00
		Effective state marginal rate	v8_20_0	5004	2.11	2.17	1.64	-1.02	15.00
		FICA rate	v9_20_0	5004	13.40	1.08	13.38	0.00	14.70
	During childbirth interval	State	v3_20_1	4503	25.22	14.96	26.00	1	51
		Federal income tax liability	v4_20_1	4503	4,279.9	9,142.1	1,622.9	-212.9	184,740.7
		State income tax liability	v5_20_1	4503	836.5	1,946.0	188.1	-795.7	40,483.9
		FICA (OADSI and HI, employee and employer)	v6_20_1	4503	3,495.7	3,891.8	2,226.0	0.0	34,759.7
		Effective federal marginal rate	v7_20_1	4503	14.16	10.21	15.00	-7.65	49.00
		Effective state marginal rate	v8_20_1	4503	2.70	2.71	2.33	-2.06	51.68
		FICA rate	v9_20_1	4503	13.95	1.55	14.20	0.00	15.30
	After second birth	State	v3_20_2	3738	24.93	14.89	25.00	1	50
		Federal income tax liability	v4_20_2	3738	6,578.7	13,140.0	2,780.2	-221.0	305,519.4
		State income tax liability	v5_20_2	3738	1,387.2	2,483.9	539.3	-879.7	30,614.0
		FICA (OADSI and HI, employee and employer)	v6_20_2	3738	5,365.7	4,783.4	4,165.0	0.0	38,346.4
		Effective federal marginal rate	v7_20_2	3738	13.46	9.85	14.60	-7.65	37.91
		Effective state marginal rate	v8_20_2	3738	3.02	2.49	2.93	-1.60	9.60
		FICA rate	v9_20_2	3738	14.87	0.96	15.13	2.32	15.30

Table A-11
Instruments for past, current and future participation, forty hours worked

		Variable		Obs	Mean	Std. Dev.	Median	Min	Max
40 hrs worked	Before first birth	State	v3_40_0	5004	25.20	14.44	25.31	1	50
		Federal income tax liability	v4_40_0	5004	1,952.5	3,684.2	799.4	-165.2	72,043.3
		State income tax liability	v5_40_0	5004	367.7	784.2	89.4	-667.7	16,033.3
		FICA (OADSI and HI, employee and employer)	v6_40_0	5004	1,732.4	1,876.7	1,120.1	0.0	15,518.7
		Effective federal marginal rate	v7_40_0	5004	11.32	8.74	12.03	-3.55	50.00
		Effective state marginal rate	v8_40_0	5004	2.11	2.17	1.64	-1.02	15.00
		FICA rate	v9_40_0	5004	13.40	1.08	13.38	0.00	14.70
	During childbirth interval	State	v3_40_1	4503	25.22	14.96	26.00	1	51
		Federal income tax liability	v4_40_1	4503	4,279.9	9,142.1	1,622.9	-212.9	184,740.7
		State income tax liability	v5_40_1	4503	836.5	1,946.0	188.1	-795.7	40,483.9
		FICA (OADSI and HI, employee and employer)	v6_40_1	4503	3,495.7	3,891.8	2,226.0	0.0	34,759.7
		Effective federal marginal rate	v7_40_1	4503	14.16	10.21	15.00	-7.65	49.00
		Effective state marginal rate	v8_40_1	4503	2.70	2.71	2.33	-2.06	51.68
		FICA rate	v9_40_1	4503	13.95	1.55	14.20	0.00	15.30
	After second birth	State	v3_40_2	3738	24.93	14.89	25.00	1	50
		Federal income tax liability	v4_40_2	3738	6,578.7	13,140.0	2,780.2	-221.0	305,519.4
		State income tax liability	v5_40_2	3738	1,387.2	2,483.9	539.3	-879.7	30,614.0
		FICA (OADSI and HI, employee and employer)	v6_40_2	3738	5,365.7	4,783.4	4,165.0	0.0	38,346.4
		Effective federal marginal rate	v7_40_2	3738	13.46	9.85	14.60	-7.65	37.91
		Effective state marginal rate	v8_40_2	3738	3.02	2.49	2.93	-1.60	9.60
		FICA rate	v9_40_2	3738	14.87	0.96	15.13	2.32	15.30

Table A-12
First stage, participation before first birth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Participation before childbearing							
v3_0_0	0.00	0.01	0.01		0.00	0.01	0.01	
	(0.15)	(1.05)	(1.08)		(0.68)	(1.29)	(1.33)	
v4_0_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(1.16)	(1.62)	(1.56)	(1.60)	(0.81)	(1.57)	(1.47)	(1.61)
v5_0_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.0)	(1.11)	(0.79)	(0.93)	(0.01)	(1.11)	(0.90)	(1.20)
v6_0_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(4.08)**	(2.76)**	(2.87)**	(2.89)**	(2.83)**	(2.67)**	(2.65)**	(2.86)**
v7_0_0	0.07	0.09	0.08	0.06	0.10	0.09	0.08	0.08
	(1.94)	(2.06)*	(1.87)	(1.60)	(2.16)*	(2.07)*	(1.88)	(2.02)*
v8_0_0	0.00	-0.03	-0.03	0.00	-0.08	-0.04	-0.05	-0.06
	(0.0)	(-0.35)	(-0.28)	(0.03)	(-0.77)	(-0.47)	(-0.54)	(-0.71)
v9_0_0	0.13	0.35	0.41	0.28	0.05	0.39	0.39	0.28
	(0.40)	(0.93)	(1.11)	(0.87)	(0.12)	(1.04)	(1.05)	(0.77)
v4_20_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(1.76)	(2.26)*	(2.20)*	(2.52)*	(1.97)*	(2.23)*	(2.11)*	(2.30)*
v5_20_0	0.00	0.00			0.00	0.00	0.00	0.00
	(0.29)	(1.35)			(0.33)	(1.33)	(0.98)	(1.30)
v6_20_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(4.33)**	(2.99)**	(3.09)**	(3.54)**	(3.27)**	(2.95)**	(2.96)**	(3.08)**
v7_20_0	0.00	-0.01	-0.02	0.01	-0.03	-0.02	-0.02	-0.01
	(0.14)	(-0.5)	(-0.57)	(0.23)	(-1.01)	(-0.58)	(-0.61)	(-0.34)
v8_20_0	0.00	-0.08	-0.04	-0.06	-0.02	-0.08	-0.03	-0.05
	(0.05)	(-1.29)	(-0.59)	(-1.09)	(-0.25)	(-1.25)	(-0.55)	(-0.74)
v9_20_0	0.03	-0.27	-0.24	-0.13	-0.03	-0.26	-0.23	-0.13
	(0.20)	(-1.2)	(-1.13)	(-0.73)	(-0.16)	(-1.15)	(-1.06)	(-0.67)
v5_40_0			0.00	0.00				
			(0.96)	(1.14)				
v3_20_0				0.00				0.01
				(0.77)				(1.25)
Constant	-9.35	-9.65	-9.52	-11.47	-15.87	-11.32	-9.42	-12.20
	(-2.95)**	(-2.39)*	(-2.39)*	(-3.42)**	(-1.68)	(-1.34)	(-1.13)	(-1.53)
Observations	1186.00	885.00	909.00	1164.00	744.00	885.00	895.00	970.00

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%
Note: All specifications control for some husband's income measure: (1) and (5) use permanent income from wages, (2) and (6) income from wages around the births, (3) and (7) total income around the births, (4) and (8) income in childbirth interval and after second birth. Specifications (1)-(4) controls for number of children ever born, (5)-(8) for predicted number using mixed sibling-sex composition.

Table A-13
First stage, participation during childbirth interval (current participation)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Participation during childbirth interval (current participation)							
v8_0_0	-0.124	-0.133	-0.117	-0.099	-0.131	-0.136	-0.123	-0.133
	(-1.13)	(-1.13)	(-1.01)	(-0.96)	(-1.02)	(-1.17)	(-1.07)	(-1.22)
v9_0_0	-2.015	-1.599	-1.602	-1.784	-2.095	-1.861	-1.758	-1.638
	(-3.83)**	(-2.59)**	(-2.63)**	(-3.35)**	(-3.04)**	(-3.03)**	(-2.89)**	(-2.85)**
v4_20_0	0	0	0	0	0	0	0	0
	(0.33)	(0.62)	(0.67)	(0.66)	(0.53)	(0.52)	(0.50)	(0.76)
v6_20_0	0	0	0	0	0	0	0	0
	(0.12)	(0.30)	(0.41)	(0.51)	(0.41)	(0.27)	(0.21)	(0.29)
v9_20_0	-0.397	-0.522	-0.527		-0.462	-0.497	-0.505	-0.569
	(-1.71)	(2.59)**	(2.59)**		(-1.87)	(2.46)*	(2.49)*	(2.76)**
unemp1	-0.087	-0.174	-0.157	-0.132	-0.151	-0.173	-0.162	-0.208
	(-0.8)	(-1.57)	(-1.42)	(-1.36)	(-1.19)	(-1.57)	(-1.47)	(1.99)*
v4_0_1	0	0	0	0	0	0	0	0
	(1.58)	(1.45)	(1.68)	(1.59)	(1.68)	(1.42)	(1.56)	(1.68)
v5_0_1	0	0	0	0	0	0	0	0
	(0.28)	(0.29)	(0.44)	(0.52)	(0.44)	(0.32)	(0.36)	(0.62)
v6_0_1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-4.44)**	(-4.15)**	(-4.30)**	(-4.43)**	(-4.14)**	(-4.04)**	(-4.03)**	(-4.01)**
v7_0_1	-0.061	-0.062	-0.055	-0.05	-0.049	-0.069	-0.065	-0.044
	(-2.19)*	(-1.92)	(-1.76)	(-1.79)	(-1.53)	(-2.17)*	(-2.09)*	(-1.49)
v8_0_1	-0.209	-0.279	-0.257	-0.247	-0.21	-0.277	-0.255	-0.247
	(-2.39)*	(-2.90)**	(-2.72)**	(-2.98)**	(-2.18)*	(-2.89)**	(-2.69)**	(-2.82)**
v9_0_1	2.025	1.889	1.911	1.996	1.976	2.073	2.014	1.964
	(6.11)**	(4.90)**	(4.97)**	(5.81)**	(4.82)**	(5.45)**	(5.31)**	(5.34)**
v4_20_1	0	0	0	0	0	0	0	0
	(2.35)*	(1.61)	(1.61)	(1.74)	(1.98)*	(1.64)	(1.67)	(1.78)
v5_20_1	0	0	0	0	0	0	0	0
	(1.45)	(1.06)	(1.02)	(1.19)	(1.44)	(1.17)	(1.15)	(1.33)
v6_20_1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0
	(4.79)**	(3.65)**	(3.63)**	(3.83)**	(3.71)**	(3.62)**	(3.66)**	(3.65)**
v7_20_1	0.041	0.055	0.053	0.074	0.033	0.057	0.057	0.059
	(1.79)	(1.91)	(1.88)	(2.96)**	(1.08)	(1.95)	(1.98)*	(2.15)*
v8_20_1	0.194	0.238	0.237	0.228	0.173	0.225	0.219	0.224
	(2.39)*	(2.66)**	(2.71)**	(2.92)**	(1.90)	(2.53)*	(2.47)*	(2.72)**
v9_20_1	0.333	0.259	0.264	0.288	0.3	0.267	0.269	0.292
	(3.89)**	(3.14)**	(3.15)**	(3.58)**	(3.37)**	(3.09)**	(3.05)**	(3.56)**
Constant	8.842	7.074	6.099	5.524	-2.717	7.425	6.673	3.317
	(2.09)*	(1.25)	(1.11)	(1.12)	(-0.24)	(0.72)	(0.65)	(0.34)
Observation	1120	849	873	1145	714	849	859	952

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%
Note: All specifications control for some husband's income measure: (1) and (5) use permanent income from wages, (2) and (6) income from wages around the births, (3) and (7) total income around the births, (4) and (8) income in childbirth interval and after second birth. Specifications (1)-(4) controls for number of children ever born, (5)-(8) for predicted number using mixed sibling-sex composition.

Table A-14
First stage, participation after the second birth (future participation)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Participation after the second birth (future participation)							
unemp0	0.326	0.331	0.347	0.266	0.434	0.342	0.363	0.315
	(2.07)*	(2.05)*	(2.19)*	(1.97)*	(2.33)*	(2.11)*	(2.26)*	(2.08)*
v3_0_0	-0.014		-0.027	-0.009	-0.012		-0.029	-0.019
	(-0.98)		(-1.85)	(-0.71)	(-0.72)		(-1.98)*	(-1.43)
v4_0_0	0	0.001	0.001	0	0	0.001	0.001	0.001
	(1.41)	(1.98)*	(1.97)*	(1.68)	(1.53)	(2.01)*	(1.97)*	(1.94)
v6_0_0	0	-0.002	-0.002	-0.001	-0.001	-0.002	-0.002	-0.002
	(0.73)	(-2.11)*	(-2.41)*	(-2.24)*	(-1.34)	(-2.12)*	(-2.33)*	(-2.24)*
v8_0_0	-0.218	-0.091	-0.116	-0.178	-0.318	-0.092	-0.107	-0.199
	(-1.81)	(-0.78)	(-1.04)	(-1.75)	(-2.36)*	(-0.79)	(-0.96)	(-1.9)
v6_20_0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(1.82)	(1.85)	(2.03)*	(2.69)**	(1.84)	(1.80)	(1.90)	(2.25)*
v9_20_0	-0.542	-0.374	-0.298		-0.436	-0.382	-0.387	-0.338
	(-1.99)*	(-1.49)	(-1.33)		(-1.42)	(-1.56)	(-1.61)	(-1.47)
unemp1	-0.244	-0.285	-0.305	-0.278	-0.319	-0.301	-0.324	-0.356
	(-1.97)*	(-2.12)*	(-2.29)*	(-2.48)*	(-2.12)*	(-2.21)*	(-2.39)*	(-2.82)**
v4_0_1	0	0	0	0	0	0	0	0
	(1.80)	(2.13)*	(2.18)*	(1.81)	(1.91)	(2.05)*	(1.87)	(1.59)
v9_0_1	0.98	0.611	0.617	0.63	1.117	0.572	0.571	0.379
	(1.99)*	(1.16)	(1.19)	(1.42)	(1.88)	(1.08)	(1.09)	(0.78)
v7_20_1	0.052	0.012	0		0.038	0.011	0.001	0.006
	(2.10)*	(0.40)	0		(1.13)	(0.35)	(0.02)	(0.21)
v8_20_1	0.09	0.211		0.188	0.062	0.21	0.208	0.134
	(1.02)	(1.87)		(2.11)*	(0.54)	(1.85)	(1.85)	(1.29)
v6_0_2	0	0	0	0	0	0	0	0
	(2.26)*	(2.54)*	(2.69)**	(2.94)**	-1.81	(2.53)*	(2.62)**	(2.57)*
v7_0_2	-0.107	-0.054	-0.053	-0.052	-0.094	-0.056	-0.052	-0.06
	(-2.52)*	(-1.44)	(-1.42)	(-1.65)	(-1.8)	(-1.48)	(-1.4)	(-1.74)
v6_20_2	0	0	0	0	0	0	0	0
	(2.70)**	(2.58)**	(2.56)*	(3.66)**	-1.9	(2.65)**	(2.74)**	(2.86)**
v7_20_2	0.147	0.098	0.111	0.054	0.129	0.098	0.1	0.084
	(3.30)**	(2.44)*	(2.80)**	(1.55)	(2.41)*	(2.43)*	(2.50)*	(2.20)*
v9_40_2	0.313							
	(2.85)**							
v9_20_2		0.301	0.294	0.307	0.372	0.309	0.306	0.353
		(2.67)**	(2.78)**	(3.43)**	(2.92)**	(2.72)**	(2.87)**	(3.64)**
v8_40_1			0.229					
			(2.07)*					
Constant	12.752	-17.259	-14.895	3.627	9.678	-6.334	-5.889	-0.271
	(0.46)	(-0.56)	(-0.49)	(0.14)	(0.28)	(-0.2)	(-0.19)	(-0.01)
Obs.	913	831	855	1118	693	831	841	932

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%

Note: All specifications control for some husband's income measure: (1) and (5) use permanent income from wages, (2) and (6) income from wages around the births, (3) and (7) total income around the births, (4) and (8) income in childbirth interval and after second birth. Specifications (1)-(4) controls for number of children ever born, (5)-(8) for predicted number using mixed sibling-sex composition.

Table A-15
Second stage, current and future participation on fertility spacing

			Current Participation	Future Participation
			(Number of months)	
OLS			15.35 (8.94)**	0.52 (0.33)
IV	Marginal Tax Schedule and unemployment rate	Controlling for husband's permanent income	49.154 (9.62)**	-13.12 (-2.53)*
		Controlling for husband's transitory income	54.681 (10.85)**	-13.582 (-2.68)**
	Marginal Tax Schedule, unemployment rate, and Mixed Sex Composition	Controlling for husband's permanent income	53.055 (10.38)**	-13.144 (-2.51)**
		Controlling for husband's transitory income	57.773 (11.47)**	-13.77 (-2.69)**

Table A-16
Second stage, current and conditional future participation on fertility spacing

First Stage's controls		Current Participation	Future Participation given no current participation
		(Number of months)	
Number of children ever born	Husband's income from wages around the time of the birth	33.217 (7.50)**	-22.091 (-4.14)**
	Husband's income from wages during and after childbirth interval	35.818 (8.57)**	-23.679 (-4.56)**
IV for number of children ever born	Husband's income from wages around the time of the birth	34.183 (7.84)**	-22.868 (-4.30)**
	Husband's income from wages during and after childbirth interval	39.398 (9.47)**	-23.817 (-4.65)**

Table A-17
Heterogeneity in effects of labor market participation on fertility spacing

	(1)	(2)	(3)	(4)	(5)
	Number of months between the first and the second birth				
Current Participation	50.2	59.57	69.51	62.97	37.21
	(10.92)**	(9.10)**	(9.29)**	(10.56)**	(2.07)*
Future Participation	-12.9	-32.2	-26.99	-20.22	6.19
	(-2.60)	(-4.47)	(-3.33)**	(-3.21)**	(0.36)
Current Participation x Schooling (>12 years)		-16.16			
		(-1.92)			
Future Participation x Schooling (>12 years)		31.4			
		(3.65)**			
Current Participation x Husband's income (>median)			-29.05		
			(-3.20)**		
Future Participation x Husband's income (>median)			19.8		
			(2.12)*		
Current Participation x More than two children				-29.92	
				(-3.68)**	
Future Participation x More than two children				13.89	
				(1.68)	
Current Participation x Age at first birth (<=20)					38.3
					(1.94)
Future Participation x Age at first birth (<=20)					-35.98
					(-1.81)
Current Participation x Age at first birth (21-25)					16.04
					(0.83)
Future Participation x Age at first birth (21-25)					-20.13
					(-1.08)
Current Participation x Age at first birth (26-30)					-5.68
					(-0.29)
Future Participation x Age at first birth (26-30)					-8.77
					(-0.47)

Table A-18

Robustness. current and future participation on spacing, IV for number of children (mixed sibling-sex somposition)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	months12birth							
Past experience (before first birth)	-28.548	-13.126	-16.006	-11.138	-39.071	-33.832	-36.958	-37.882
	(-3.42)**	(-1.63)	(-2.03)*	(-1.58)	(-4.03)**	(-3.84)**	(-4.11)**	(-4.60)**
Current participation (during childbirth interval)	56.769	49.56	53.159	62.198	57.773	50.2	52.327	58.934
	(12.14)**	(10.48)**	(11.24)**	(13.36)**	(11.47)**	(10.92)**	(11.28)**	(13.01)**
Future Participation (after second birth)	-18.747	-14.193	-16.381	-30.234	-13.77	-12.902	-13.039	-16.814
	(-3.57)**	(-2.81)**	(-3.23)**	(-5.45)**	(-2.69)**	(-2.60)**	(-2.62)**	(-3.36)**
Age began first marriage	-0.796	-2	-2.444	-2.374	-2.019	-1.813	-2.051	-1.943
	(-0.43)	(-1.13)	(-1.4)	(-1.46)	(-1.03)	(-1.03)	(-1.17)	(-1.18)
Age at first birth	8.999	1.752	2.508	2.644	7.456	2.844	2.867	0.53
	(1.74)	(0.35)	(0.51)	(0.58)	(1.43)	(0.57)	(0.59)	(0.12)
Age2	-0.155	-0.026	-0.031	-0.025	-0.106	-0.049	-0.046	-0.002
	(-1.98)*	(-0.34)	(-0.41)	(-0.35)	(-1.3)	(-0.64)	(-0.61)	(-0.03)
Months between first marriage and first birth	-0.058	-0.154	-0.189	-0.22	-0.112	-0.122	-0.142	-0.144
	(-0.37)	(-1.04)	(-1.3)	(-1.62)	(-0.67)	(-0.83)	(-0.97)	(-1.04)
Number children ever born (predicted)	26.616	4.768	4.988	7.135	19.469	-4.62	-6.715	-8.262
	(1.94)	(0.35)	(0.37)	(0.57)	(1.41)	(-0.34)	(-0.5)	(-0.67)
Second birth after second marriage	24.413	16.999	16.629	15.88	25.036	17.532	17.401	16.723
	(7.52)**	(5.75)**	(5.68)**	(5.75)**	(7.04)**	(5.93)**	(5.92)**	(5.97)**
Marriage before first birth	8.661	-2.566	-3.737	-3.256	-3.83	-4.754	-5.669	-7.832
	(1.04)	(-0.33)	(-0.49)	(-0.55)	(-0.45)	(-0.62)	(-0.74)	(-1.32)
Years of Schooling	-0.05	-0.555	-0.573	-0.711	-0.038	-0.33	-0.376	-0.557
	(-0.13)	(-1.42)	(-1.49)	(-2.02)*	(-0.1)	(-0.84)	(-0.97)	(-1.57)
ln(husband's income around first birth)	8.104	8.681	9.191	6.326	10.182	8.935	9.324	7.658
	(4.74)**	(5.14)**	(5.53)**	(4.47)**	(5.90)**	(5.31)**	(5.60)**	(5.45)**
ln(husband's income around second birth)	-3.362	-0.963	-1.319	1.098	-4.865	-1.167	-1.386	2.816
	(-1.75)	(-0.55)	(-0.77)	(0.81)	(-2.50)*	(-0.67)	(-0.81)	(2.04)*
Constant	-154.556	-23.238	-27.772	-34.158	-98.609	-20.061	-14.434	-11.136
	(-1.9)	(-0.3)	(-0.36)	(-0.47)	(-1.18)	(-0.25)	(-0.19)	(-0.15)
Observations	599	736	745	821	599	736	745	821
	Number of children ever born				IV for number of children ever born			
First stage	Husband's income from wages	Husband's income from wages about the time of the first birth	Husband's total income about the time of the first birth	Husband's income from wages during childbirth interval	Husband's income from wages	Husband's income from wages about the time of the first birth	Husband's total income about the time of the first birth	Husband's income from wages during childbirth interval
		Husband's income from wages about the time of the second birth	Husband's total income about the time of the second birth	Husband's income from wages after the second birth		Husband's income from wages about the time of the second birth	Husband's total income about the time of the second birth	Husband's income from wages after the second birth

Absolute value of z statistics in parentheses

* significant at 5%; ** significant at 1%

APPENDIX B

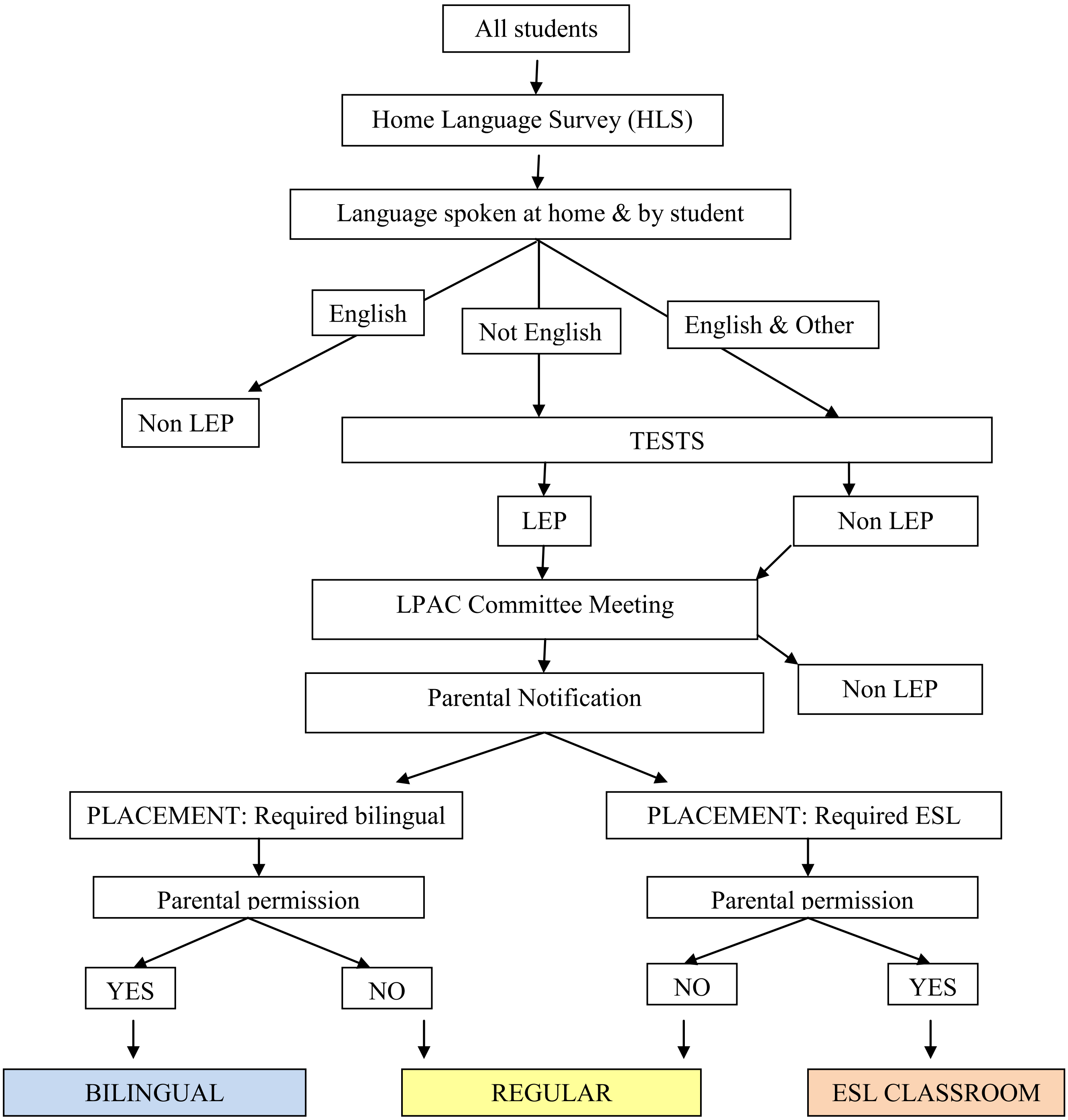


Fig. 1. ELL decision chart

Table B-1
Samples of cohorts of Texas elementary school students

	Language version of the test				Number of
	grade 3	grade 4	grade 5	grade 6	observations
Reading					
EEEE read	English	English	English	English	2,526,288
SSSE read	Spanish	Spanish	Spanish	English	45,807
Mathematics					
EEEE math	English	English	English	English	2,574,255
SSSE math	Spanish	Spanish	Spanish	English	31,884

Table B-2
Summary statistics for the students who took English version of the tests

	Model with reading gains as the dependent variable		Model with reading gains as the dependent variable	
Number of observations	2,526,288		2,574,255	
	Mean	Std. Dev.	Mean	Std. Dev.
Raw score	34.72	5.36	36.08	6.60
Scale score	2304	189	2313	216
Meet standard	91.7%	27.7%	87.1%	33.5%
Prior year score	2281	171	2294	198
Migrant status	0.9%	9.6%	0.9%	9.7%
Economically disadvantaged	42.5%	49.4%	42.7%	49.5%
Hispanic	40.7%	49.1%	40.9%	49.2%
ELL	4.2%	20.2%	4.6%	21.1%
Bilingual program	1.6%	12.4%	1.8%	13.3%
ESL program	2.3%	14.9%	2.4%	15.3%

Table B-3
Summary statistics for the students who took Spanish version of the tests in grades 3-5

	Model with reading gains as the dependent variable		Model with reading gains as the dependent variable	
Number of observations	45,807		31,884	
	Mean	Std. Dev.	Mean	Std. Dev.
Raw score	29.53	6.46	30.30	7.73
Scale score	2179	177	2154	211
Meet standard	76.5%	42.4%	62.6%	48.4%
Prior year score	2192	172	2143	195
Migrant status	4.2%	20.1%	4.2%	20.0%
Economically disadvantaged	71.0%	45.4%	72.2%	44.8%
Hispanic	99.8%	4.4%	99.8%	4.9%
ELL	98.3%	12.9%	97.9%	14.5%
Bilingual program	74.7%	43.5%	75.9%	42.8%
ESL program	22.9%	42.0%	21.5%	41.1%

Table B-4
Cohorts of Texas elementary school students, reading sample, students who took English version of the test

	Grades			
Year	4	5	6	Observations
2004	201,969	-	-	201,969
2005	205,445	201,969	-	407,414
2006	209,965	205,445	201,969	617,379
2007	224,717	209,965	205,445	640,127
2008	-	224,717	209,965	434,682
2009	-	-	224,717	224,717
	842,096	842,096	842,096	2,526,288

Table B-5
Distribution of ELL students in Texas by classroom type and grade level, reading sample, students who took English version of the test

	Grade		
	4	5	6
ELL	51,534	33,258	22,384
Classroom		(%)	
Regular	12.3%	12.0%	11.5%
Bilingual	42.3%	43.7%	7.5%
ESL	45.4%	44.3%	81.0%

Table B-6
Distribution of ELL students in Texas by classroom type and grade level, reading sample, students who took Spanish version of the test in grades 3-5

	Grade		
	4	5	6
ELL	51,534	33,258	22,384
Classroom		(%)	
Regular	12.3%	12.0%	11.5%
Bilingual	42.3%	43.7%	7.5%
ESL	45.4%	44.3%	81.0%

Table B-7
Number of observations of each path

	period t-1			period t			Number of observations			
Path	lell	lbil	lesl	ell	bil	esl	EEEE read	EEEE math	SSSE read	SSSE math
1	1	1	0	0	0	0	47,770	49,380	479	386
2	1	1	0	0	0	1	61	70	45	31
3	1	1	0	0	1	0	637	680	127	85
4	1	0	1	0	0	0	45,681	46,379	10	11
5	1	0	1	0	0	1	499	535	-	-
6	1	0	1	0	1	0	31	32	-	-
7	1	0	0	0	0	0	16,629	16,864	8	3
8	1	0	0	0	0	1	34	34	-	-
9	1	0	0	0	1	0	12	12	3	2
10	1	1	0	1	0	0	998	1,180	488	302
11	1	1	0	1	0	1	10,256	12,222	10,136	6,625
12	1	1	0	1	1	0	35,203	41,588	33,591	23,732
13	1	0	1	1	0	0	1,217	1,351	-	-
14	1	0	1	1	0	1	40,965	43,692	228	128
15	1	0	1	1	1	0	628	665	34	27
16	1	0	0	1	0	0	8,795	9,407	6	1
17	1	0	0	1	0	1	793	878	27	15
18	1	0	0	1	1	0	197	237	141	93
19	0	1	0	0	0	0	1,059	1,086	8	15
20	0	1	0	0	0	1	1	1	1	-
21	0	1	0	0	1	0	482	476	12	-
22	0	0	1	0	0	0	805	863	-	-
23	0	0	1	0	0	1	38	39	-	-
24	0	0	1	0	1	0	2	2	-	-
25	0	0	0	0	0	0	2,304,768	2,337,509	79	133
26	0	0	0	0	0	1	286	306	-	-
27	0	0	0	0	1	0	317	309	3	15
28	0	1	0	1	0	0	10	15	1	1
29	0	1	0	1	0	1	46	60	46	28
30	0	1	0	1	1	0	112	141	139	116
31	0	0	1	1	0	0	27	29	-	-
32	0	0	1	1	0	1	265	306	2	2
33	0	0	1	1	1	0	8	9	1	-
34	0	0	0	1	0	0	1,881	1,969	5	3
35	0	0	0	1	0	1	3,912	4,006	21	13
36	0	0	0	1	1	0	1,863	1,923	166	117
							2,526,288	2,574,255	45,807	31,884

Notes: ell (English language learner), bil (Bilingual program), esl (English as a second language program).

Table B-8
Effect of paths on standardized gains for students who took English version of the test

	period t-1			period t			Reading		Mathematics	
Path	lell	lbil	lesl	ell	bil	esl	grades 4 & 5	grade 6	grades 4 & 5	grade 6
1	1	1	0	0	0	0	0.015	0.314 **	-0.051 **	-0.084
2	1	1	0	0	0	1	-0.274	-0.461 **	-0.148	-0.066
3	1	1	0	0	1	0	0.035	0.082	0.017	0.004
4	1	0	1	0	0	0	0.001	0.271 **	-0.038 **	0.084 *
5	1	0	1	0	0	1	0.009	1.105 **	-0.091	-0.880 *
6	1	0	1	0	1	0	0.429	N.A.	0.669	N.A.
7	1	0	0	0	0	0	0.041 *	0.259 **	-0.032 *	0.088
8	1	0	0	0	0	1	-0.618 *	0.270 **	0.258	0.510 **
9	1	0	0	0	1	0	0.382	N.A.	-0.821 **	N.A.
10	1	1	0	1	0	0	0.254 **	0.337	-0.083	-0.313
11	1	1	0	1	0	1	0.241 **	0.521 **	-0.095 **	0.091
12	1	1	0	1	1	0	0.408 **	0.622 **	0.000	0.208 **
13	1	0	1	1	0	0	0.164 **	0.024	-0.037	-0.028
14	1	0	1	1	0	1	0.328 **	0.478 **	0.014	0.156 **
15	1	0	1	1	1	0	0.318 **	0.464 **	0.000	0.183
16	1	0	0	1	0	0	0.267 **	0.341 **	0.011	0.087
17	1	0	0	1	0	1	0.377 **	0.309	0.121	0.069
18	1	0	0	1	1	0	0.178	-0.275	0.002	-0.285
19	0	1	0	0	0	0	-0.025	0.046	-0.195 **	0.427 *
20	0	1	0	0	0	1	N.A.	N.A.	N.A.	N.A.
21	0	1	0	0	1	0	0.186	0.576 *	-0.256	-0.297
22	0	0	1	0	0	0	-0.020	0.284	-0.088	0.174
23	0	0	1	0	0	1	0.426	N.A.	0.211	N.A.
24	0	0	1	0	1	0	0.800 **	N.A. **	0.881 **	N.A.
25	0	0	0	0	0	0	Reference group			
26	0	0	0	0	0	1	0.165	0.428	0.085	-0.138
27	0	0	0	0	1	0	-0.058	0.131	-0.029	0.077
28	0	1	0	1	0	0	0.381	N.A.	-0.294	N.A.
29	0	1	0	1	0	1	0.309	-1.270 **	-0.027	-2.429 **
30	0	1	0	1	1	0	0.106	0.035	0.131	0.627
31	0	0	1	1	0	0	-0.231	-1.534 **	0.083	1.770 **
32	0	0	1	1	0	1	0.211	0.611 **	0.127	0.178
33	0	0	1	1	1	0	0.426	N.A.	-0.009	N.A.
34	0	0	0	1	0	0	0.295 **	0.424 *	-0.007	0.348 **
35	0	0	0	1	0	1	0.462 **	0.402 **	0.084 *	0.114
36	0	0	0	1	1	0	0.600 **	0.565 **	0.150 **	0.365

Notes: ** Significant at 5%, * Significant at 10%

Table B-9
Estimates effects of language programs on reading and mathematics test score gains by ELL status

	paths	Reading grade 4& 5		Reading grade 6		Mathematics grade 4& 5		Mathematics grade 6	
Non-Exiters									
Bilingual effect	(12)-(16)	0.141	**	0.280	**	-0.011		0.121	
ESL effect	(14)-(16)	0.061		0.136		0.003		0.069	
Bilingual effect of one-period treatment	(10)-(16)	-0.013		-0.004		-0.094		-0.400	
ESL effect of one-period treatment	(13)-(16)	-0.103		-0.317		-0.048		-0.115	
Changing programs: Bilingual-to-ESL effect	(11)-(12)	-0.166	**	-0.101		-0.096	**	-0.116	
Changing programs: Bilingual-to-Regular effect	(10)-(12)	-0.154	**	-0.284		-0.084		-0.521	**
Changing programs: ESL-to-Bilingual effect	(15)-(14)	-0.009		-0.013		-0.014		0.027	
Changing programs: ESL-to-Regular effect	(13)-(14)	-0.164	**	-0.454		-0.051		-0.184	
Exiters									
Bilingual effect	(3)-(7)	-0.006		-0.177		0.049		-0.084	
ESL effect	(5)-(7)	-0.032		0.846	**	-0.059		-0.968	**
Bilingual effect of one-period treatment	(1)-(7)	-0.026		0.055		-0.019		-0.172	**
ESL effect of one-period treatment	(4)-(7)	-0.040	**	0.012		-0.006		-0.004	

Notes: All students in this sample took English version of the tests every period.

Table B-10
Effect of paths on standardized gains for students who took Spanish version of the test in grades 3-5

	period t-1			period t			Reading		Mathematics	
Path	lell	lbil	lesl	ell	bil	esl	grades 4 & 5	grade 6	grades 4 & 5	grade 6
1	1	1	0	0	0	0	0.157	0.550	-1.278	-1.858 **
2	1	1	0	0	0	1	-2.091 **	- **	-1.123 **	-
3	1	1	0	0	1	0	0.472	1.007 *	-1.087	-1.071
4	1	0	1	0	0	0	3.522 **	-	-1.066	-
5	1	0	1	0	0	1	-	-	-	-
6	1	0	1	0	1	0	-	-	-	-
7	1	0	0	0	0	0	-0.375	1.063	1.030	-
8	1	0	0	0	0	1	-	-	-	-
9	1	0	0	0	1	0	-0.146	-	-0.769	-
10	1	1	0	1	0	0	0.615	0.802 **	-1.096	-1.115
11	1	1	0	1	0	1	-0.322	0.297	-1.578 **	-1.640 **
12	1	1	0	1	1	0	0.363	0.332	-1.072	-1.209 **
13	1	0	1	1	0	0	-	-	-	-
14	1	0	1	1	0	1	0.189	0.005	-1.161	-1.818 **
15	1	0	1	1	1	0	0.348	1.199	-1.549 **	-
16	1	0	0	1	0	0	0.448	0.449	-	-
17	1	0	0	1	0	1	-	-	-2.038 **	-
18	1	0	0	1	1	0	0.534	-0.082	-1.181	-1.375
19	0	1	0	0	0	0	-0.616	-0.304	-1.511 **	-0.381
20	0	1	0	0	0	1	-	-	-	-
21	0	1	0	0	1	0	1.973 **	-	-	-
22	0	0	1	0	0	0	-	-	-	-
23	0	0	1	0	0	1	-	-	-	-
24	0	0	1	0	1	0	-	-	-	-
25	0	0	0	0	0	0	0.000	0.000	0.000	0.000
26	0	0	0	0	0	1	-	-	-	-
27	0	0	0	0	1	0	2.222 **	-3.449 **	0.459	-1.391 **
28	0	1	0	1	0	0	-	-	-	-
29	0	1	0	1	0	1	-	-	-	-
30	0	1	0	1	1	0	0.452	1.646	-0.556	-1.353
31	0	0	1	1	0	0	-	-	-	-
32	0	0	1	1	0	1	-1.896 **	-	-	-
33	0	0	1	1	1	0	-	-	-	-
34	0	0	0	1	0	0	-0.179	-	-0.811	-
35	0	0	0	1	0	1	0.063	0.868	2.677 **	-1.918 **
36	0	0	0	1	1	0	0.359	0.108	-0.807	-2.388 **

Notes: ** Significant at 5%, * Significant at 10%

Table B-11
Estimates effects of language programs on reading and mathematics test score gains by ELL status

	paths	Reading grade 4& 5	Reading grade 6	Mathematics grade 4& 5	Mathematics grade 6
Non-Exiters					
Changing programs: Bilingual-to-ESL effect	(11)-(12)	-0.685 **	-0.035	-0.505 **	-0.430 **
Changing programs: Bilingual-to-Regular effect	(10)-(12)	0.252	0.471 **	-0.024	0.095
Changing programs: ESL-to-Bilingual effect	(15)-(14)	0.160	1.194	-0.388	-
Changing programs: ESL-to-Regular effect	(13)-(14)	-	-	-	-

Notes: All students in this sample took Spanish version of the tests in grades 3,4, and 5.

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