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Estimating the Impact of Marriage and Fertility on the Female Labor Force Participation when Decisions are Interrelated:

Evidence from Urban Morocco

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Abstract: Studying the impact of fertility on the extent of female labor force participation and the form that this participation takes is complicated by the fact that both fertility and participation are potentially endogenous household decisions, requiring simultaneous estimation. Such estimation is further complicated by the need to find appropriate instruments for fertility. Moreover, the timing of marriage (or the probability of being married at a certain age), which is an important determinant of both fertility and participation, may also be endogenous to those decisions. In this paper, we estimate a structural model for labor force participation that distinguishes between different participation states (non-wage work, public wage work, private wage work, and unemployment) and that takes into account the endogeneity of the timing of marriage and fertility. We find that, in urban Morocco, marriage per se is not a constraint on labor force participation, but that it is a constraint on engaging in paid employment in the private sector. The presence of school-age children significantly reduces participation in all types of wage work. Moreover, a woman's own education, as well as that of her father, significantly increase the probability of her participation in the public sector. With the dramatic slowdown in public sector hiring in recent years, these variables are also strong determinants of female unemployment.

I. Introduction

Taking into account the simultaneity of the timing of marriage, the fertility, and participation decisions is one of the principal challenges in modeling female labor market behavior. Delayed marriage, and declining fertility in the MENA region in general, and in Morocco, in particular, can potentially translate into significant increases in female participation in market work. An accurate assessment of the impact of these demographic changes on labor market behavior requires the specification of structural models, that can disentangle the effect of fertilty and and the timing of marriage on participation,from the impact of particpation on these two sets of decisions.

The economic literature on the female particpation in the labor force is quite extensive. (Killingsworth 1983, Heckman et MaCurdy 1986, Killingsworth and Heckman 1986, Blundell 1990 and Browning 1992). Studies focusing on the United States have shown that participation in paid work is strongly related to age at marriage and fertility. In fact, fertility in the United States has declined considerably in the 1960s (National Center for Health Statistics 1991) in part due to the delay in marriage (Rodgers and Thornton 1985, Espenshade 1985, Bianchi and Spain 1986) and, in part, due to the reduction in the number of births per woman (Heckman and Willis 1977).

Although many early studies of female labor supply simply introduced the number and age of children in the home as exogenous regressors in participation equations (Mincer 1962, Heckman 1974, Heckman and MaCurdy 1980), the recent literature has insisted that these variables are potentially endogenous and can therefore result in biased estimates(Schultz 1978, Dooley 1982, Moffit 1984, Hotz and Miller 1988, Nakamura and Nakamura 1985, 1992). Mroz (1987) tested the sensitivity of the parameters of the labor supply equation of married women with respect to a number of assumptions including the exogeneity of the fertility decision, as captured by number of childen in two age categories. He could not reject the exogeneity of fertility in the case of hours of work. Xie (19970 conducted an exogeneity test for both the particpation and hours of work equations using the generalized residual method and rejected exogeneity in the particupatio decision, but could not reject it for hours of work.

Some authors attempted to address the endogeneity of fertility in the participation decision by adopting an instrumental variable methodology, whereby auxiliary equations are estimated for number of children and predicted values are subsitituted for the original child (Nakamura and Nakamura 1992). The main challenge in doing this has been to identify instruments that influence the fertility decision without also affecting the particpation decision directly. In searching for suitable instruments for fertility, researchers have looked for sources of unplanned births (like the presence of twins) (Rosenzweig and Wolpin 1980) and to the availability and cost of contraceptive technology (Rosenzweig and Schultz 1985). Previous work on female participation and sector choice in the MENA region either assumes that the number of children a woman has is exogenous to her participation or sector choice decision (Assaad and El-Hamidi 2001, 2002, El Aynaoui 1997) or simply leaves that information out altogether (Tunali and Baslevent 2001; Tansel 1994, 1996, 1999; Dayioglu 1999), essentially estimating a reduced form model.

The timing of marriage is almost always left out as a determinant of participation. The usual practice in the female labor supply literature is to include marital status as a set of exogenous dummy variables or to limit the estimation of the participation or labor supply function to married women. However the exogeneity of marital status can also be called into question since particiption in the workforce prior to marriage can allow women to delay marriage. In a structural framework, the timing of marriage is also a crucial determinant of fertility, but may also be endogenous to that decision.

Finally there is the issue of how participation itself is modeled. The recent literature on developing countries stresses the different forms of market work that women can engage in and how each of these forms can have

different implications for women ability to combine market work and child care (Hill 1983, 1989, Tiefenthaler 1994, Assaad and El-Hamidi 2001). In particular, self-employment can allow women to generate income while simultaneously caring for their chidren. Even within wage employment, public sector employment often involves shorter hours than employment in the private sector and often provides child care services that make it more compatible with child rearing.

Our paper attempts to address these various issues by estimiating a structural model that takes into account the endogeneity of fertility and the timing of marriage to the participation decision and by modeling participation as a polychotomous variable that distinguishes between different participation states. Since there is little heterogeneity in the kinds of economic activities that rural women in Morocco engage in, we focus our attention on urban women between the ages of 15 and 54. The rest of the paper is organized as follows: section 2 discusses the methodolgy used in the econometric estimation, section 3 discusses the sources of data and the characteristics of the sample we use, section 4 presents our results, and section 5 concludes.

2. Methodology

The procedure we adopt in our empirical work consists of three stages. The first stage consists of estimating an equation for the age at first marriage using a parametric duration model that takes into account that the dependent variable is censored for the unmarried women in our sample. We use this model to predict the age at first marriage for use in modeling fertility and the probability of marriage for use in modeling participation. The second stage consists of estimating the determinants of the number of children born alive and the number of children under seven years of age for married women using a count data model. We use these estimates to predict the number of children under seven and the number of children seven and over, as the difference between the predicted total number of children and the predicted number of children under seven. The final stage consists of estimating a nested logit model of participation for all women that accounts for the endogeneity of marital status and the number of children under seven and seven and over [1].

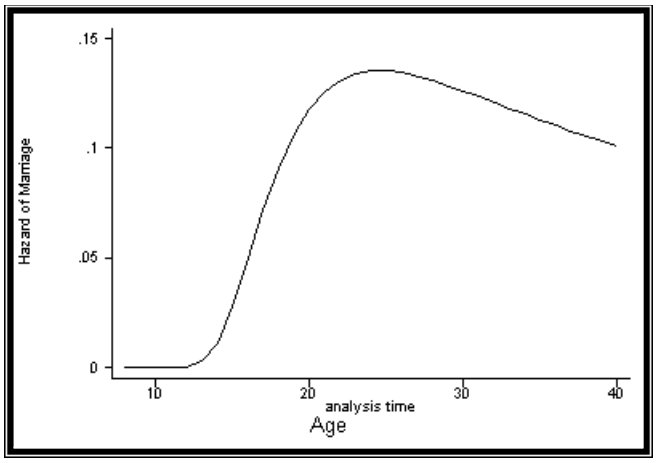
The main challenge in this estimating procedure is to find appropriate instruments for the endogenous regressors. In the case of the timing of marriage, we use information from the mortality module of the survey on the total number of married sisters a women has. This variable is unlikely to directly affect either the fertility or participation decisions, but is likely to affect the timing of marriage on the theory that parents with many daughters will prefer to marry them off early. In the case of fertility, we obtain estimates of average contraceptive use by age at the provincial level from the Moroccan Demographic Health Survey of 1992. These can as indicators of the availablity of family planning services in the vicinity of where the woman lives, and are, therefore, appropriate instruments for fertility.

First Stage: Estimation of the Timing and Probability of Marriage

The objective here is to predict the median age at first marriage for a woman of given characteristics for use as a regressor in the models for number of children and the probability of marriage for use as a determinant of the participation decision. In estimating the age at first marriage, we use a parametric duration model to account for the fact that the dependent variable is right censored for the unmarried women in the sample. Because the hazard of marrying is likely to first increase sharply after age 15, the legal age of marriage in Morocco, and then decrease gradually with age after the mid twenties, we adopt a generalized Gamma distribution, which allows for such a shape (See Figure 1).

Besides the number of married sisters a woman has, other explanatory variables for the age at first marriage

include age cohort (in 5-year age categories), the woman's education level, the education and work status of the parents, and region of residence. The woman's own education variable had to be carefully specified so that it would not be affected by the timing of marriage. We have therefore specified educational attainment into three categories: no schooling (the reference category), some primary (six or fewer years of schooling) and primary and above (more than 6 years of schooling). The decision to continue schooling beyond six years, which is usually done around age 12, is not likely to be affected by when a woman is to be married.



- **Figure 1 : Hazard Function for the Timing of Marriage using a Generalized Gamma Distribution**

Analysis time in our model is a woman's age, with the earliest observed entry time being 7, the earliest age at marriage in the sample. The median age at first marriage is calculated as the time, t, at which the survival function, S(t), is equal to 0.5. The predicted probability of marriage is equal to 1-S(t), where t is a woman's actual age. The survival function under the Gamma parametrization is given by:

$$S(t) = \begin{cases} 1 - I(\gamma, u), & \text{if } \kappa > 0 \\ 1 - \Phi(z) & \text{if } \kappa = 0 \\ I(\gamma, u) & \text{if } \kappa < 0 \end{cases}$$

where $\gamma = |\kappa|^{-2}$, $z = sign(\kappa)\{\ln(t_j) - \lambda_j\}/\sigma$, $u = \gamma \exp(|\kappa| z)$, $\Phi(z)$ is the standard normal cumulative distribution function, and $I(a,b)$ is the incomplete gamma function. κ is the Gamma parametrization shape parameter and σ is the scale parameter. The model is implemented by parametrizing $\lambda_j = \mathbf{x}_j\beta$ and treating κ and σ as ancillary parameters to be estimated from the data [2].

Second Stage: The Fertility Decision

Because the age of the children present in the household matters for the participation decision, we carry out estimates of both the total number of children born alive as well as the number of children under seven years of age for all ever married women in the sample [3]. In both cases we use the prediced age at first marriage, obtained from the first stage, as a regressor.

To account for the fact that the number of children is not a normally distributed continuous variables, it is preferrable to use a count data model rather than OLS. We opt for a negative binomial model, which is a count data distribution, which allows for greater variation than a true Poission distribution. In the case of number of children under seven, the relevant statistical tests show that the negative binomial model reduces to a Poisson model, which we use to maximize efficiency.

As mentioned above the instrumental variables used in this set of regressions are based on age-specific

contraceptive use in the province of residence, which is an indicator of access to family planning methdods and general awareness of these methods. For each of the 32 provinces represented in the sample, we use data from the 1992 Moroccan Demographic Health Survey to calculate mean use rates for different age cohorts of women for modern and traditional contraception methods. We thus produce a set of 14 instrumental variables (7 age groups by two types of methods). Other explanatory variables include the woman's age and age squared, her level of education, the presence of other adult women in the household, her parents' education, and region. The model for children under seven has an identical specification.

An additional set of instruments that could be used is the presence of unplanned births, as indicated by having twins in the first pregnancy (Rosenzweig and Wolpin, 1980). In our case, the number of women having twins proved to be very small and the rank of the twins in the order of births was other than the first pregancy in over half the cases. Moreover, introducing this variable would limit the sample to women who have had at least one pregnancy, which would eliminate many married women in our sample.

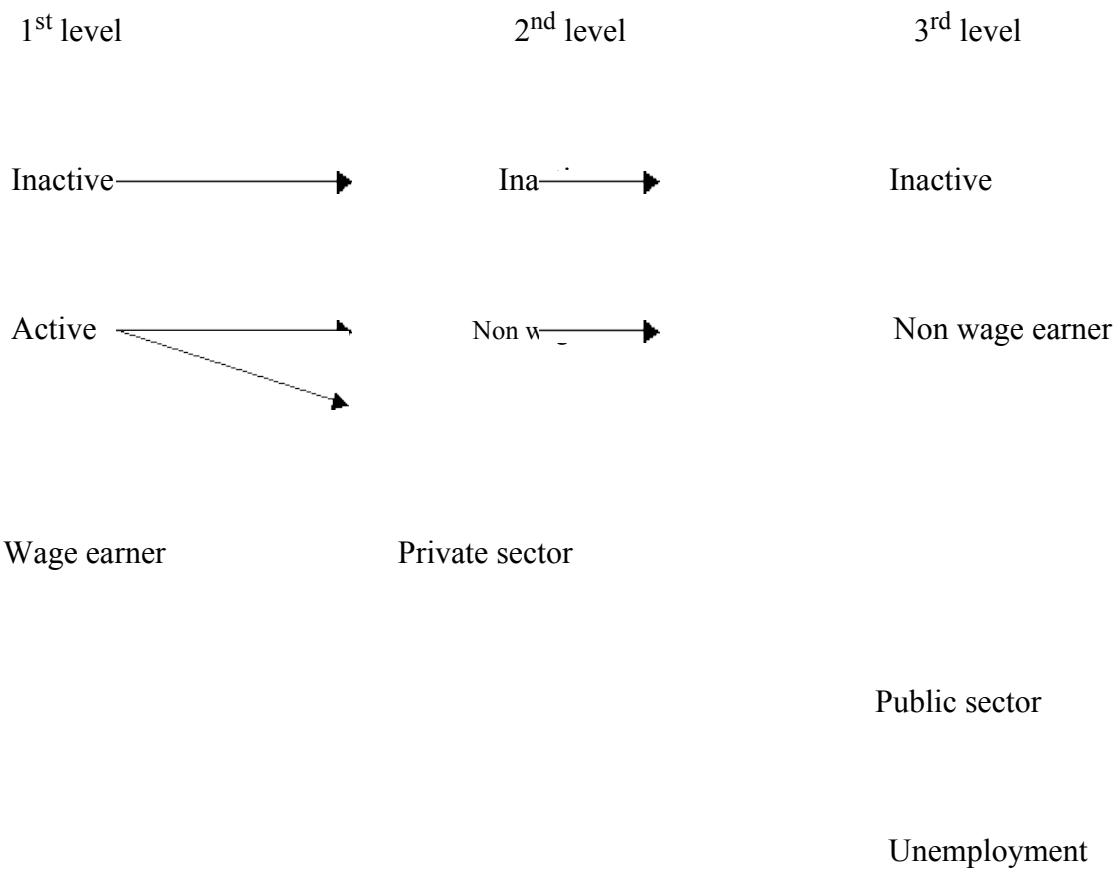
We use the estimates from the two fertility regressions to predict the number of children born alive and the number of children under seven for both married and unmarried women. The predicted number of children who are seven and older is calculated as the difference between these two predictions.

Before we can introduce the predicted number of children in the two age groups into the third stage of our analysis – the participation stage -- we need to deal with the fact that our fertility estimates are conditional on being married, and marriage is endogenously determined in our model. We obtain estimate of the number of children that are unconditional on marriage by multiplying the predicted probability of marriage obtained in the first stage with the predicted number of children in the two age groups obtained in the second stage.

Third Stage: The Participation Decision

As discussed above, the forms of participation in economic activity in the Moroccan context differ considerably in their implication for combining household responsibilities, and especially child rearing, with market work. Accordingly we distinguish between five possible participation states, namely domestic work only (non-participation), non-wage market work (which includes self-employment and unpaid family labor), public wage work, private wage work, and unemployment. Although the multinomial logit specification is often used for such a polychotomous dependent variable, this specification suffers from the need to make the independence of irrelevant alternatives (IIA) assumption. This assumption results from the maintained assumption that the disturbances associated with the utility derived from each option are independent and homoscedastic. One way to relax the IIA assumption is to group the orginal alternatives into subgroups and allow the variances to differ across the groups while maintaning the IIA assumption within the groups. This defines the nested logit model (Greene, 2000).

As shown in Figure 2, suppose that the particpation decision can be subdivided into a three-level choice problem. The first level consists of the decision of whether or not to engage in any kind of market work. The second level is a choice between wage and non-wage work for those who decide to participate in market work and leaves the non-participants as they are. The third level distinguishes between public and private work and unemployment, for those who select wage work, leaving the other branches unchanged [4]. Under the nested logit model, the IIA assumption is maintained within the alternatives of each decision, but can be relaxed across decisions.



- **Figure 2: Decision Tree for the Nested Logit Participation Model**

Suppose that each alternative at the third level is associated with a level of utility given by:

$$U_{ijk} = \beta' X_{ijk} + \alpha' Y_{ij} + \gamma' Z_i + \varepsilon_{ijk} + \varepsilon_{ij} + \varepsilon_i \qquad (1)$$

where Z_j ,Y_{ij} , and X_{ijk} ,and are vectors of explanatory variables specific to the first, second and third level choices, respectively and ε_i , ε_{ij} , ε_{ijk} are independent and identically distributed error terms with Weibull distribution [5]. The probability that an individual will choose alternative ijk in the third stage is given by:

$$P(ijk) = P(k|ij)P(j|i)P(i) \qquad (2)$$

where the conditional probability $P(k|ij)$ will depend only on the parameter vector β'.

$$P(k|ij) = \frac{e^{\beta' X_{ijk}}}{\sum_{n=1}^{N_{ij}} e^{\beta' X_{ijn}}} \qquad (3)$$

Define the inclusive value for the second level options j as:

$$I_{ij} = \ln \sum_{n=1}^{N_{ij}} e^{\beta' X_{ijn}}$$

so that the second level conditional probabilities $P(j|i)$ are given by:

$$P(j|i) = \frac{e^{\alpha' Y_{ij} + \pi_{ij} I_{ij}}}{\sum_{m=1}^{M_i} e^{\alpha' Y_{im} + \pi_{im} I_{im}}} \qquad (4)$$

Similarly define the inclusive value for the first level options i as follows:

$$J_i = \ln \sum_{m=1}^{M_i} e^{\alpha' Y_{im} + \pi_{im} I_{im}}$$

yielding the following unconditional first level probability P(i):

$$P(i) = \frac{e^{\beta' Z_i + \delta_i J_i}}{\sum_{l=1}^{L} e^{\beta' Z_l + \delta_l J_l}} \qquad (5)$$

By substituting equations (3), (4) and (5) into equation (2), we obtain an expression of how the probability of each level-3 alternative depends on the explanatory variables and the model parameters. The nested logit model can be estimated by full information maximum likelihood estimation, where the log-likelihood function is given by:

$\ln L = \sum_{g=1}^{G} \ln P_g(i,j,k)$ where g indexes individuals in the sample.

3. Data and Descriptive Statistics

Our main source of data from this study is the Moroccan Living Standards Measurement Study (LSMS), which was carried out in 1990-91. The overall sample for this household survey consists of 3,323 households, containing 19,577 individuals. Our working sample consists of all urban never married women aged 15 to 54 (1,076 individuals) and a subsample of urban ever married females aged 15-54 to whom the fertility module of the survey was administered (1,237 individuals). The fertility module was administered to only one randomly selected ever-married woman in each household.

[See Table 1]

As shown in Table 1, mean age of marriage for the ever married women was 18.5 , with wage workers in the private and public sectors having a higher than average age at marriage and non-participants and non-wage workers having lower than average age at marriage. On average, these ever-married women have 3.8 children, with public and private wage workers, as well as the unemployed having fewer children than average. The pattern for children less than seven is less clear, with non-wage workers having fewer of them than wage workers but no-participants having more of them. These patterns could well indicate an association between employment status, on the one hand, and the timing of marriage and fertility, on the other hand, or they could simply be due to the fact that differences in educational and other characteristics among women in different employment states account for their differences in age at marriage and in fertility. It will be up to the multivariate analysis to show us how fertility and timing of marriage affect employment choices.

Comparing the never-married and the ever-married subsamples, the statistics shown in Table 1 show that the never-married women are much younger than the ever-married women. The distribution by age group reveals that 44 percent of the never-married women are below the age of 20, compared to only 1.6 percent of the ever-married ones. Never-married women are also more educated, and have more educated parents.

Never married women are somewhat more likely to be active than ever-married women, with an overall activity rate of 29 percent compared to 21 percent. However, they are also much four times as likely to be unemployed, with a 12 percent of them being unemployed compared to 3 percent for ever-married women. Never married women who are employed however, are much more likely to be private sector wage workers, whereas employed ever-married women are more likely to be non-wage or public sector workers. These results suggest that public sector work and non-wage work may be much more accommodating to the domestic and child rearing responsibilities that come with marriage than is private sector employment. Again, these preliminary observations will need to be confirmed in the multivariate analysis.

Comparing the characteristics of women in different employment states within the never-married subsample, we find that among wage workers in the public and private sectors are older, suggesting an association between these work states and a delay in marriage. There is a sharp contrast in education, however, among never-married women working for wages in the private and public sectors. Never married female wage workers in the private sector are significantly less educated than average, whereas their counterparts in the public sector are significantly more educated. A similar pattern holds true for the education of their fathers. Private wage workers are also much more likely to have an inactive father than never-married women in any other employment state. Turning to the ever-married women subsample, we note that unemployed women are the youngest among them, and non-wage workers the oldest. Although public sector wage workers are still the most educated among them, the least educated are non-wage workers, followed by non-participants. Again, similar patterns holds for father's education. Mother's education is invariably very low among ever-married women, with private and public wage workers having the most educated mothers.

4. Estimation Results

In what follows, we present estimation results in the order laid out in the methodology section above. We start with the determinants of the timing of marriage, moving onto the determinants of fertility ending with the nested logit participation model.

First Stage: Estimation of the Age at First Marriage

As indicated above, we estimate a parametric duration model for the age at first marriage using a Gamma parametrization. The first thing to note is that the instrument we selected for the timing of marriage, namely the number of married sisters is highly significant and has the expected negative sign. Because parents with many daughters will typically want to marry them off quickly, women with more married sisters tend to marry earlier. The marginal effect indicates that each additional married sister reduces the age at marriage by about 0.6 years for the reference woman [6]. We marked the few cases that had missing information on married sisters with an indicator variable. The fact that this variable is positive and significant suggests that women with few or no married sisters were more likely to report the number of married sisters as missing.

[See Table 2]

The fact that the coefficients of the age cohort dummies are all negative indicates that, as expected, age at marriage has increased steadily over the years in Morocco. As shown in Figure 2, women with reference characteristics above age 45 have the lowest predicted age at marriage of about 21 and the predicted age at

marriage increases steadily as age declines to reach about 26 years for the youngest women in the sample.

As expected, a woman's own education significantly raises the age at marriage. A woman with reference characteristics have has had some primary education marry 0.52 years later than one with no education, and one who completed more than six years of schooling marries 4.4 years later. Parental education also tends to raise women's age of marriage, as educated parents are more likely to be aware of the problems associated with marrying their daughters early. A reference woman with a father who has some primary education marries 1.1 years later than one who's father is illiterate, and one whose father has some secondary education or more marries 1.4 years later. Mother's education has an even larger effect. A reference woman whose mother has some primary education marries 2.5 years later than one whose mother is illiterate. The fact there is no significant effect for mothers with higher levels of education can probably be attributed to the very small fraction of mothers with more than primary education.

It is hard to know a priori what direction of effect to expect on a father's activity status. It turns out that active fathers marry their daughters much sooner than inactive fathers. Since paternal activity is probably related to the age of the father, this is probably an indication of the difference in age between father and daughter. Holding the woman's age constant, an inactive father probably indicates an older father and therefore a larger age difference. Fathers who have daughters later in life are probably less likely to marry them off early. Maternal activity has the expected positive effect on age at marriage. Mothers who work are more likely to want to keep their daughters at home with them to help with household chores.

We decided to specify the regions of Morocco in this regression at a greater level of detail to capture possible cultural and ethnic differences in attitudes about early marriage. With the Casa Blanca region as the reference category, we note a somewhat lower age at marriage in the Southern region of Guelmime–Es Semara, in the Center-South region of Tadla-Azilal, in the Central region of Chaouia–Ouardigha, and in the Northern region of Tanger–Tetouan. Age at marriage for urban women in other regions of the country is not significantly different from Casa Blanca, when other variables are controlled for.

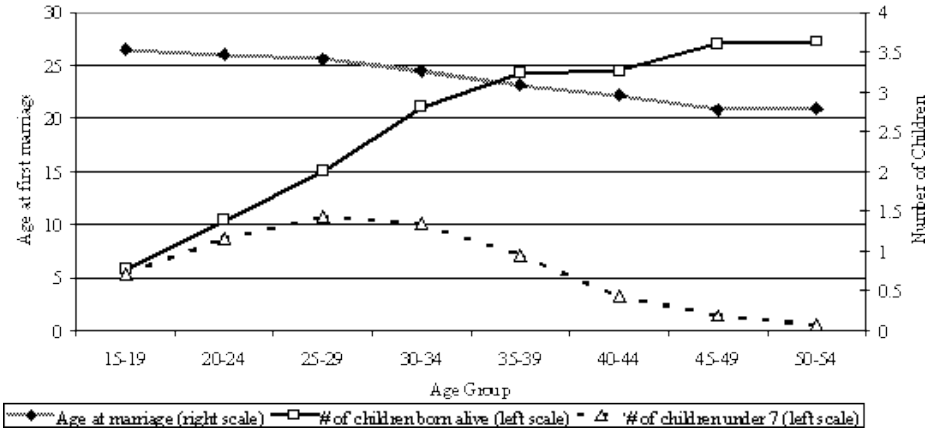
Second Stage: The Fertility Equation

In this stage of the analysis we estimate the number of children born alive and the number of children under seven years of age present in the household for urban ever-married women between the ages of 15 and 54. As shown in Table 3, the predicted median age at first marriage obtained from the first stage, has the expected negative effect on fertility. For the reference woman, a delay in marrying of one year significantly reduces the reference woman's fertility by 0.04 children. The effect on number of children under seven is not significant.

[See Table 3]

At least some of the age-specific rates of contraceptive use at the province level by type of contraception appear to be significant determinants of fertility, indicating that they are appropriate instruments. For the modern methods of contraception, three of the age-specific utilization rates are significant determinants of the total number of children born alive, and two of the three have the expected negative sign. Only the utilization rate for women 45-49 is a significant determinant of the number of children under age seven. For the traditional methods, five of the age-specific utilization rates have a significant effect on the total number of children born alive, with four out of the five, having the expected sign. None of the traditional methods utilization rates have an effect on the number of children under seven.

Figure 2
Predicted Median Age At Marriage, Predicted Number of Children Born Alive, Predicted Number of Children Under Six by Age Cohort, Urban Moroccan Women 15-54, 1991



To further test the performance of our instruments, we conducted a Wald test of the joint significance of all the coefficients of the age-specific rates of modern contraceptive use and found them to be jointly significant in both models. A similar test for the traditional methods also proved significant. Finally, we replaced the age-specific rates with a single rate of modern contraceptive use and one of traditional contraceptive use and found both to be negative and significant determinant of fertility in both models. As expected, the number of children born alive increases steadily with age, with all the age group dummies being positive, significant, and progressively larger. As shown in Figure 2, the predicted number of children born alive for the reference woman increases from 0.77 children at age 15 to 19 to 3.23 children for women aged 35-39, stabilizes, and then increases again for women 45 to 49 and 50 to 54. The predicted number of children under 6 increases from 0.71 at age 15-19 to reach a peak of 1.43 at age 25-29, and then declines steadily to about 0 at age 50 to 54.

The education variable is specified in a little more detail in this model than in the age of marriage regression, with dummy variables indicating levels of educational attainment from incomplete primary to university. Illiterate is still the reference category. In the regression for the total number of children born alive, all the education coefficients are negative and increasing in magnitude, indicating an inverse relationship between education and fertility. For the regression of children under seven, the coefficients are all negative as well, but there is a weaker association between the number of children in this age group and the education level, because the younger women who are likely to have such children are also likely to be more educated. The marginal effects indicate that increasing the level of education for the reference woman from illiterate to lower secondary reduces the total number of children she is expected to have from 0.77 to 0.59 children, a reduction of 23 percent. A further increase in education and increasing it all the way to university reduces it to 0.39 children or 49 percent.

Once a woman's own education is taken into account, parental education seems to have a weak and insignificant effect on a woman's fertility. The presence of other adult women in the household appears to significantly increase the total number of children born alive, but to reduce the number of children under seven. The first effect can be interpreted to be the result of the reduced burden of child care when other care providers are available. It is not clear why the presence of alternative care givers would reduce the number of children under seven.

Compared to Casa Blanca, the reference region, urban areas in the regions of Tensift and the East have higher fertility rates. Fertility in the urban areas of other regions seems to be no different from that of Casa Blanca.

Third Stage: The Participation Decision

In this stage of the analysis we estimate a structural nested logit model of participation with the probability of marriage, the expected number of children under seven and the expected number of children 6 and over as endogenous regressors. As indicated in the methodology section, the expected number-of-children variables are specified here as unconditional on marriage by multiplying the predicted number of children conditional on having married by the probability of having married. The estimation results are shown in Table 4. The reference state is inactive in the first level, non-wage worker in the second level, and private wage worker in the third level. The interpretation of the coefficient estimates is therefore how the relevant variable affects log odds of being active vs. inactive in the first level, being a wage worker versus a non-wage worker in the second level, conditional on having chosen to be active in the first level, and being a public wage worker or being unemployment versus a private wage worker in the third level, conditional on having chosen wage work in the second level.

[See Table 4]

The predicted probability of marriage appears on its own and interacted with the number of children conditional on being married. The interpretation of the coefficients associated with this variable is therefore the effect of being married and not having children, a situation in which few women find themselves in Morocco. Being married with no children, has no significant effect on the choice to be active nor the choice to be a wage worker. It has a large positive effect on being employed for wages in the public sector. In other words, has a negative effect of being employed for wages in the private sector once the wage work path has been chosen. This is not surprising given that a woman's domestic responsibility increase significantly with marriage, making it incompatible with the usually long hours of work required in private sector wage work.

Surprisingly the predicted number of children under the age of seven has an insignificant impact on the probability of being active, on the probability of being a wage worker once active, and on the probability of being unemployed or a public sector worker, once a wage worker. In fact, the expected negative effect of having young children on private wage work seems to have been already captured by the probability of marriage variable.

Having children who are seven years of age and older has a negative effect on the probability of being a wage worker, once active, confirming that non-wage work is more compatible with child care than wage work. It has insignificant effects on the choice of being active and an insignificant effect on the type of wage work one engages in.

The preceding reveal that wage work in the private and public sectors have extremely different implications for married and unmarried women. The public sector appears to be much more hospitable to married women. It seems fairly easy to continue working in the public sector after marriage, whereas most private sector workers quit their jobs after marrying. Although Moroccan law in theory provides for paid and unpaid maternity leaves in all sectors, these are often only respected in the public sector. Mothers in that sector can also benefit from child care services and can generally work significantly shorter hours than in the private sector. In contrast, it appears to be very difficult to be a mother in the private sector.

We now move to the discussion of the remaining regressors on the participation decision. The coefficients estimates are shown in Table 4. Age and age squared have predictable pattern on the probability of being active and on the probability of wage work once active. These probabilities first increase with age and then decline after a certain point. The negative coefficient of age and positive coefficient on age squared in the case of participation in the public sector (relative to the private sector) shows in no uncertain terms the effects of the dramatic slowdown in public sector hiring in Morocco in recent years and the resultant aging of the public sector work force.

The probability of being active seems to have a U-shaped relationship with education, with the highest levels reached for illiterates and university graduates and lowest for the lower secondary level. However, none of the education dummies are significant for this selection process. Education does not seem to strongly influence the choice of engaging in wage work versus non-wage work either, once the decision to be active has been made. In contrast, education has a very strong effect on the probability of joining the public sector relative to working for wages in the private sector, and on the probability of unemployment, also relative to wage work in the private sector. The strong similarity in the effect of education on unemployment and public sector work suggests that unemployment in Morocco is strongly concentrated among the more educated youths who in the past would have been hired by the public sector but whose opportunities in that sector have been strongly curtailed by attempts to reduce the growth of that sector. The private sector on the other hand seems to hire primarily less educated workers, providing few acceptable opportunities for the more educated. The relative drop in unemployment at the university level indicates that those most affected by the slowdown in public sector hiring are workers with intermediate levels of education.

Once a woman's own education has been controlled for, the education of the father seems to have little effect on the decision to be active and that of being a wage worker. However, it significantly increases the probability of working in the public sector and of being unemployed, relative to working for wages in the private sector. This confirms again that women from relatively more privileged backgrounds tend to shun wage work in the private sector and have a strong preference for public sector work. When they are unable to get such work, they remain unemployed. The education of the mother does not have much of an effect on the participation decision.

The presence of men in the household, irrespective of their employment status, tends to have no significant effect on the participation decision, once the other determinants have been controlled for. The presence of adult women seems to increase the probability of wage work, but the effect is only significant at the 10 percent level. This is in line with expectations, since other adult women can serve as alternative caregivers and can reduce the burden of domestic work, allowing a woman to work outside the home.

5. Conclusion

Our analysis has allowed us to elucidate the causal relationship between the timing of marriage and fertility on the one hand, and between these two factors and a woman's participation decision in urban Morocco, while overcoming the methodological difficulties associated with the mutual interdependence of these decisions. Through a judicious choice of instruments for the timing of marriage and fertility, we were able to estimate structural equations that provide estimates for the effect of fertility and marital status on the participation decision. We were also able to specify participation as a set of distinct employment states, offering significantly different opportunities for women to reconcile between market work and their domestic responsibilities.

Our findings indicate that marriage per se significantly reduces participation in private wage work, relative to public wage work. We also find that participation as a whole and in wage work relative to non-wage work is not strongly affected by marriage. The results also suggest that the presence of children under seven does not have a significant effect beyond that of marriage. Since the arrival of children is an anticipated event once a women gets married, its effect may already be included in the effect of marriage. The larger the number of children 6 and over a woman has, the less likely she is to participate in wage work.

With regards to the other determinants of participation, our work confirms previous results that indicate a strong positive relationship between education and participation in public sector work and in the probability of being unemployed. It suggests that the significant increase in unemployment among youth in Morocco in recent years is directly associated with the slowdown in public sector employment. Since the public sector

hires primarily female workers with intermediate and higher levels of education, these are the workers that have the highest rates of unemployment. It appears however that university educated workers experience less unemployment than those with secondary schooling.

Endnotes:

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[1] In a subsequent study we intend to address the problem of the downward bias of reported standard errors when predicted regressors are present by bootstrapping all three stages of the model and reporting the bootstrap standard errors.

[2] See STATA reference manual, Volume 3, p. 353

[3] The large effect that the presence of preschool children has on participation has been noted by Nakamura and Nakamura (1992) and Zie (1997).

[4] We assume that the unemployed are either wage or salary workers who lost their jobs or young new entrants to the workforce who are primarily seeking wage employment. This allows us to specify unemployment as an option within the wage branch. Those seeking to set up their own enterprises are not likely to be a significant fraction of the unemployed in Morocco.

[5] In our case, all the explanatory variables refer to the individual's or her household's characteristics rather than to the alternatives she selects so that the same explanatory variables show up at all three stages. Since each potential alternative is specified as a separate observation in the nested logit model, it was necessary to re-specify all the explanatory variables as interactions between the original explanatory variables and the relevant alternatives at teach level, thus leading to different vectors of explanatory variables at each level.

[6] The reference woman is one for whom all dummy variables take on a value of 1 and whose continuous variables are set at the sample mean. For purposes of this regression, the reference woman is a 15 to 19 year old illiterate woman who has no married sisters and whose parents have not completed their primary education and are not economically active. She lives in the Greater Casa Blanca region.

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Table 1: Descriptive Statistics for the Variables Used in the Analysis, Urban Moroccan Women, Ages 15-54, 1991

	Never Married						Ever Married					
	Inactive	Non-Wage Workers	Private Wage Workers	Public Wage Worker	Unemployed	All	Inactive	Non-Wage Workers	Private Wage Workers	Public Wage Worker	Unemployed	All
Endogenous Variables:												
age at marriage	N/A.	N/A.	N/A.	N/A.	N/A.	N/A.	18.262	17.351	19.078	21.148	18.429	18.458
							(3.354)	(2.892)	(4.233)	(4.466)	(3.852)	(3.568)
total number of children	N/A.	N/A.	N/A.	N/A.	N/A.	N/A.	4.064	3.922	2.688	2.239	2.429	3.808
							(2.784)	(3.090)	(1.983)	(1.794)	(3.128)	(2.779)
number of children under 7	N/A.	N/A.	N/A.	N/A.	N/A.	N/A.	0.888	0.558	0.719	0.648	0.571	0.833
							(0.974)	(0.925)	(0.917)	(0.774)	(0.815)	(0.956)
Number of Married Sisters:												
number of married sisters	0.823	0.592	0.950	1.313	0.908	0.849	2.109	1.987	2.375	2.023	1.400	2.089
	(1.314)	(0.788)	(1.329)	(1.991)	(1.235)	(1.314)	(1.672)	(2.593)	(2.059)	(1.794)	(1.439)	(1.770)
number of married sisters missing	0.058	0.082	0.188	0.094	0.108	0.078	0.013	0.039	0.031	0.057	0.086	0.021
	(0.233)	(0.277)	(0.393)	(0.296)	(0.311)	(0.268)	(0.115)	(0.195)	(0.175)	(0.233)	(0.284)	(0.144)
Age and Age Categories:												
Age	20.9	23.3	24.2	30.1	23.9	21.9	36.8	39.2	37.4	37.3	34.0	36.9

	(5.7)	(7.7)	(7.4)	(5.5)	(4.7)	(6.2)	(9.6)	(9.1)	(7.8)	(7.2)	(10.5)	(9.3)
Age Squared	466.9	603.4	642.3	937.3	591.2	518.6	1442.9	1617.8	1455.2	1445.4	1263.7	1449.5
	(298.3)	(446.9)	(410.8)	(344.6)	(251.6)	(329.1)	(714.0)	(692.8)	(610.5)	(558.6)	(764.4)	(700.2)
Age 15-19*	0.521	0.388	0.347	0.000	0.162	0.440	0.017	0.013	0.000	0.000	0.057	0.016
	(0.500)	(0.487)	(0.476)	(0.000)	(0.368)	(0.496)	(0.131)	(0.113)	(0.000)	(0.000)	(0.232)	(0.126)
Age 20-24	0.275	0.306	0.198	0.188	0.423	0.284	0.098	0.052	0.016	0.011	0.114	0.085
	(0.447)	(0.466)	(0.400)	(0.397)	(0.496)	(0.451)	(0.297)	(0.223)	(0.125)	(0.107)	(0.323)	(0.279)
Age 25-29	0.128	0.122	0.208	0.281	0.323	0.164	0.151	0.117	0.141	0.114	0.257	0.149
	(0.335)	(0.331)	(0.408)	(0.457)	(0.469)	(0.370)	(0.358)	(0.323)	(0.350)	(0.319)	(0.443)	(0.356)
Age 30-34	0.043	0.061	0.158	0.313	0.077	0.067	0.174	0.130	0.219	0.295	0.200	0.183
	(0.203)	(0.242)	(0.367)	(0.471)	(0.268)	(0.250)	(0.379)	(0.338)	(0.417)	(0.459)	(0.406)	(0.387)
Age 35-39	0.021	0.082	0.069	0.156	0.008	0.031	0.170	0.156	0.297	0.216	0.057	0.175
	(0.143)	(0.277)	(0.255)	(0.369)	(0.088)	(0.172)	(0.375)	(0.365)	(0.460)	(0.414)	(0.236)	(0.380)
Age 40-44	0.007	0.020	0.010	0.063	0.000	0.008	0.138	0.195	0.141	0.182	0.086	0.143
	(0.081)	(0.143)	(0.100)	(0.246)	(0.000)	(0.091)	(0.345)	(0.399)	(0.350)	(0.388)	(0.284)	(0.350)

Table 1: Descriptive Statistics (Continued)

	Never Married						Ever Married					
	Inactive	Non-Wage Workers	Private Wage Workers	Public Wage Worker	Unemployed	All	Inactive	Non-Wage Workers	Private Wage Workers	Public Wage Worker	Unemployed	All
Age 45-49	0.003	0.000	0.000	0.000	0.008	0.003	0.122	0.208	0.063	0.114	0.114	0.124
	(0.051)	(0.000)	(0.000)	(0.000)	(0.088)	(0.053)	(0.328)	(0.408)	(0.244)	(0.319)	(0.323)	(0.329)
Age 50-54	0.003	0.020	0.010	0.000	0.000	0.004	0.131	0.130	0.125	0.068	0.114	0.125
	(0.051)	(0.143)	(0.100)	(0.000)	(0.000)	(0.061)	(0.337)	(0.338)	(0.333)	(0.254)	(0.323)	(0.331)
Own Schooling:												
no schooling*	0.195	0.184	0.465	0.094	0.108	0.206	0.695	0.779	0.578	0.125	0.486	0.648
	(0.396)	(0.387)	(0.499)	(0.291)	(0.310)	(0.405)	(0.461)	(0.415)	(0.494)	(0.331)	(0.500)	(0.478)
incomplete primary	0.178	0.490	0.257	0.031	0.162	0.193	0.170	0.143	0.078	0.057	0.314	0.159
	(0.383)	(0.505)	(0.439)	(0.177)	(0.369)	(0.395)	(0.375)	(0.352)	(0.270)	(0.233)	(0.471)	(0.366)
complete primary	0.315	0.204	0.089	0.188	0.231	0.275	0.086	0.026	0.031	0.159	0.000	0.082
	(0.465)	(0.407)	(0.286)	(0.397)	(0.423)	(0.447)	(0.281)	(0.160)	(0.175)	(0.368)	(0.000)	(0.275)
lower secondary	0.229	0.061	0.099	0.250	0.200	0.206	0.032	0.026	0.109	0.205	0.057	0.049
	(0.421)	(0.242)	(0.300)	(0.440)	(0.402)	(0.405)	(0.176)	(0.160)	(0.315)	(0.406)	(0.236)	(0.215)
vocational secondary	0.016	0.041	0.069	0.156	0.115	0.038	0.009	0.000	0.063	0.216	0.057	0.027
	(0.124)	(0.200)	(0.255)	(0.369)	(0.321)	(0.192)	(0.096)	(0.000)	(0.244)	(0.414)	(0.236)	(0.164)
upper secondary	0.056	0.020	0.020	0.094	0.131	0.061	0.003	0.013	0.031	0.114	0.057	0.015
	(0.231)	(0.143)	(0.140)	(0.296)	(0.338)	(0.240)	(0.055)	(0.114)	(0.175)	(0.319)	(0.236)	(0.120)

university	0.010	0.000	0.000	0.188	0.054	0.020	0.005	0.013	0.109	0.125	0.029	0.020
	(0.102)	(0.000)	(0.000)	(0.397)	(0.227)	(0.138)	(0.072)	(0.114)	(0.315)	(0.333)	(0.169)	(0.141)
Parental Schooling:												
father, illiterate or incomp. primary*	0.527	0.653	0.782	0.375	0.485	0.547	0.783	0.831	0.766	0.602	0.571	0.766
	(0.499)	(0.476)	(0.413)	(0.484)	(0.500)	(0.498)	(0.412)	(0.375)	(0.424)	(0.489)	(0.495)	(0.423)
father, complete primary	0.321	0.286	0.168	0.563	0.415	0.323	0.191	0.156	0.125	0.307	0.400	0.200
	(0.467)	(0.456)	(0.376)	(0.504)	(0.495)	(0.468)	(0.393)	(0.365)	(0.333)	(0.464)	(0.497)	(0.400)
father, secondary or above	0.152	0.061	0.050	0.063	0.100	0.129	0.026	0.013	0.109	0.091	0.029	0.034
	(0.359)	(0.242)	(0.218)	(0.246)	(0.301)	(0.336)	(0.158)	(0.114)	(0.315)	(0.289)	(0.169)	(0.181)
mother, illiterate or incomp, primary*	0.822	0.878	0.931	0.938	0.831	0.839	0.980	0.974	0.922	0.943	0.971	0.974
	(0.383)	(0.328)	(0.254)	(0.242)	(0.375)	(0.367)	(0.138)	(0.159)	(0.268)	(0.231)	(0.167)	(0.159)
mother, complete primary	0.115	0.102	0.040	0.031	0.138	0.108	0.014	0.013	0.031	0.034	0.000	0.016
	(0.319)	(0.306)	(0.196)	(0.177)	(0.347)	(0.310)	(0.119)	(0.114)	(0.175)	(0.183)	(0.000)	(0.126)

Table 1: Descriptive Statistics (Continued)

	Never Married						Ever Married					
	Inactive	Non-Wage Workers	Private Wage Workers	Public Wage Worker	Unemployed	All	Inactive	Non-Wage Workers	Private Wage Workers	Public Wage Worker	Unemployed	Al
mother, secondary or above	0.063	0.020	0.030	0.031	0.031	0.053	0.005	0.013	0.047	0.023	0.029	0.0
	(0.243)	(0.143)	(0.171)	(0.177)	(0.173)	(0.224)	(0.072)	(0.114)	(0.213)	(0.150)	(0.169)	(0.0
Parental Activity Status:												
father, active	0.827	0.898	0.931	0.719	0.777	0.831	0.989	0.961	1.000	0.943	0.943	0.9
	(0.378)	(0.306)	(0.255)	(0.457)	(0.418)	(0.375)	(0.106)	(0.195)	(0.000)	(0.233)	(0.236)	(0.1
mother, active	0.139	0.265	0.178	0.094	0.138	0.147	0.111	0.195	0.188	0.080	0.143	0.1
	(0.346)	(0.446)	(0.385)	(0.296)	(0.347)	(0.354)	(0.314)	(0.399)	(0.393)	(0.272)	(0.355)	(0.3
Household Characteristics:												
presence of inactive males	0.559	0.408	0.356	0.594	0.469	0.523	0.398	0.260	0.172	0.239	0.314	0.3
	(0.813)	(0.840)	(0.687)	(0.798)	(0.864)	(0.811)	(0.731)	(0.616)	(0.521)	(0.479)	(0.932)	(0.7
presence of male wage workers	0.429	0.469	0.436	0.250	0.300	0.411	0.365	0.416	0.203	0.125	0.200	0.3
	(0.750)	(0.767)	(0.767)	(0.568)	(0.643)	(0.736)	(0.644)	(0.695)	(0.596)	(0.396)	(0.473)	(0.6
presence of male non-wage workers	0.359	0.327	0.267	0.156	0.231	0.327	0.342	0.234	0.281	0.136	0.286	0.3
	(0.696)	(0.555)	(0.527)	(0.574)	(0.536)	(0.656)	(0.629)	(0.535)	(0.487)	(0.345)	(0.572)	(0.6
presence of other adult females	0.988	0.939	0.970	0.906	0.962	0.979	0.576	0.714	0.500	0.568	0.543	0.5
	(0.108)	(0.242)	(0.171)	(0.296)	(0.193)	(0.145)	(0.495)	(0.455)	(0.504)	(0.498)	(0.505)	(0.4
Modern												

contraceptive use in province:												
by women 15-19	0.308	0.286	0.337	0.276	0.268	0.304	0.300	0.267	0.367	0.281	0.277	0.2
	(0.217)	(0.243)	(0.298)	(0.220)	(0.198)	(0.225)	(0.213)	(0.218)	(0.298)	(0.261)	(0.191)	(0.2
by women 20-24	0.340	0.373	0.393	0.395	0.338	0.348	0.340	0.341	0.384	0.369	0.327	0.3
	(0.133)	(0.201)	(0.143)	(0.224)	(0.111)	(0.140)	(0.141)	(0.192)	(0.146)	(0.161)	(0.135)	(0.1
by women 25-29	0.419	0.431	0.427	0.433	0.420	0.421	0.418	0.427	0.414	0.428	0.404	0.4
	(0.121)	(0.110)	(0.121)	(0.118)	(0.132)	(0.121)	(0.117)	(0.113)	(0.136)	(0.132)	(0.121)	(0.1
by women 30-34	0.430	0.414	0.441	0.370	0.434	0.429	0.420	0.398	0.419	0.442	0.408	0.4
	(0.135)	(0.170)	(0.157)	(0.174)	(0.128)	(0.140)	(0.138)	(0.170)	(0.161)	(0.166)	(0.137)	(0.1
by women 35-39	0.467	0.470	0.436	0.456	0.446	0.462	0.475	0.463	0.442	0.454	0.429	0.4
	(0.135)	(0.108)	(0.120)	(0.133)	(0.128)	(0.132)	(0.148)	(0.147)	(0.139)	(0.135)	(0.115)	(0.1
by women 40-44	0.406	0.410	0.384	0.433	0.423	0.407	0.412	0.448	0.383	0.388	0.424	0.4
	(0.148)	(0.199)	(0.172)	(0.167)	(0.174)	(0.157)	(0.167)	(0.201)	(0.190)	(0.190)	(0.218)	(0.1
by women 45-49	0.263	0.269	0.275	0.272	0.289	0.268	0.246	0.250	0.247	0.268	0.277	0.2
	(0.148)	(0.177)	(0.162)	(0.153)	(0.152)	(0.151)	(0.157)	(0.196)	(0.177)	(0.153)	(0.203)	(0.1

Table 1: Descriptive Statistics (Continued)

	Never Married						Ever Married					
	Inactive	Non-Wage Workers	Private Wage Workers	Public Wage Worker	Unemployed	All	Inactive	Non-Wage Workers	Private Wage Workers	Public Wage Worker	Unemployed	All
Traditional contraceptive use in province:												
by women 15-19	0.004	0.000	0.013	0.000	0.003	0.004	0.003	0.001	0.005	0.015	0.010	0.004
	(0.034)	(0.002)	(0.065)	(0.000)	(0.029)	(0.036)	(0.030)	(0.003)	(0.042)	(0.070)	(0.056)	(0.035
by women 20-24	0.043	0.034	0.044	0.052	0.043	0.043	0.041	0.034	0.031	0.041	0.036	0.040
	(0.047)	(0.048)	(0.049)	(0.050)	(0.045)	(0.047)	(0.046)	(0.052)	(0.042)	(0.050)	(0.046)	(0.046
by women 25-29	0.042	0.031	0.040	0.051	0.044	0.042	0.039	0.028	0.026	0.047	0.030	0.038
	(0.046)	(0.045)	(0.058)	(0.051)	(0.051)	(0.048)	(0.045)	(0.040)	(0.044)	(0.062)	(0.040)	(0.046
by women 30-34	0.063	0.060	0.071	0.051	0.069	0.064	0.064	0.064	0.067	0.079	0.056	0.065
	(0.054)	(0.055)	(0.054)	(0.039)	(0.057)	(0.054)	(0.059)	(0.050)	(0.056)	(0.058)	(0.042)	(0.058
by women 35-39	0.081	0.066	0.098	0.076	0.081	0.082	0.081	0.077	0.073	0.096	0.073	0.081
	(0.066)	(0.072)	(0.082)	(0.080)	(0.070)	(0.069)	(0.067)	(0.067)	(0.075)	(0.083)	(0.066)	(0.069
by women 40-44	0.064	0.067	0.099	0.095	0.074	0.069	0.060	0.057	0.071	0.109	0.064	0.064
	(0.087)	(0.091)	(0.107)	(0.098)	(0.090)	(0.090)	(0.085)	(0.080)	(0.082)	(0.117)	(0.081)	(0.088
by women 45-49	0.067	0.073	0.095	0.049	0.062	0.069	0.064	0.057	0.081	0.090	0.052	0.066
	(0.077)	(0.085)	(0.077)	(0.064)	(0.067)	(0.077)	(0.078)	(0.071)	(0.083)	(0.077)	(0.059)	(0.078
Region:												

South	0.110	0.122	0.129	0.219	0.085	0.112	0.132	0.169	0.250	0.080	0.200	0.138
	(0.313)	(0.331)	(0.337)	(0.420)	(0.279)	(0.316)	(0.338)	(0.377)	(0.436)	(0.272)	(0.406)	(0.345
Tensift	0.149	0.204	0.198	0.313	0.223	0.170	0.131	0.182	0.156	0.205	0.171	0.141
	(0.357)	(0.407)	(0.400)	(0.471)	(0.418)	(0.376)	(0.337)	(0.388)	(0.366)	(0.406)	(0.382)	(0.349
Center*	0.101	0.143	0.218	0.094	0.115	0.115	0.117	0.182	0.188	0.102	0.257	0.128
	(0.301)	(0.350)	(0.413)	(0.291)	(0.319)	(0.319)	(0.322)	(0.386)	(0.390)	(0.303)	(0.437)	(0.334
North-West	0.154	0.163	0.218	0.125	0.215	0.167	0.140	0.169	0.109	0.284	0.171	0.151
	(0.362)	(0.373)	(0.415)	(0.336)	(0.413)	(0.373)	(0.347)	(0.377)	(0.315)	(0.454)	(0.382)	(0.358
Center-North	0.134	0.122	0.178	0.094	0.108	0.133	0.148	0.169	0.188	0.159	0.143	0.152
	(0.340)	(0.331)	(0.385)	(0.296)	(0.311)	(0.340)	(0.355)	(0.377)	(0.393)	(0.368)	(0.355)	(0.359
East	0.198	0.102	0.020	0.125	0.154	0.169	0.171	0.026	0.016	0.057	0.029	0.141
	(0.398)	(0.306)	(0.140)	(0.336)	(0.362)	(0.375)	(0.376)	(0.160)	(0.125)	(0.233)	(0.169)	(0.349
Center-South	0.154	0.143	0.040	0.031	0.100	0.133	0.162	0.104	0.094	0.114	0.029	0.148
	(0.362)	(0.354)	(0.196)	(0.177)	(0.301)	(0.340)	(0.369)	(0.307)	(0.294)	(0.319)	(0.169)	(0.355
Number of Observations	764	49	101	32	130	1076	973	77	64	88	35	1237

Standard Deviations are in parentheses.

* denotes reference category, N/A. = "not applicable"

Table 2: Determinants of Age at First Marriage.

Estimates from a Parametric Duration Model of Age at First Marriage (Generalized Gamma Distribution), Urban Moroccan Females 15-54,1991

Variables	Age at first marriage	
	Coefficients	Marginal effects
Number of married sisters	-0.022	-0.588
	(0.004)***	(0.098)***
Number of married sisters	0.059	1.617
missing	(0.029)**	(0.656)**
Age (15-19 is the reference)		
Age 20-24	-0.019	-0.495
	(0.023)	(0.477)
Age 25-29	-0.034	-0.885
	(0.022)	(0.470)*
Age 30-34	-0.080	-2.026
	(0.023)***	(0.489)***
Age 35-39	-0.136	-3.364
	(0.024)***	(0.507)***
Age 40-44	-0.176	-4.278
	(0.027)***	(0.552)***
Age 45-49	-0.240	-5.649
	(0.027)***	(0.553)***

Age 50-54	-0.239	-5.626
	(0.028)***	(0.578)***
Own education level (illiterate is the reference)		
Some Primary	0.019	0.518
	(0.017)	(0.354)
Completed primary and above	0.152	4.359
	(0.014)***	(0.358)***
Parent's Education Level (Illiterate and incomplete primary is the reference)		
Father primary	0.042	1.142
	(0.013)***	(0.294)***
Father lower secondary and above	0.050	1.352
	(0.030)*	(0.653)**
Mother primary	0.091	2.516
	(0.031)***	(0.722)***
Mother lower secondary and above	-0.022	-0.568
	(0.045)	(0.930)
Parents' Activity		
Father active	-0.195	-4.69

	(0.027)***	(0.595)***
Mother active	0.022	0.578
	(0.017)	(0.369)

Table 2: Determinants of Age at First Marriage (Continued)

Variables	Age at first marriage	
	Coefficients	Marginal effects
Regions (Casa Blanca is the reference)		
Souss Massa – Draâ	0.011	0.298
	(0.029)	(0.607)
Guelmime - Es Semara	-0.048	-1.239
	(0.031)	(0.652)*
Marrakesh - Tensift – Al Haouz	-0.032	-0.836
	(0.026)	(0.552)
Doukkala – Abda	0.004	0.093
	(0.031)	(0.657)
Tadla – Azilal	-0.099	-2.497
	(0.060)*	(1.170)**
Chaouia - Ouardigha	-0.101	-2.552
	(0.036)***	(0.725)***
Tanger – Tetouan	-0.056	-1.440
	(0.034)*	(0.695)**
Gharb – Chrarda – Bni Hsen	-0.041	-1.074
	(0.034)	(0.694)

Rabat – Sale	0.020	0.534
	(0.029)	(0.618)
Taza – Alhouceima - Taounate	0.017	0.461
	(0.038)	(0.820)
Fez – Boulemane	-0.005	-0.125
	(0.026)	(0.552)
L'Oriental	-0.004	-0.100
	(0.025)	(0.523)
Meknes – Tafilalet	-0.001	-0.033
	(0.026)	(0.538)
Constant/Predicted Median Prob.	3.223	26.50
	(0.045)***	
kappa	-1.028	
(Generalised Gamma shape param.) parameter)	(0.084)***	
Sigma	0.235	
(Generalised Gamma scale param.)	(0.006)***	
Number of observations	2,313	
Log-likelihood without regressors	-840.81	
Log-likelihood of full model	-426.18	

Standard errors in parentheses

Marginal effects are computed for a reference individual for whom the continuous variables are set at the sample mean and the

dummy variables are set to zero. The effects for dummy variables are for discrete change of the dummy variable from 0 to 1.

* Statistically significant coefficient or effect at the 10% level.

** Statistically significant coefficient or effect at the 5% level.

*** Statistically significant coefficient or effect at the 1% level.

Table 3: Determinants of the Number of Children.

Parameter Estimates from a Negative Binomial Regression Model for the total Number of Children Born Alive and a Poisson Regression Model for the Number of Children under age 6, Moroccan Ever- Married Women in Urban Areas, Ages 15-54, 1991

Variables	Total number of children		Number of children under 7	
	Coefficients	Marginal effects	Coefficients	Marginal effects
Predicted age at first marriage	-0.051	-0.039	-0.031	-0.022
	(0.014)***	(0.014)***	(0.024)	(0.018)
Age (15-19 is the reference)				
Age 20-24	0.595	0.623	0.497	0.454
	(0.265)**	(0.232)***	(0.296)*	(0.236)*
Age 25-29	0.961	1.235	0.704	0.721
	(0.257)***	(0.247)***	(0.289)**	(0.246)***
Age 30-34	1.301	2.048	0.639	0.631
	(0.256)***	(0.302)***	(0.292)**	(0.248)**
Age 35-39	1.439	2.464	0.301	0.248
	(0.25	(0.3	(0.302)	(0.231)

	9)***	62)***		
Age 40-44	1.450	2.499	-0.494	-0.275
	(0.262)***	(0.393)***	(0.322)	(0.209)
Age 45-49	1.548	2.836	-1.317	-0.517
	(0.266)***	(0.472)***	(0.361)***	(0.209)**
Age 50-54	1.557	2.867	-2.417	-0.643
	(0.266)***	(0.469)***	(0.434)***	(0.213)***
Own education level (Illiterate woman is the reference)				
Incomplete Primary	-0.002	-0.001	-0.077	-0.052
	(0.052)	(0.040)	(0.094)	(0.066)
Primary, completed	-0.089	-0.065	-0.106	-0.071
	(0.081)	(0.061)	(0.148)	(0.098)
Lower Secondary	-0.261	-0.176	-0.214	-0.136
	(0.109)**	(0.080)**	(0.185)	(0.116)
Technical	-0.351	-0.227	-0.187	-0.121
	(0.137)***	(0.097)**	(0.212)	(0.132)
Upper Secondary	-0.518	-0.310	-0.316	-0.192

	(0.213)**	(0.128)**	(0.295)	(0.165)
University	-0.668	-0.373	-0.100	-0.068
	(0.187)***	(0.124)***	(0.232)	(0.151)
Presence of adult women	0.209	0.178	-0.144	-0.094
aged 15-64 in the household	(0.037)***	(0.056)***	(0.069)**	(0.053)*

Table 3: Determinants of Number of Children (Continued)

Variables	Total number of children		Number of children under 7	
	Coefficients	Marginal effects	Coefficients	Marginal effects
Parents' Education Level (Illiterate and incomplete primary is the reference)				
Father primary	-0.050	-0.037	0.013	0.000
	(0.046)	(0.035)	(0.084)	(0.060)
Father lower secondary and above	-0.248	-0.168	-0.223	-0.141
	(0.137)*	(0.093)*	(0.231)	(0.137)
Mother primary	0.119	0.097	0.142	0.108
	(0.157)	(0.138)	(0.265)	(0.218)
Mother lower secondary and above	-0.131	-0.094	0.084	0.062
	(0.287)	(0.194)	(0.419)	(0.322)
Average use of modern contraceptive methods in Province by age group:				
Age 15-19	-0.141	-0.108	-0.237	-0.167
	(0.143)	(0.112)	(0.274)	(0.195)
Age 20-24	-0.303	-0.232	0.120	0.085
	(0.394)	(0.308)	(0.742)	(0.524)
Age 25-29	-0.835	-0.640	-1.273	-0.899

	(0.453)*	(0.389)*	(0.887)	(0.689)
Age 30-34	0.629	0.482	0.625	0.442
	(0.364)*	(0.310)	(0.691)	(0.509)
Age 35-39	0.039	0.030	0.282	0.199
	(0.299)	(0.229)	(0.583)	(0.414)
Age 40-44	-0.165	-0.126	0.338	0.239
	(0.204)	(0.159)	(0.362)	(0.267)
Age 45-49	-0.808	-0.619	-1.098	-0.775
	(0.349)**	(0.330)*	(0.650)*	(0.551)
Average use of traditional contraceptive methods in province by age group:				
Age 15-19	-2.697	-2.066	-1.252	-0.884
	(1.547)*	(1.300)	(3.038)	(2.163)
Age 20-24	-2.583	-1.978	-1.307	-0.923
	(1.175)**	(1.050)*	(2.204)	(1.602)
Age 25-29	-2.036	-1.559	-0.000	0.000
	(1.193)*	(0.946)*	(2.199)	(1.553)
Age 30-34	-2.237	-1.713	-1.021	-0.721
	(0.818)	(0.752)**	(1.563)	(1.114)

	***			
Age 35-39	1.633	1.250	1.021	0.721
	(1.086)	(0.868)	(2.019)	(1.420)
Age 40-44	1.844	1.413	0.026	0.018
	(0.891) **	(0.778) *	(1.667)	(1.177)
Age 45-49	0.496	0.380	0.363	0.256
	(0.480)	(0.383)	(0.946)	(0.675)

Table 3: Determinants of the Number of Children (Continued)

Variables	Total number of children		Number of children under 7	
	Coefficients	Marginal effects	Coefficients	Marginal effects
Regions: (Center is the reference)				
South	-0.138	-0.098	-0.168	-0.109
	(0.129)	(0.096)	(0.233)	(0.151)
Tensift	0.236	0.204	0.161	0.123
	(0.142)*	(0.143)	(0.281)	(0.229)
North-West	-0.048	-0.036	0.023	0.017
	(0.162)	(0.120)	(0.304)	(0.220)
Centre-North	0.028	0.021	0.168	0.129
	(0.117)	(0.091)	(0.210)	(0.169)
East	0.330	0.299	0.267	0.216
	(0.116)***	(0.133)**	(0.213)	(0.187)
Center-South	-0.194	-0.135	-0.252	-0.157
	(0.141)	(0.101)	(0.274)	(0.163)
Constant/Pred. # of children	1.428	0.766	0.678	0.706
	(0.424)***		(0.670)	
Alpha	0.069			
(Negative binomial regression ancillary parameter)	(0.014)***			

Number of observations	1,237	1,237
Log-likelihood without regressors	-2,901.68	-1,522.07
Log-likelihood of full model	-2,600.51	-1,264.23

Standard errors in parentheses

Marginal effects are computed for a reference individual for whom the continuous variables are set at the sample mean and the dummy variables are set to zero. The effects for dummy variables are for discrete change of the dummy variable from 0 to 1.

* Statistically significant coefficient or effect at the 10% level.

** Statistically significant coefficient or effect at the 5% level.

*** Statistically significant coefficient or effect at the 1% level.

Table 4: Parameter Estimates from a Three-Level Nested Logit Model of Participation in the Labor Force, Urban Moroccan Women, 15-54, 1991

	1st level	2nd level	3rd level	
	Active vs. Inactive	Wage work vs. Non-wage Work	Public wage work vs. Private Wage Work	Unemployment vs. Private Wage Work
Predicted probability	2.705	1.074	7.790	-1.740
of marriage	(1.851)	(1.363)	(1.970) ***	(1.496)
Predicted number of children	-1.095	-0.060	-0.576	0.569
under 7 unconditional on marriage	(0.822)	(0.641)	(0.959)	(0.780)
Predicted number of children 7	0.362	-0.811	0.045	-0.217
and older unconditional on marriage	(0.441)	(0.179) **	(0.286)	(0.308)
Age	-0.178	-0.019	-0.440	-0.046
	(0.057) ***	(0.044)	(0.064) ***	(0.050)
Age square	0.001	0.002	0.005	0.001
	(0.001)	(0.001) *	(0.001) ***	(0.001)
Own education level (Illiterate is the reference)				
Incomplete Primary	0.448	-0.358	0.613	0.628
	(0.346)	(0.324)	(0.560)	(0.365)*
Primary, completed	-1.262	0.030	3.589	1.323
	(0.847)	(0.727)	(0.585)	(0.466)**

			***	*
Lower Secondary	-2.094	1.074	3.391	0.768
	(1.481)	(0.740)	(0.572)***	(0.447)*
Technical	-0.957	1.311	3.637	1.058
	(1.834)	(0.897)	(0.646)***	(0.536)**
Upper Secondary	-1.372	0.462	4.483	2.054
	(1.686)	(1.129)	(0.818)***	(0.674)***
University	0.989	1.139	3.691	0.593
	(2.159)	(1.141)	(0.750)***	(0.687)
Parents' education level (Illiterate and incomplete primary are the reference)				
Father primary	-0.181	-0.353	0.925	1.039
	(0.350)	(0.368)	(0.347)***	(0.303)***
Father lower Secondary and above	-1.055	0.205	-0.194	-0.146
	(0.920)	(0.623)	(0.574)	(0.503)
Mother primary	0.822	-0.638	-0.668	0.349
	(0.745)	(0.514)	(0.765)	(0.541)
Mother lower Secondary and above	0.994	-0.748	-0.852	-0.706
	(1.475)	(0.909)	(0.841)	(0.730)
Household characteristics				

(Household with no adult male or female present is the reference)				
Presence of inactive male	-0.328	-0.016	0.045	0.226
	(0.231)	(0.188)	(0.233)	(0.182)
Presence of adult male	0.040	-0.182	-0.450	-0.213
wage worker	(0.203)	(0.166)	(0.287)	(0.195)
Presence of adult male	-0.320	-0.104	-0.455	0.035
non-wage worker	(0.239)	(0.191)	(0.328)	(0.224)
	0.186	0.569	-0.376	-0.099
Presence of adult woman	(0.471)	(0.299) *	(0.395)	(0.394)
Regions: (Center is the reference)				
South	-0.456	0.128	1.409	-0.218
	(0.504)	(0.379)	(0.539) ***	(0.417)
Tensift	-0.467	0.099	1.496	0.308
	(0.455)	(0.362)	(0.495) ***	(0.378)
North-West	-0.495	0.270	1.549	0.105
	(0.502)	(0.370)	(0.530) ***	(0.408)
Centre-North	-0.475	0.281	0.876	-0.513
	(0.500)	(0.371)	(0.553)	(0.432)
East	-1.987	-0.381	2.907	1.902
	(0.723)	(0.820)	(0.843)	(0.727)**

	***		***	*
Centre-South	-0.759	-0.578	1.672	0.491
	(0.495)	(0.479)	(0.612) ***	(0.508)
Inclusive Value Parameters	1.716	0.595		
	(0.727) **	(0.381)		

Number of observations : 11,565

Number of individuals : 2,313

Log-likelihood of full model: -1718.70

Standard errors in parentheses.

* Statistically significant coefficient at the 10% level

** Statistically significant coefficient at the 5% level

*** Statistically significant coefficient at the 1% level