Chapter Three

3. Fertility Timing

Introduction

During the last three decades, Venezuela experienced a dramatic fertility decline. Chapter one presents this decline in detail, and Chapter two estimates a model of total fertility and confirms the consistent decline for females entering a first union between 1967 and 1982. Since the 1960s, economic growth, industrialization, and educational expansion have transformed Venezuela from an agricultural based economy into a system more dependent on industrial production and service activities. Venezuela's development was closely associated with the expansion of an export-oriented economy based on oil production. The discovery of oil in the 1920s and the subsequent oil boom in the 1970s and early 1980s transformed Venezuela into one of the richest countries in Latin America. The large revenues from oil exports facilitated state expenditures on education and contributed to the development of service sector activities and the general modernization of the country. Venezuela's economic growth, however, was highly dependent on international oil prices, and the rapid growth of the 1970s was followed by a sharp decline in per capita income during the early 1980s (Bulmer-Thomas 1994).

While the second chapter explores total fertility after 14 years of marriage by union cohort and shows how it has consistently declined, this chapter concentrates on showing how this decline has been accompanied by changes in the timing of births in Venezuela. This is accomplished by taking a comparative approach that contrasts females who entered their first union before the oil boom of the 1970s with females who entered their first union after the boom.

3.1. A Model of Fertility Timing

Fertility timing has been modeled in different ways in the literature. Some models concentrate on addressing the timing of births in the context of economic growth. Iyigun (2000) incorporates the timing of childbearing into a growth model with endogenous fertility. It analyzes a situation in which individuals' human capital stock depends positively on their education and parental human capital and in which producing and raising children and acquiring human capital are time intensive. The model highlights how changes in the human capital stock interact with individual timing of childbearing to affect the evolution of the economy. It shows that increases in the human capital stock raise the opportunity cost of having children while young and induce individuals to delay childbearing. That, in turn, accelerates human capital accumulation in the future. The model also demonstrates that early childbearing may lead to a development trap with low human capital.

Blackburn (2002) develops a model where economic and demographic outcomes are determined jointly in a dynamic general equilibrium model of longevity, fertility, and growth. Reproductive agents in overlapping generations mature safely through two periods of life and face an endogenous probability of surviving for a third period. Given this probability, each agent maximizes her expected lifetime utility by choosing consumption and the number of children. Child-bearing is costly in the sense that time must be spent on child-rearing activities rather than on production or education. The model produces multiple development regimes which yield different predictions about life expectancy, fertility, timing of births, and educational investment, depending on the initial conditions.

These models concentrate on capturing how choices of fertility influence economic growth and mainly look at life cycle issues and choices and the effect of these on economic growth. However, since the short changes generated during the oil fueled economic booms in Venezuela are of a more temporary nature, this section focuses on a simpler two period model of fertility timing to predict fertility substitutions between these periods in light of changes in income through either a change in wages or a change in direct transfers. These changes would have different effects on fertility and these effects are outlined here.

3.1.1. The Female Decision Problem

To simplify this model, the lifetime of a female is represented as two periods. Each female maximizes a utility function of the following form:

$$U\left(C_i, N_i\right) = U_1\left(C_1, N_1\right) + \beta U_2\left(C_2, N_2\right)$$

In this utility function, future utility is discounted at the rate beta that is less than one ($\beta < 1$). This reflects the fact that present utility is more valuable. In the first period, utility depends on consumption of goods and services (C_1) and the number of children (N_1). Also, in the second period, utility depends upon consumption of goods and services (C_2) and the number of children (N_2).

Resources for consumption are constrained by limits on time in each period. Each female has a fixed amount of time in each period that does not change from period to period. This amount of time can be devoted either to childrearing or to market work. The amount of time available to females is normalized to be equal to one. Then, the total amount of time available in each period has to be equal to the time allocated to each child (h) times the number of children to obtain the total time allocated to childrearing (hN_i) plus the time allocated to market work (L_i). Therefore, at each period, a female faces the following time constraint:

$$1 = hN_i + L_i$$

Consumption is also constrained by limits on resources in each period and the presence of children with whom resources must be shared (f). It is assumed that the budget constraint is binding at each period so that females are not allowed to borrow against period two earnings. However, females have an exogenous rate of saving in period one (s) and the rewards of savings are collected in period two [$s(1+r)$]. Also, since income for consumption depends upon earnings ($w_i L_i$) and transfers (Y_i), earnings are the product of the market wage (w_i) and the proportion of time allocated to market work (L_i). Then, at each period, the perceived female earnings are:

$$I_i = w_i L_i + Y_i$$

The availability of transfer would depend upon the female's decision regarding fertility. In general, actual support received is endogenous and choices of fertility, marital status, and living arrangements in period one will depend on the availability of such support and the perceived cost of receiving it. However, these aspects are not modeled here.

The problem of the female is solved as follows:

Maximize:

$$U(C_i, N_i) = U_1(C_1, N_1) + \beta U_2(C_2, N_2)$$

Subject to:

$$C_1 + fN_1 + s = w_1(1 - hN_1) + Y_1$$

$$C_2 + f(N_1 + N_2) = s(1+r) + w_2(1 - hN_2) + Y_2$$

It is important to note that the costs of goods and services in period one and period two have been normalized to one. Then, the constraints can be re-written as:

$$C_1 + (f + w_1 h) N_1 = w_1 + Y_1 - s$$

$$C_2 + fN_1 + (f + w_2 h) N_2 = s(1+r) + w_2 + Y_2$$

The expression ($w_i h + f$) represents the cost of children in terms of the wage given up by allocating time to childrearing and the amount of resources that need to be shared with children in every period. Finally, the expression ($w_i + Y_i$) represents the total income in terms of the wage and the sum of all transfers at each period. In period one, savings are deducted from this term and in period two, savings plus interest are added to this term.

3.1.2. Solving the Model

The question now is what kind of predictions can be extrapolated from this model for fertility in period one and period two in light of a temporal shock in income at period one because of either direct transfers or changes in wages. In the context of this simple model, it becomes very easy to asses this impact.

To assess how fertility in period one changes when income changes because of a positive change in direct transfer in period one, the Hessian of the Lagrange is computed and its determinant along with information on second order conditions can be used to shown that the sing of dN_1 / dY depends on the following expression:

$$U_{11}\left[f + (1+r)(f + w_1 h)\right] - U_{12}(1+r)$$

If this expression is positive then the derivative is negative if this expression is negative then the derivative is positive. It is known that U_{11} is negative and U_{12} can be either positive or negative, thereby the derivative cannot be signed. However, if N_1 and

Y_1 are complements (as in the Cobb Douglas function) then $U_{12} > 0$, therefore, the above expression is less than zero and $dN_1 / dY_1 > 0$. Hence, in the C-D case a positive change in income caused by direct transfers in period one generates a positive change to fertility in period one if $U_{12} > 0$. On the other hand, if N_1 and Y_1 are strong substitutes, then U_{12} is negative and the expression above may be grater than zero and a positive change in transfers in period one could in theory cause a decrease in fertility in period one.

It is of interest to explore the impact that this change in period one transfer has on period two fertility. To assess how fertility in period two changes when income changes because of a positive change in direct transfer in period one, the Hessian of the Lagrange is computed and its determinant along with information second order conditions can be used to shown that the sing of the derivative dN_2 / dY_1 depends on the following expression:

$$U_{11}\left(f + w_2 h\right) - U_{12}$$

Again, if this expression is positive then the derivative is negative if this expression is negative then the derivative is positive. It is known that U_{11} is negative and U_{12} can be either positive or negative, thereby the derivative, again, cannot be signed. However, if N_1 and Y_1 are complements (as in the Cobb Douglas function) then $U_{12} > 0$, therefore, the above expression is less than zero and $dN_2 / dY_1 > 0$. Hence, a positive change in income caused by direct transfers in period one generates a positive change to fertility in period one if $U_{12} > 0$. On the other hand, if N_1 and Y_1 are substitutes, then U_{12} is negative and the expression above may be grater than zero, Hence a positive change in transfers in period one could in theory also cause a decrease in fertility in period two.

This model can be used to predict the changes in the timing of births due to temporary changes in the economic conditions that affect the conditions influencing households on when to have children, as well as how many to have. This model illustrates how females may change the timing and level of fertility in response to temporary changes in income, either through changes in wages or changes in the amount of transfers. Temporary changes in income in period one through transfers could increase or decrease fertility in period one, while increasing or decreasing fertility in period two by a smaller amount, thereby leaving total fertility over the two periods at a higher or lower level. Temporary changes in wages carry two competing effects and, depending on the proportion of time allocated to each child, can decrease (increase) fertility in period one, thereby increasing (decreasing) fertility in period two, while leaving total fertility at a different level. This finding illustrates the possibility that decreases in total fertility are accompanied by changes in the timing or pattern of childbearing and that these changes in the patterns of childbearing are due to changes in economic conditions households faced.

3.2. Data and Methods

To investigate changes in childbearing patterns, this empirical analysis uses the 1998 National Survey of Population and Family collected in Venezuela by The Central Office of Statistics and Information (OCEI), which gives detailed event-histories of fertility and nuptiality. This survey also provides information on current education, limited retrospective migration, and limited retrospective labor force participation. The main advantage of the retrospective information in the fertility survey over other data sources is that the collection of marital, employment, and migration information allows for the identification of short term changes in socioeconomic conditions on fertility conditions.

This empirical analysis takes a comparative approach by dividing the sample of 2,038 females ages 26 to 49 into boom and bust union cohorts of women who represent the demographic behavior during the economic boom of the 1970s and the economic bust of the early 1980s. The boom cohorts, which are made up of women entering their first union between 1967 and 1974, are representative of women who experienced the economic boom of the mid 1970s. The bust cohorts, which are made up of women entering their first union between 1975 and 1982, are representative of women who experienced the economic bust of the early 1980s. The substitution hypothesis states that there is a difference between the rate of accumulation among females who entered their first union before the boom and females who entered their first union after the boom.

Since the birth histories of the cohorts are truncated at different ages, the analysis is limited to events occurring 14 years after entering the first union in order to make the cohorts perfectly comparable. Table 3.1, which presents general socioeconomic and family characteristics of the cohorts, shows that the timing of the first union is significantly different across the boom and bust cohorts. The boom cohorts entered the first union about two years earlier than the bust cohorts. Also, significant improvements in socioeconomic conditions across the boom and bust cohorts are evident along a number of different dimensions. For example, the level of schooling increased between the boom and bust cohorts, and the percentage of females who reported working prior to entering their first union also increased considerably. Further, migration has disproportionally affected the boom cohorts, where the percentage of females who have never moved is much lower than the bust cohorts.

Table 3.1 Socioeconomic and family characteristics

	Boom Cohorts 1967-1974	Bust Cohorts 1975-1982
Mean age at first union	17.78	19.36
Level of education		
None (reference)	8.45	4.33
Middle or High School	79.23	76.04
University	12.32	19.63
Work	55.87	56.72
Worked before first union	52.08	63.53
Worked before first birth	22.92	22.01
Widowed/Divorced/Separated/Single	25.54	20.75
Never moved (migratory experience)	36.96	43.96
Age at first birth	20.11	21.58
Age at second birth	23.16	24.73
Age at third birth	26.03	27.02
Sample	698	1340

The analysis formulates a sequential model of childbearing that considers each birth as a separate event (Rodriguez 1980). The dependent variable in the analysis is the parity specific transition rate from first union to first child, first to second child, second to third child, and third to fourth child. The analysis is equivalent to a multi-stage single spell hazard rate model, where each parity corresponds to a different stage and the transition into a subsequent state is conditional on having achieved the previous parity (Hobcraft 1992; Rodriguez et al. 1984).

The sequential model approach to childbearing in this chapter has several advantages over the approach taken in the previous chapter, which uses number of children born during 14 years after entering the first union as the dependent variable. First, it allows for the effect of socioeconomic conditions on fertility to vary by parity, thus capturing differences in fertility behavior during the "early" and "later" stages of a woman's reproductive career (Namboodiri 1972; Hout 1978). Secondly, a sequential hazard rate model allows for the calculation of predicted parity specific survival curves across cohorts. The approach in this chapter allows for the recognition of timing effects that may be parity specific.

Table 3.2 List of variables included in the analysis

Variables Common to all Parities	
Place of residence	
Caracas Metropolitan Area (Reference)	
Cities with 25,000 people or more	
Urban centers with less than 25,000 people or rural areas	
Marital status	
Divorced	Equal to one if a woman is divorced, separated or widowed
Education	
None or < middle (reference)	Level of education reached
Middle/High School	
University	
Employment status	
Work	Equal to one if currently employed
Migratory exprerience	
Never moved	Equal to one if never moved
Parity Specific Variables	
Parity 1	
Age at first union	
Worked before first union	Equal to one if worked before first union
Parity 2	
Age at first child	
Worked before first birth	Equal to one if worked before first birth
Parity 3	
Age at second child	
Parity 4	
Age at third child	

The statistical analysis applies a proportional hazard rate model to each parity transition. The model is written as

$$h_i(t) = \lambda_0(t)\exp(\beta_1 x_{i1} + \ldots + \beta_k x_{ik})$$

This equation says that the hazard for an individual i at time t is the product of two factors: a baseline hazard function $\lambda_0(t)$ that is left unspecified, except that it cannot be negative, and the exponential of a linear function of a set of k fixed covariates.

This chapter explores the baseline hazard for time to first, second, third, and fourth births. Differences in such baseline hazards are detected between the boom and the bust cohorts; however, such differences can be the result of secular changes in education, work experience, or other similar factors and not changes in the timing of birth due to the oil boom. Therefore, the model is run to check if the differences remain unexplained by these secular changes.

Table 3.2 lists the variables included as predictors of the transition rate from first union to first birth, from first birth to second birth, and so on. It is possible to distinguish between those variables that are general to all parities and those that are parity specific. Among predictors included at all parities are place of residence, marital status that controls for the lower risk of childbearing arising from no longer being married or in an union, educational attainment, which is coded as three dummy variables-- none or less than middle school, middle school or high school, and university, and women's labor force participation. The parity-specific variables include demographic controls for age at the first union or previous birth and work experience for parity one and two.

3.3. Childbearing Patterns

Chapter two of this study shows drops in total fertility across cohorts entering their first union in 1967 through cohorts entering their first union in 1982 in Venezuela. To address whether these decreases in total fertility were accompanied by changes in the timing of childbearing and whether there are differences between the boom and bust cohorts, the distribution of births is investigated

This section takes a comparative approach to detect changes in the timing of births between the boom and bust cohorts. The cohorts compared are composed of females entering their first union between 1967 and 1974 and females entering their first union between 1975 and 1982. Females that entered into an union from 1967 through 1974 would have experienced the boom of the mid 1970's. However, females entering into an union from 1975 through 1982 would have experienced the bust years. If the boom played a roll in changing the economic conditions that households take into consideration when making decisions about when to have children, it ought to be possible to observe distinctive childbearing patterns between these two cohorts that cannot be explained by other secular changes.

The following nonparametrically describes the distribution of failure times, where failure refers to having a birth. There are different ways that can be used to describe the distribution of birth times. If T is considered to be a non negative random variable denoting the time to birth, it is possible to refer to the probability density function $f(t)$, cumulative distribution function $F(t)=Pr(T\leq t)$, the survivor function $S(t)$, or its hazard function $h(t)$.

In survival analysis, it is more convenient to think in terms of $S(t)$ and $h(t)$ rather than $F(t)$ of $f(t)$. However, all forms describe exactly the same probability distribution for T and translating between these four forms is quite simple. In order to compare the boom and the bust cohorts, the Kaplan-Meier (1958) nonparametric estimate of the survivor function $S(t)$ is computed. This estimates the probability of survival past time t. In the case of births, the desired comparison at a given time is not the probability of not having a child past time t, but instead the probability of having a child on or before time t. Therefore, the reverse of the survivor distribution function estimate is computed and graphed, which is simply an estimate of the cumulative distribution function as the following equation shows:

$$\hat{F}(t)=1-\hat{S}(t)=1-\prod_{j|t_j\leq t}\left(\frac{n_j-d_j}{n_j}\right)$$

where n_j is the number of females at risk at time t_j and d_j is the number of births at time t_j.

Figure 3.1, which graphs the probability of having a first birth on or before time t $\hat{F}(t)$, shows no apparent difference in this probability for the boom and bust cohorts. However, this observation can be tested more rigorously. As explained above, $\hat{F}(t)$

completely defines $\hat{S}(t)$ and they convey the exact same information. Due to an interpretation convenience, $\hat{F}(t)$ is graphed. Table 3.3 offers three tests where the null hypothesis is that the corresponding survivor functions estimates are the same for the boom and bust cohorts. Three tests, the log-rank (Mantel and Haenszel 1959), the Wilcoxon (Breslow 1970; Gehan 1965), and the Tarone-Ware (1977), are appropriate for testing the equality of survivor functions across two or more groups. However, these tests do not test the equality of survivor functions at a specific time point. Instead they are global tests in the sense that they compare the overall survivor function by comparing at each failure time the expected versus the observed number of failures for each group and combining these comparisons over all observed failure times. They differ only on how they weight each of these comparisons when combining them to form the overall test statistic.

Table 3.3 reveals that the survivor function estimates are not different across the boom and bust cohorts (all p values are greater than 0.10, indicating strong support for the null hypothesis), meaning that there is not a statistically significant difference between the two estimates presented in Figure 3.1.

In other words, the risk or probability of transitioning from marriage to first birth

Figure 3.1 Nonparametric Estimate of the first birth cdf F(t)

is the same for the boom and bust cohorts. Hence, this approach reveals no apparent difference between the boom and bust cohorts in the timing of childbearing for the first birth. This finding possibly reflects the fact that entering an union is a signal for being ready to have children. This seems to suggest that, given that a female entered a first union, the timing of first child was not responsive to the major socioeconomic event that took place in the mid 1970s.

Table 3.3 Test for equality of corresponding survival functions

Test for equality of corresponding survivor fun	First Birth Pr>Chi2	Second Birth Pr>Chi2	Third Birth Pr>Chi2	Fourth Birth Pr>Chi2
Log-rank	0.2745	0.0001	0.3343	0.6407
Wilcoxon (Breslow)	0.1024	0.0001	0.0161	0.6914
Tarone-Ware	0.1163	0.0001	0.0529	0.9065

However, when exploring the timing of birth of the second child, after parity one has been reached, a different picture emerges. Figure 3.2, which graphs the probability of having a second birth on or before time t $\hat{F}(t)$, shows a significant change in the timing of childbearing across these two cohorts. The boom cohort has a greater probability than

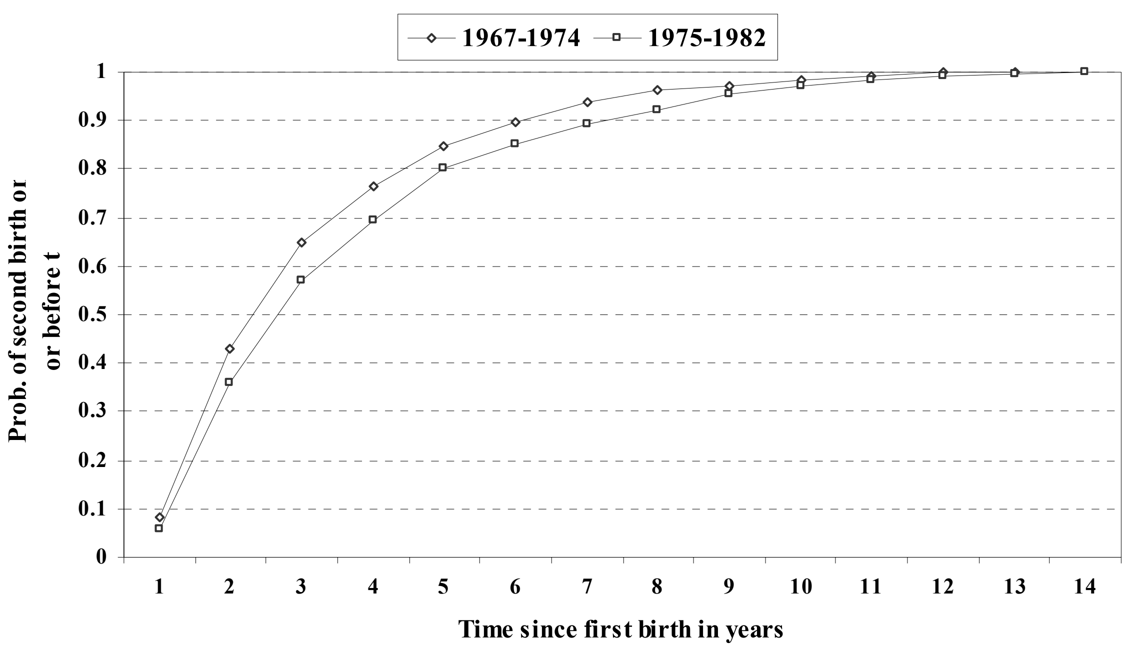

Figure 3.2 Nonparametric Estimate of the second birth cdf F(t)

the bust cohort of having a second birth on or before time *t* for every *t*. This means that females who belong to the boom cohort have a higher risk or probability than those in the bust cohort of transitioning into second birth once the first birth has taken place. Table 3.3 confirms this observation. The three tests where the null hypothesis is that the corresponding survivor functions estimates for the second birth are the same across boom and bust cohorts reveal that the corresponding survival functions estimates are different across the boom and bust cohorts (all p values are less than 0.01 indicating a strong lack of support for the null hypothesis), meaning that there is a statistically significant difference between the two functions graphed in Figure 3.2. In other words, the risk or probability of transitioning from the first birth to the second birth is higher for the boom cohort than for the bust cohort.

This change in the pattern of childbearing from boom to bust cohorts is consistent with the hypothesis that the oil shock filtered to the household so as to create an incentive to change the timing of birth. Therefore, parities more responsive to such temporary changes in economic conditions would show such acceleration. This shift in the timing of birth from the boom to bust cohorts is reflected in the second child, perhaps because the transition into a second child is expected to be more responsive to changes in economic conditions. In general, since couples who deicide to enter an union are

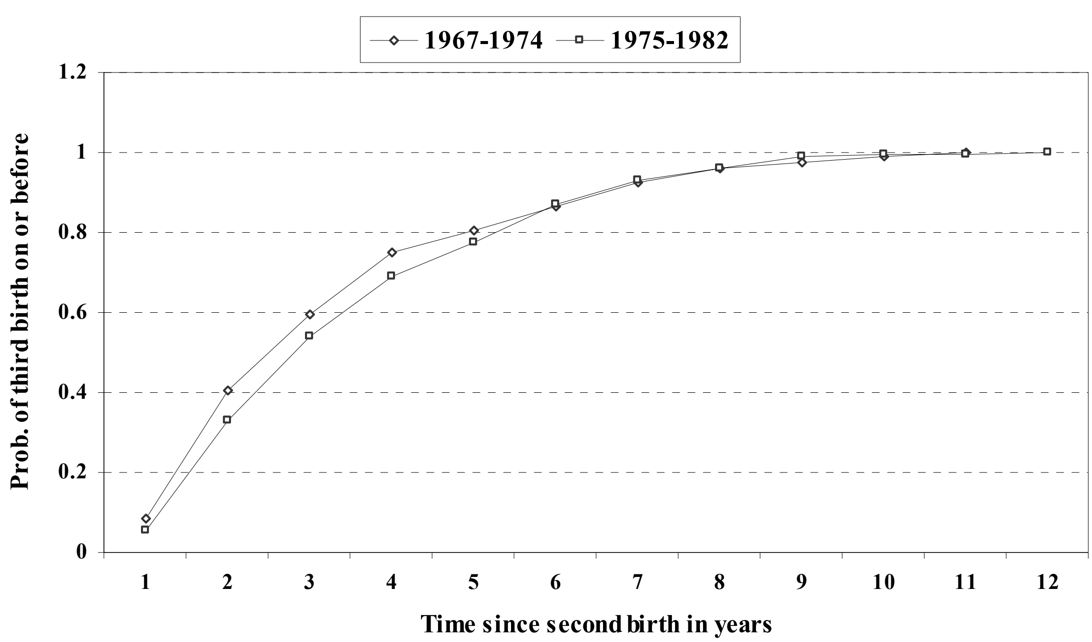

Figure 3.3 Nonparametric Estimate of the third birth cdf F(t)

signaling the desire to have a child, given that the couple entered the union, the timing for having the first child is not very responsive to other factors. However, the timing of the second child, given the couple already have a child, is likely very responsive to many other factors, including economic considerations. The transition is, therefore, more responsive to sharp changes in economic conditions.

Examining the transition into the third and fourth births reveals the temporary nature of the acceleration noticeable in the transition between the first and second child across the boom and bust cohorts. Figure 3.3, which graphs the probability of having a third birth on or before time t $\hat{F}(t)$, shows that the higher probability of transitioning from the second to third birth is not present across the boom and bust cohorts. The tests in Table 3.3 confirm that the two functions graphed in Figure 3.3 are not statistically different according to the log-rank test and the Tarone-Ware at a 0.05 confidence level; however, the Wilcoxon shows a statistically significant difference. Since the transition into the fourth birth is unambiguously the same between the boom and bust cohorts, as Table 3.3 shows, the difference in childbearing experience between the boom and bust cohorts is not statistically significant. However, it is important to notice that the probability of transition into a fourth birth does seem higher for the bust cohort for years

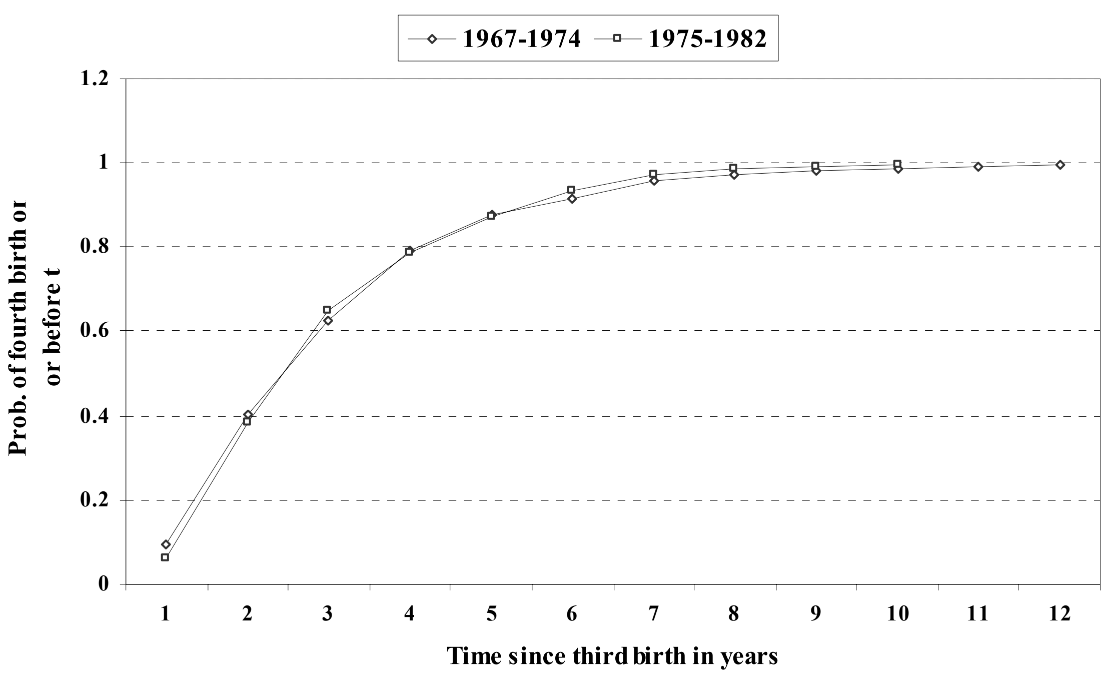

Figure 3.4 Nonparametric Estimate of the fourth birth cdf F(t)

2, 3, 6, 7, 8, and 10. This would be consistent with the substitution hypothesis, but these differences are not significant.

This section clearly shows a distinct change in the pattern of childbearing between the boom and bust cohorts. Neither seems to behave any differently when the transition from the first union into the first birth is considered. However, the timing of the transition between the first and second child seems distinctively different across the boom and bust cohorts, as does the transition from third to fourth birth. Such a change in behavior is not present in the transition into the third birth. This temporary nature of the acceleration of transition noticeable for the second birth is consistent with the temporary nature of the oil boom of the early 1970s. This boom, which lasted just a few years, is not enough to affect a transition into higher parities.

In summary, the risk of transitioning from marriage to first birth does not show changes across the boom and bust cohorts. However, the boom cohort seems to have a statistically significant higher risk of transitioning into second and third births and the bust cohort seems to have a higher risk of transitioning into a fourth birth, but this difference is not statistically significant.

3.4. Socioeconomic and Demographic Factors Affecting Childbearing

The change in birth timing between the boom and bust cohorts highlighted in the previous section is consistent with inter-temporal substitution. In general, however, secular changes in desired family size may also be associated with changes in the timing of births. Hence, differences in timing between the boom and bust cohorts could be the result of secular changes in educational levels, age at marriage, work experience, or other similar factors. Therefore, to re-examine the results presented in the previous section, it is necessary to resort to multivariable analysis

Changes in childbearing patterns having been described, this section presents the results of the proportional hazard model that estimates the effect of socioeconomic characteristics on childbearing by parity. A dummy variable is introduced for the boom cohort to see how the differences in childbearing fair when controls for other secular changes are introduced.

A proportional hazard model for the time to birth at each parity is especially useful, because no parametric assumption of the shape of the baseline hazard for the time to first birth, second birth, and so on is imposed. The shape can be estimated from the data and differences between the boom and bust cohorts can be tested. In the event of inter-temporal substitution for the boom cohort compared to the bust cohort, the boom cohort is expected to be at greater risk of birth at lower parities, and at lower risk of birth at higher parities, even after controlling for the effects of secular changes.

Parameter estimates and standard errors for the full models are presented in Table 3.8, which shows that differences in the risk of childbearing highlighted in the previous section persist even after controlling for secular changes. The boom cohort has a statistically higher risk of transitioning into the second birth than the bust cohort, even after controlling for secular changes. Furthermore, the bust cohort has a higher risk of transitioning into the fourth birth, but this higher risk is not statistically significant. These results are consistent with the inter-temporal substitution of fertility hypothesis. The explanatory variables offer some interesting results that are covered in the following sections. To simplify the discussion, summary tables for the effect of socioeconomic and demographic factors on childbearing are provided.

3.4.1. Place of Residency

Previous research suggests important fertility differentials between rural and urban areas (Sharlin 1986). The results of this study confirm the existence of an important fertility differential between more urban areas when compared to less urban ones.

Table 3.4, which summarizes the effects of the place of residence on a female's childbearing, shows that place of residence affects fertility behavior across parities. It reveals that women in rural areas transition into first, second, third, and fourth birth faster than women who reside in more urban areas. However, this effect is not statistically significant for the transition into the fourth birth.

Table 3.4 Effect of place of residence on childbearing

First Birth	**Coef.**	**Std. Err.**	**z**	**P>z**
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.0909	0.0574	1.58	0.113
Urban centers with < 25K people or rural areas	0.1963	0.0724	2.71	0.007
Second Birth				
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.1962	0.0606	3.24	0.001
Urban centers with < 25K people or rural areas	0.2891	0.0755	3.83	0.000
Third Birth				
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.1565	0.0796	1.97	0.049
Urban centers with < 25K people or rural areas	0.2237	0.0929	2.41	0.016
Fourth Birth				
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	-0.0858	0.1233	-0.70	0.486
Urban centers with < 25K people or rural areas	-0.0809	0.1329	-0.61	0.543

3.4.2. Age Effect

In general, older ages at marriage or previous births reflect higher levels of fertility control and reduce the overall level of fertility (Tolnay and Guest 1984; Teachman and Schollaert 1989; Yamaguchi 1995). Table 3.5, which summarizes the effect of age on childbearing, shows that females who are older at first union and at the second birth exhibit a statistically higher incidence of having an additional child.

Table 3.5 Effect of age on childbearing

First Birth	**Coef.**	**Std. Err.**	**z**	**P>z**
Age at First Union	0.0299	0.0068	4.40	0.000
Second Birth				
Age at First Birth	0.0038	0.0065	0.58	0.560
Third Birth				
Age at Second Birth	0.0243	0.0078	3.12	0.002
Fourth Birth				
Age at Third Birth	0.0102	0.0110	0.93	0.354

3.4.3. Educational Attainment

The effect of educational attainment on women's childbearing has received considerable attention in fertility studies (Cochrane 1979). However, researchers disagree about the exact mechanism through which education influences fertility (Graff 1979). Neoclassical economic theory stresses the association between the education and changing economic opportunities for women. According to this view, a higher level of education increases the value of women's time and results in a reduction in the demand for children.

While there seems to be consensus from the empirical stand point, the case of Venezuela shows that higher levels of education are associated with a lower incidence of having an additional birth. Table 3.6, which summarizes the effect of educational attainment on the risk of having an additional birth, shows that the risk of transitioning from three births to four births is significantly reduced by additional levels education. However, this effect is not as predominant for the transition into the first and second births.

Table 3.6 Effect of educational attainment on childbearing

First Birth	**Coef.**	**Std. Err.**	**z**	**P>z**
Less than Middle				
Middle/ High School	0.2943	0.1037	2.84	0.005
University	0.0297	0.1205	0.25	0.806
Second Birth				
Less than Middle				
Middle/ High School	0.0547	0.1053	0.52	0.604
University	-0.1373	0.1238	-1.11	0.268
Third Birth				
Less than Middle				
Middle/ High School	-0.4840	0.1144	-4.23	0.000
University	-0.7267	0.1514	-4.80	0.000
Fourth Birth				
Less than Middle				
Middle/ High School	-0.1207	0.1283	-0.94	0.347
University	0.0925	0.2133	0.43	0.665

3.4.4. Female Labor Force Participation

Improvements in women's occupational opportunities have reduced the demand for children. However, the lack of longitudinal data in developing countries has limited researchers' ability to assess the relationship between female employment and fertility (Rosenzweig 1976; Gurak and Kritz 1981). In general, the available empirical evidence suggests that the direction and magnitude of the association depends on women's socioeconomic opportunities and the type of work in which they are engaged (Mason and Palan 1981; Loyd 1991). Specifically, employment in professional or skilled occupations, which is associated with more rigid time-schedules and better career prospects, is expected to present the highest degree of conflict with childbearing. Moreover, this effect is expected to become stronger over time. Other types of employment, which have more flexible hours or are associated with a lower degree of commitment, do not necessarily present a conflict with household activities. Thus, domestic and manual employment is not expected to affect fertility to the same extent as professional or skilled employment.

Table 3.7, which summarizes the effect of labor force participation on childbearing, reveals that working status today does not seem to significantly affect childbearing at any parity, except at parity three for the boom cohorts where it significantly increases the likelihood of a third child. Further, females who belong to the boom cohorts who worked before their first union and before their first birth have a significantly lower likelihood of transitioning into the first birth and second birth, respectively, whereas this effect is not statistically significant for females who belong to the bust cohorts, even though this effect follows the same direction.

Table 3.7 Summary of the effect of labor force participation on childbearing

First Birth	**Coef.**	**Std. Err.**	**z**	**P>z**
Work	0.0554	0.0506	1.10	0.273
Worked before first union	-0.2415	0.0502	-4.81	0.000
Second Birth				
Work	-0.1099	0.0579	-1.90	0.058
Worked before first birth	-0.0580	0.0652	-0.89	0.374
Third Birth				
Work	-0.0243	0.0599	-0.41	0.685
Fourth Birth				
Work	-0.0569	0.0840	-0.68	0.498

3.5. Childbearing Pattern by Agricultural Intensity

In previous chapters, the channels through which an oil boom could have changed the timing of childbearing is discussed in great detail. In particular, greater revenues collected by the government can unexpectedly change a family's income either through changes in real wages or changes in income transfer from the government. How the oil boom filters to the households would disproportionably affect different households. In particular, for households that live in predominantly agricultural or non-agricultural regions, it is expected that oil booms are most likely to increase disproportionably childbearing in agricultural regions due to the lower opportunity cost of having children. To explore this idea in order to identify the hypothesis, the proportion of people employed in agriculture is introduced to split the sample into regions that are agricultural and non-agricultural. This percentage of people employed in agriculture comes from the 1971 census, and Table 3.8 tabulates it by grouping states to show which states are agricultural and which ones are non-agricultural.

Table 3.8 Percent of people employed in agriculture

Agricultural	**Agricultural/Non Agricultural Ratio**
Apure	52.22
Barinas	52.54
Cojedes	46.22
Falcón	29.93
Guarico	43.26
Mérida	44.09
Portuguesa	41.46
Sucre	40.84
Táchira	35.52
Trujillo	40.92
Yaracuy	46.14
Amazonas	29.91
Delta Amacuro	45.99
Monagas	34.26
Mean	**41.66**
Non-agricultural	
Federal District	1.04
Anzoátegui	24.10
Aragua	12.15
Bolívar	16.74
Lara	26.31
Miranda	7.09
Nueva Esparta	24.76
Zulia	17.10
Carabobo	10.42
Mean	**15.52**

For the third birth, according to Figure 3.3 and Table 3.3, there does not seem to be a plausible difference between the behavior of the boom cohort and the bust cohort. However, when segmenting by the percent of people working in agricultural sector a very different picture emerges. Figure 3.5, which graphs the non-parametric estimate of the

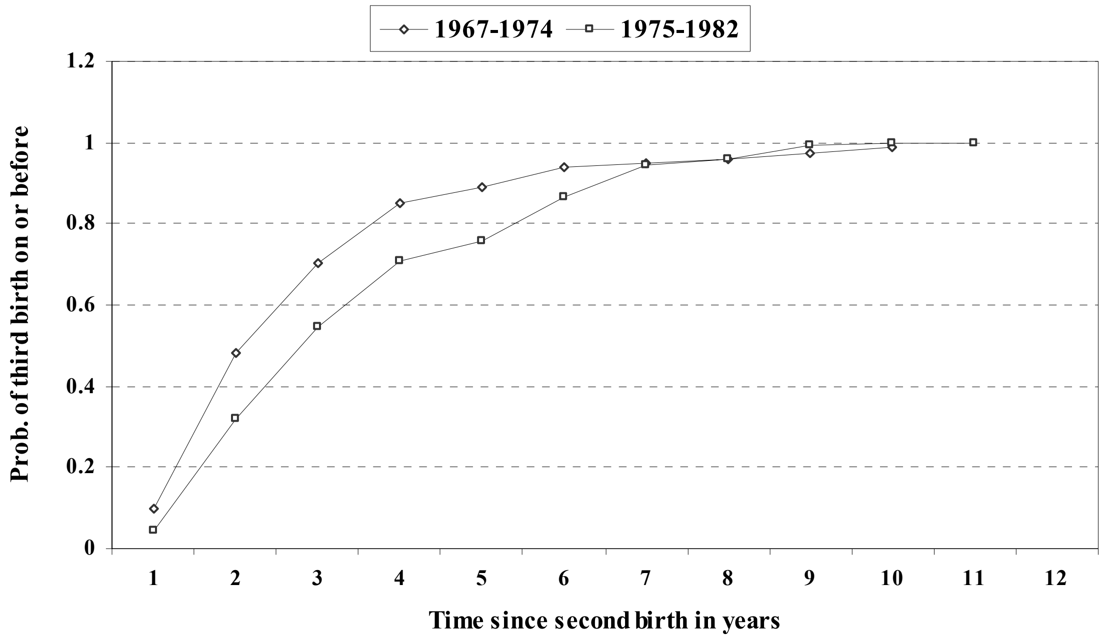

Figure 3.5 Nonparametric Estimate of the third birth cdf F(t), Agricultural

probability of having a third birth on or before time t, shows a great difference between the boom and bust cohorts for agricultural regions.

In agricultural regions, as expected, the boom cohort accumulates a third child much faster than the bust cohort, even after controlling for secular changes (see Table 3.10). However, this acceleration is not present in the boom cohorts that belong to the non-agricultural regions. Figure 3.6, which graphs the non-parametric estimate of the probability of having a third birth on or before time t for the non-agricultural regions, shows no difference in the accumulation of third a birth between the boom and bust cohorts even after controlling for secular changes (see Table 3.11). Furthermore, the coefficient is actually negative for the boom dummy variable, which suggests a deceleration; however, such a coefficient is not statistically significant.

When considering the fourth birth, Tables 3.10 and 3.11 suggest that after controlling for secular changes the boom cohort in agricultural areas is still accelerating childbearing. In contrast, the boom cohort in the non-agricultural areas is actually decelerating or stopping the accumulation of a fourth child. This result is consistent with the timing of birth hypothesis. On the one hand, agricultural states engage in acceleration of childbearing, because they may be benefiting largely from income transfers (Y). On the other hand, non-agricultural states present no distinguishable difference, because the

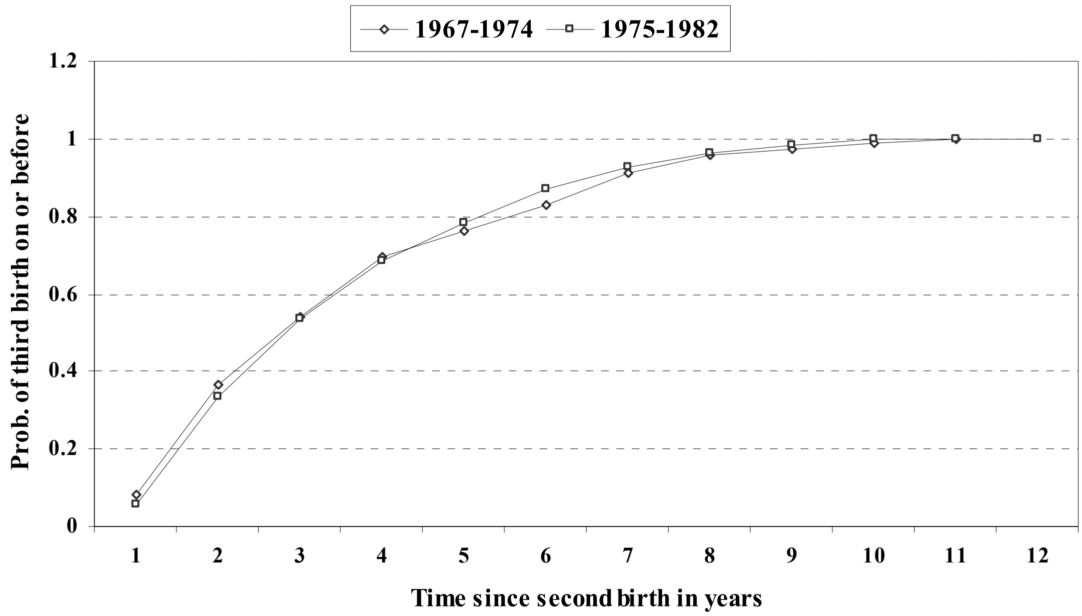

Figure 3.6 Nonparametric Estimate of the third birth cdf *F(t)*, Non-agricultural

effects from Y and the wage (w) are canceling each other out. However, in some non-agricultural states the w effect is dominant, and is, therefore, causing females to delay birth. Consider Carabobo state, which is a predominantly industrial state. It is possible that in Carabobo the oil fueled boom enhanced household's income mostly through increases in real wages, causing females to delay having children, thereby substituting having children today for having them in the future.

3.6. Summary

The simple two period model of fertility timing developed in this chapter illustrates how females may change their fertility timing by responding to temporary changes in income, either through changes in wages or changes in the amount of transfers, thereby possibly leaving their total fertility after the two periods unchanged. Temporary changes in income in period one through transfers unambiguously increase fertility in period one, while decreasing fertility in period two. How total fertility would be changed depends on the parameters of the utility function. Temporary changes in wages carry two competing effects and, depending on the portion of time allocated to each child, can decrease (increase) fertility in period one, thereby increasing (decreasing) fertility in period two.

Also, this chapter presents evidence that the changes in period fertility rates during the economic boom of the mid 1970s is likely have been the result of changes in the timing of births, which is consistent with the proposed model. A duration analysis presents differences in childbearing patterns where the boom cohort seems to be at higher risk of an additional child for lower parities, but at lower risk for higher parities when compared to the bust cohort. These differences seem to remain even after controlling for individual characteristics or secular changes between the two cohorts.

Furthermore, segmenting the sample into agricultural and non-agricultural states offers valuable insights on how the economic boom may have differentially affected different households in Venezuela. On the one hand, agricultural states engage in acceleration of childbearing, because they may be benefiting largely from income transfers (Y). On the other hand, non-agricultural states present no distinguishable difference, because the effects from Y and the wage (w) can be canceling each other out. However, in some non-agricultural states the w effect may be dominant and, therefore, causing females to delay birth. This last also confirms the substitution hypothesis.

Table 3.9 Exponential hazard rate model for predicting childbearing

First Birth	**Coef.**	**Std. Err.**	**z**	**P>z**
Boom	0.0707	0.0502	1.41	0.159
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.0909	0.0574	1.58	0.113
Urban centers with less than 25,000 people or rural areas	0.1963	0.0724	2.71	0.007
Less than Middle (Reference)				
Middle/ High School	0.2943	0.1037	2.84	0.005
University	0.0297	0.1205	0.25	0.806
Work	0.0554	0.0506	1.10	0.273
Work before first union	-0.2415	0.0502	-4.81	0.000
Widowed/Divorced/Separated	-0.0452	0.0591	-0.76	0.444
Never Moved	0.0073	0.0471	0.15	0.878
Age at first union	0.0299	0.0068	4.40	0.000
Observations	1881			
Second Birth				
Boom	0.1890	0.0514	3.68	0.000
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.1962	0.0606	3.24	0.001
Urban centers with less than 25,000 people or rural areas	0.2891	0.0755	3.83	0.000
Less than Middle (Reference)				
Middle/ High School	0.0547	0.1053	0.52	0.604
University	-0.1373	0.1238	-1.11	0.268
Work	-0.1099	0.0579	-1.90	0.058
Worked before first birth	-0.0580	0.0652	-0.89	0.374
Widowed/Divorced/Separated	-0.0432	0.0622	-0.69	0.487
Never moved	-0.0298	0.0494	-0.60	0.547
Age at first birth	0.0038	0.0065	0.58	0.560
Observations	1743			
Third Birth				
Boom	0.0637	0.0614	1.04	0.299
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.1565	0.0796	1.97	0.049
Urban centers with less than 25,000 people or rural areas	0.2237	0.0929	2.41	0.016
Less than Middle (Reference)				
Middle/ High School	-0.4840	0.1144	-4.23	0.000
University	-0.7267	0.1514	-4.80	0.000
Work	-0.0243	0.0599	-0.41	0.685
Widowed/Divorced/Separated	0.0111	0.0745	0.15	0.881
Never moved	-0.0538	0.0589	-0.91	0.360
Age at second birth	0.0243	0.0078	3.12	0.002
Observations	1219			
Fourth Birth				
Boom	-0.0139	0.0826	-0.17	0.866
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	-0.0858	0.1233	-0.70	0.486
Urban centers with less than 25,000 people or rural areas	-0.0809	0.1329	-0.61	0.543
Less than Middle (Reference)				
Middle/ High School	-0.1207	0.1283	-0.94	0.347
University	0.0925	0.2133	0.43	0.665
Work	-0.0569	0.0840	-0.68	0.498
Widowed/Divorced/Separated	0.0875	0.1080	0.81	0.418
Never moved	0.0207	0.0805	0.26	0.797
Age at third birth	0.0102	0.0110	0.93	0.354
Observations	664			

Table 3.10 Exponential hazard rate model for predicting childbearing, Agricultural

First Birth	**Coef.**	**Std. Err.**	**z**	**P>z**
Boom	0.0914	0.0930	0.98	0.326
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	-0.3190	0.3870	-0.82	0.410
Urban centers with less than 25,000 people or rural areas	-0.1823	0.3889	-0.47	0.639
Less than Middle (Reference)				
Middle/ High School	0.5000	0.1622	3.08	0.002
University	0.1979	0.2107	0.94	0.348
Work	0.0149	0.0942	0.16	0.875
Work before first union	-0.2807	0.0910	-3.08	0.002
Widowed/Divorced/Separated	-0.1796	0.1104	-1.63	0.104
Never Moved	0.0106	0.0893	0.12	0.906
Age at first union	0.0396	0.0120	3.30	0.001
Observations	557			
Second Birth				
Boom	0.1389	0.0912	1.52	0.128
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.4075	0.4161	0.98	0.327
Urban centers with less than 25,000 people or rural areas	0.4099	0.4186	0.98	0.327
Less than Middle (Reference)				
Middle/ High School	0.3010	0.1669	1.80	0.071
University	-0.0985	0.2129	-0.46	0.644
Work	-0.0971	0.0998	-0.97	0.331
Worked before first birth	-0.0577	0.1159	-0.50	0.618
Widowed/Divorced/Separated	-0.0600	0.1117	-0.54	0.591
Never moved	-0.0297	0.0911	-0.33	0.745
Age at first birth	-0.0120	0.0126	-0.95	0.340
Observations	546			
Third Birth				
Boom	0.2697	0.1102	2.45	0.014
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.1748	0.5858	0.30	0.765
Urban centers with less than 25,000 people or rural areas	0.1651	0.5899	0.28	0.780
Less than Middle (Reference)				
Middle/ High School	-0.4602	0.1782	-2.58	0.010
University	-0.8302	0.2666	-3.11	0.002
Work	0.0211	0.1046	0.20	0.840
Widowed/Divorced/Separated	-0.0726	0.1294	-0.56	0.575
Never moved	-0.1653	0.1043	-1.58	0.113
Age at second birth	0.0229	0.0122	1.89	0.059
Observations	411			
Fourth Birth				
Boom	0.1179	0.1489	0.79	0.429
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	-0.9667	0.7260	-1.33	0.183
Urban centers with less than 25,000 people or rural areas	-0.8247	0.7263	-1.14	0.256
Less than Middle (Reference)				
Middle/ High School	-0.0863	0.1991	-0.43	0.665
University	0.4586	0.3788	1.21	0.226
Work	-0.1187	0.1414	-0.84	0.401
Widowed/Divorced/Separated	0.2771	0.1905	1.45	0.146
Never moved	-0.0577	0.1400	-0.41	0.680
Age at third birth	0.0052	0.0179	0.29	0.771
Observations	248			

Table 3.11 Exponential hazard rate model for predicting childbearing, Non-agricultural

First Birth	**Coef.**	**Std. Err.**	**z**	**P>z**
Boom	0.0604	0.0600	1.01	0.314
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.1107	0.0621	1.78	0.075
Urban centers with less than 25,000 people or rural areas	0.2134	0.0944	2.26	0.024
Less than Middle (Reference)				
Middle/ High School	0.1375	0.1359	1.01	0.311
University	-0.1086	0.1516	-0.72	0.474
Work	0.0685	0.0605	1.13	0.257
Work before first union	-0.2250	0.0605	-3.72	0.000
Widowed/Divorced/Separated	0.0202	0.0703	0.29	0.774
Never Moved	0.0075	0.0560	0.13	0.894
Age at first union	0.0254	0.0083	3.08	0.002
Observations	1324			
Second Birth				
Boom	0.2153	0.0625	3.44	0.001
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.1957	0.0658	2.97	0.003
Urban centers with less than 25,000 people or rural areas	0.3844	0.0985	3.90	0.000
Less than Middle (Reference)				
Middle/ High School	-0.1727	0.1368	-1.26	0.207
University	-0.2903	0.1561	-1.86	0.063
Work	-0.1140	0.0715	-1.59	0.111
Worked before first birth	-0.0663	0.0792	-0.84	0.402
Widowed/Divorced/Separated	-0.0210	0.0755	-0.28	0.780
Never moved	-0.0191	0.0595	-0.32	0.748
Age at first birth	0.0115	0.0077	1.50	0.134
Observations	1197			
Third Birth				
Boom	-0.0375	0.0748	-0.50	0.616
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.1334	0.0851	1.57	0.117
Urban centers with less than 25,000 people or rural areas	0.2368	0.1166	2.03	0.042
Less than Middle (Reference)				
Middle/ High School	-0.4912	0.1510	-3.25	0.001
University	-0.6884	0.1905	-3.61	0.000
Work	-0.0538	0.0733	-0.73	0.463
Widowed/Divorced/Separated	0.0461	0.0920	0.50	0.616
Never moved	0.0178	0.0721	0.25	0.805
Age at second birth	0.0257	0.0102	2.52	0.012
Observations	808			
Fourth Birth				
Boom	-0.0753	0.1023	-0.74	0.461
Caracas Metropolitan Area (Reference)				
Cities with 25,000 people or more	0.0109	0.1323	0.08	0.934
Urban centers with less than 25,000 people or rural areas	-0.0863	0.1568	-0.55	0.582
Less than Middle (Reference)				
Middle/ High School	-0.0794	0.1705	-0.47	0.641
University	0.0228	0.2686	0.08	0.932
Work	-0.0326	0.1057	-0.31	0.758
Widowed/Divorced/Separated	0.0486	0.1342	0.36	0.717
Never moved	0.0486	0.1016	0.48	0.633
Age at third birth	0.0203	0.0145	1.40	0.162
Observations	416			