Out-of-Union Fertility in Paraguay

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ABSTRACT

Between 1998 and 2008, the total fertility rate (TFR) in Paraguay decreased from 4.3 lifetime births per woman to 2.5 births, a significant portion of which come from out-of-union childbearing. Given the connection between out-of-union fertility and both unmet need for family planning and negative child outcomes, this study aims to evaluate the impact of out-of-union births on the TFR of the Paraguayan population and to identify related factors. We use data from the 2008 National Survey of Demography and Sexual and Reproductive Health to provide an estimation of Paraguay's TFR using the Bongaarts model, and evaluate the predictive capacity of the model using a revision by Stover that includes out-of-union sexual activity. Finally, we explore significant predictors of out-of-union births in Paraguay. Results show that age, region, religiosity, and wealth are associated with likelihood of experiencing an out-of-union first birth. Further examination of factors affecting fertility—not only sexual activity outside of marriage but also abortion—in Paraguay is needed to determine exactly where the underlying assumptions and equations of the Bongaarts model have not held true, as well as to understand the mechanisms through which variables operate to impact individual behavior.

INTRODUCTION

Between 1998 and 2008, the total fertility rate (TFR) in Paraguay decreased from 4.3 lifetime births per woman to 2.5 births (CEPEP 2008). This rapid decline occurred during a period marked by a stagnant economy and low levels of socioeconomic progress. Despite its history of relatively high TFR and low economic status, Paraguay's TFR is now similar to that of other more developed South American countries that entered stages of fertility decline far earlier (Ishida, Stupp and Melian 2009; Klimas Blanc 1982; Quesada et al. 2006).

Fertility Decline in Context

Paraguay is a country of 6 million people located in central South America. Approximately 36% of the population lives in the capital of Asunción and surrounding areas (CEPEP 2004). Still, 43% live in rural areas, although this proportion is steadily declining as rural to urban migration becomes more prevalent and the country goes through the process of urbanization (CEPEP 2004).

Although relatively late, the characteristics of rapid fertility decline in Paraguay are consistent with the rest of Latin America, where fertility declined quickly in the late 20th century and was not strongly correlated with socioeconomic progress (Casterline 2001; Mason 1997). The pace of decline in the absence of economic modernization is often dependent on the quality and coverage of family planning services (Casterline 2001). In the case of Paraguay, the government made family planning services a priority during the early 2000s, and donations from international organizations decreased prices of contraceptives during that time period as well (Quesada et al. 2004, 2006). While several other factors such as urbanization, delayed marriage and higher age at first birth certainly contributed to the fertility decline, the most significant factor in the case of Paraguay has indeed been a rise in contraceptive use (Ishida et al. 2009).

In the early 1990s, Paraguay had among the lowest prevalences of contraceptive use in Latin America (PRIME II 2002). In 1998, Paraguay's unmet need for family planning was 17% among all women in union and 60% among women in the lower income quintiles (Quesada et al. 2004). Since then, most of the decrease in fertility has occurred in rural areas and among women with lower socioeconomic status (CEPEP 2008; Ishida et al. 2009). A study by Ishida, Stupp and Melian[1] (2009) found that an increase in prevalence of contraceptive use in all population subgroups was the largest contributor to the reduction in the TFR between 1998 and 2004. In addition to populations in rural areas and those with lower socioeconomic status, this increase occurred in two groups that previously had markedly low prevalence: the youngest (15-19) and the oldest (40-44) married women (Quesada et al. 2006). Within the youngest groups of women, prevalence of contraceptive use rose nearly 50%, from 42% in 1998 to 61% in 2004 (Quesada et al. 2006). By 2004, 73% of all women were using contraception (CEPEP 2004).

Out-of-Union Fertility

Partly due to the rapid increase in prevalence of contraceptive use, by 2004 only 7% of pregnancies in Paraguay were reported as unplanned—either mistimed or unwanted (CEPEP 2004; Ishida et al. 2009). However, measuring unplanned pregnancy is difficult because many women may be unlikely to report their pregnancy as unplanned after the child is born (Shapiro-Mendoza et al. 2007). Based on survey data, between a fifth and a quarter of all first births in Paraguay occur prior to a woman's entrance into her first union (Ishida et al. 2009). Thus, examining out-of-union fertility as an alternative measure of unplanned pregnancy yields a different picture in which unmet need for family planning is quite relevant. Out-of-union fertility is defined as fertility experienced by women who are not married or in a consensual union at the

[1] The influence of the paper "Fertility Decline in Paraguay" by Ishida, Stupp and Melian in 2009 cannot be understated. In addition to borrowing the Bongaarts figures from that analysis, this paper loosely follows the outline of those authors' recommendations for future research on fertility in Paraguay.

time they give birth. Most out-of-union fertility is unplanned and, despite a higher prevalence of contraceptive use in the last decade, it remains common in Paraguay (Willis and Haaga 1996).

Out-of-union fertility is also a concern because single motherhood is negatively associated with child well-being (Thomson, Hanson, and McLanahan 1994). Lack of spousal support is associated with lower levels of income and less time and attention spent on children (Amato 1987; Dornbusch et al. 1985; Thomson et al. 1994). Given the implications of out-of-union fertility on both unmet need for family planning and child outcomes, the goal of this study is to evaluate the relative importance of out-of-union births in determining the current TFR of the Paraguayan population and to identify possible predictors.

The Bongaarts Proximate Determinants in Paraguay

Out-of-union fertility has only recently been recognized as a significant contributor to the TFR in Paraguay (Ishida et al. 2009). One way to evaluate the impact of these births is by using the Bongaarts framework of proximate determinants of fertility. The Bongaarts model assesses the relative importance of the proximate determinants of fertility—postpartum lactational infecundability, proportion of women in union, contraceptive prevalence, proportion of women who have undergone an induced abortion—to the TFR. Despite the accuracy of the proximate determinants model when first introduced in 1978, applying the data from Paraguay to the model consistently under-predicts the TFR by nearly one birth (Bongaarts 1978, 1982; Ishida et al. 2009). Ishida et al. (2009) explain that this disjuncture between predicted and observed TFRs may occur for two reasons. First, the proximate determinants of fertility are measured based on prevalence at the time of the survey, whereas the TFR is measured based on births during the three years prior to the survey. Because fertility in Paraguay is changing so rapidly, using data

from three years prior to the survey—especially data for contraception, which is the most influential determinant—can lead to a deceptively higher observed TFR.

Second, the disjuncture could occur because the assumptions imperative for the Bongaarts model may not hold true for Paraguay. In particular, the Bongaarts model assumes that women are only sexually active inside a union (Bongaarts 1978). While reproductive health surveys in the country now incorporate both married and cohabitating couples into the "union" classification, calculations for Bongaarts's index of marriage assume there is no fertility outside these unions. However, out-of-union childbearing is in fact common in Paraguay—and characterized as high as 21% of first births in 2004 (Ishida et al. 2009). These births are not captured by the Bongaarts model and could contribute to the underestimation of the TFR by that model. An attempt to re-estimate the model by including out-of-union births is therefore warranted in order to both improve its predictive capacity and to evaluate the relative importance of these births on the TFR.

By highlighting out-of-union fertility, Ishida et al. set the stage for—and in fact recommended—research on the relevance of the Bongaarts model for Paraguay as well as examination of the "patterns and prevalence of out-of-union fertility" (p. 234, 2009). In this paper, we provide an estimation of Paraguay's TFR and accompanying age-specific fertility rates (ASFRs) using the Bongaarts model and applying data from the most recent reproductive health survey from 2008. We then re-estimate the Paraguay TFR and ASFRs using Stover's (1998) revised calculation for the index of marriage, which does not rely on the assumption that fertility only occurs within unions, in order to test if this is indeed a better fit. Finally, we explore significant predictors of out-of-union births in Paraguay to understand which sectors of the population are most likely to experience this outcome.

DATA AND METHODS

This analysis uses data from Paraguay's most recent national reproductive health survey: the 2008 National Survey of Demography and Sexual and Reproductive Health (ENDSSR). This survey was conducted by the Paraguayan Center of Population Studies (Centro Paraguayo de Estudios de Población—CEPEP)[2]. Survey samples are designed to be representative of the population of Paraguay, with the exception of those who live in the Chaco region in the western part of the country. The Chaco, which makes up 60% of Paraguayan territory, has been excluded from all surveys to date because of its low population density (2% of the populatin). The rest of the country is divided into four regions: Gran Asunción, which includes the capital city of Asunción as well as surrounding districts; the North region; the East region; and the Central South region.

The survey consists of both household and individual questionnaires. Individual questionnaires are utilized to record detailed information about women of reproductive age (15-44 years). Information for the 2008 ENDSSR was collected between June and September 2008. The response rate was 95.1%, and the final sample consisted of 6,540 women of reproductive age.

In this study, we set out three analytic objectives. First, we apply the Bongaarts framework to the Paraguay data to determine the values of the proximate determinants of fertility (Bongaarts 1978, 1982). While the predicted TFRs using the Bongaarts model were shown to be quite accurate when the method was first developed, there have been several attempts to improve upon the original model of proximate determinants of fertility (Hobcraft and Little 1984; Stover

[2] The authors are grateful to CEPEP for kindly making these data available prior to their publication by the Centers for Disease Control, which serves as the primary United States source for reproductive health surveys in Latin America.

1998). We therefore apply Stover's (1998) measurement of the proportion sexually active to replace the index of marriage in order to ascertain whether or not this brings the predicted TFR closer to the observed TFR.

Second, in order to further test the hypothesis that the Bongaarts assumption of no out-of-union fertility does not accurately apply to Paraguay, we divide the predicted TFR into predicted ASFRs using a method developed by Bongaarts and Stover (1986). Because most out-of-union fertility occurs in the earliest age group (15-19 year olds), we hypothesize that the predicted ASFR for that age group will be farther from the observed ASFR and that the predicted and observed ASFRs for subsequent age groups will converge.

Finally, we present the results of a logistic regression analysis conducted using STATA 11.0 software. With out-of-union birth as the dependent variable, we employ models with various sociodemographic, cultural and economic indicators as independent variables.

I. APPLICATION OF THE PROXIMATE DETERMINANTS MODEL

The first analytic objective includes applying data from the 2008 ENDSSR to the original Bongaarts model and then re-assessing the predicted TFR using an alternative measure for the index of union provided by Stover (1998).

Indexes of the Proximate Determinants of Fertility

Proximate determinants of fertility are biological and behavioral factors that are directly associated with fertility rates. Developed by Bongaarts (1978), the basic model is:

$$TFR = Cm * Cc * Ci * Ca * Cp * TF$$

where *Cm* is the index of proportion married, *Cc* is the index of contraception, *Ci* is the index of postpartum lactational infecundability, *Ca* is the index of abortion, *Cp* is the index of pathological sterility, and *TF* is the total fecundity. A discussion of each index and its application to Paraguay 2008 ENDSSR data follows.

Index of Marriage (*Cm*). The index of marriage is intended to capture the reduction in fertility due to the proportion of women who are not married and are therefore not at risk for pregnancy because they are theoretically not sexually active (Bongaarts 1978). When applied to the Paraguayan population, this index will be referred to as the "index of union." There is a pattern of cohabitation in Latin America called a "consensual union" that coexists with formal marriages, most commonly in lower economic strata (Landale and Oropesa 2007). Women surveyed in the ENDSSR are therefore asked whether they are in a formal marriage or a union, and those with affirmative responses are combined into the "unida" category (CEPEP 2004, 2008). Calculating the index of union requires age-specific proportions in union as well as the in-union ASFRs (Bongaarts 1978).

Index of Contraception (*Cc*). In Paraguay the increased prevalence of contraceptive use was the largest contributor to the decrease in TFR from 1998 to 2004 (Ishida et al. 2009). The index of contraception is calculated based on the average proportion of married women currently using contraception, as well as the average contraceptive effectiveness (average of use-effectiveness levels by method) (Bongaarts 1978). For this analysis, proportion using each contraceptive method was calculated using data from the 2008 ENDSSR. The average effectiveness of each method was based on Trussell's (2009) summary table of contraceptive efficacy.

Index of Postpartum Lactational Infecundability (*Ci*). Lactation contributes to inhibiting ovulation, thereby increasing birth intervals and reducing fertility. Lactation is relatively long in Latin America compared to more modern Western populations (Bongaarts 1978). However, at 61%, Paraguay has one of the lowest one-year breastfeeding continuation rates in Latin America (Shapiro-Mendoza et al. 2007). The index of postpartum lactational infecundability is measured using the average duration in months between a live birth and the first postpartum ovulation (Bongaarts 1978). Based on data from the 2008 ENDSSR, the average duration of lactational infecundability in Paraguay was 4.7 months.

Index of Induced Abortion (Ca). Although abortion has a clear impact on fertility, reliable estimates of induced abortion rates do not exist in most countries. Even with good estimates, the exact reduction in fertility that occurs due to abortion is difficult to determine. This is primarily because an induced abortion averts less than one birth due to the fact that a woman resumes ovulation more quickly than if she had carried the pregnancy to term (Bongaarts 1978). Furthermore, since abortion is illegal in Paraguay, reliable abortion rates are extremely difficult to estimate. Sedgh et al. (2007) estimate the general abortion rate for South America to be 33 abortions per 1,000 women. However, due to both the lack of reliable data and to efforts to maintain comparability with the predicted TFRs calculated by Ishida et al. (2009), we do not consider abortion in this analysis.

Index of Pathological Sterility (Cp). This index is no longer used except for populations with high rates of sexually transmitted infections (Stover 1998).

Total Fecundity (*TF*). Total fecundity is defined as the total fertility rate with none of the fertility-inhibiting effects of the proximate determinants (Stover 1998). This is generally estimated to be 15.3 (Bongaarts 1978).

Stover's Index of Sexual Activity (*Cx*)

Stover (1998) proposed several revisions for the proximate determinants framework, of which the most significant for this analysis is the calculation of the index of marriage. The index of marriage, or the index of union in the case of Paraguay ENDSSR data, is intended to capture the effect of periods when women are not sexually active. The Bongaarts model assumes that women who are not married are not sexually active. Stover proposes a new measure of sexual activity, defined as the proportion of women who were sexually active in the 30 days prior to being surveyed. To this he adds women who are currently pregnant and those abstaining postpartum (Stover 1998).

Applying the Bongaarts Model and Stover's Revision: Results

We calculate the TFR in three ways: the observed TFR from ENDSSR respondents, and the two predicted TFRs obtained using the calculations specified by Bongaarts in the first case and Stover in the second case. Table 1 shows the proximate determinants of fertility in Paraguay by survey date, in addition to a new calculation of the predicted TFR using 2008 ENDSSR data on the proportion sexually active in the last 30 days. Values for all three indexes decline over time, suggesting that each proximate determinant had an effect on the fertility decline. However, the index of contraception has consistently the smallest value. Calculations from 2008 show that prevalence of contraceptive use has continued to increase, up to 80.6% from 73% in 2004. The indexes of union and postpartum infecundability appear to be consistent with previous estimations.

The predicted TFR based on 2008 data is significantly lower than the observed TFR. In this case, the Bongaarts model under-predicts the TFR by nearly one child (0.97). This gap has remained fairly constant since 1998, suggesting that a fundamental change occurred between the 1995 and 1998 surveys that has affected the Bongaarts model ever since.

When we apply Stover's index of sexual activity instead of the traditional index of union, the predicted TFR in 2008 rises by 26% to 1.89 and is closer to the observed TFR. Holding the other indexes constant, accounting for sexual activity outside unions and, accordingly, fertility outside unions, increases the predictive capacity of the Bongaarts model.

II. APPLICATION OF THE AGE-SPECIFIC MODEL

With the purpose of further examining the disjuncture between the predicted and observed TFRs, we apply a model developed by Bongaarts and Stover (1986) to predict ASFRs, and an additional model developed by Stover (1998) that includes an index of sexual activity instead of an index of union. To calculate the age-specific version of the model, the equation for each proximate determinant is applied to each age group separately.[3]

If sexual activity is indeed a better predictor than being in a union, the predicted ASFRs based on Stover's model should be a better fit with the observed ASFRs. In addition, we expect the Stover model to better predict the ASFRs at younger ages, when women are more likely to be sexually active outside unions, and at older ages, when women are more likely to be sexually inactive inside unions.

Applying the Age-Specific Model: Results

[3] It should be noted that the age-specific models predict a TFR that is not the same as the corresponding aggregate model. This discrepancy results primarily from the fact that the TFRs predicted by the age-specific models rely on potential fertility (*PF*) in each age group. Because the numbers provided by Bongaarts for the *PF* add up to 18.9 instead of 15.3 like the aggregate model, the TFRs will necessarily be higher.

Results from ASFR calculations again display the limited prediction ability of both models but also indicate the specific age groups in which those models fall short. Table 2 shows the indexes of proximate determinants with observed ASFRs beside the predicted ASFRs determined by both the Bongaarts and Stover models. The Bongaarts predicted ASFRs are calculated using *Cm* (the index of union), whereas the Stover predicted ASFRs are calculated using *Cx* (index of sexual activity).

Both models under-predict the ASFRs in younger age groups and over-predict the ASFRs beginning in the 35-39 age group. While Figure 2 shows that the model incorporating an index of sexual activity appears to be closer to the observed ASFRs than the model with the index of union, it still under-predicts observed ASFRs by 24% in the youngest age group and by 35% in the 25-29 age group. Perhaps more problematically, both predicted ASFRs over-predict the observed ASFR in the 40-44 age group by more than a threefold margin.

As expected, the age-specific models provide TFRs much closer to the observed TFR. This is primarily, however, an artifact of the *PF* values. Nevertheless, the models give insight as to the age groups in which the proximate determinants contribute to inaccurate estimates of the TFR. While revising the model using Stover's index of sexual activity leads to predicted ASFRs and a TFR closer to the observed values, it does not fully account for the differences between the Bongaarts model and those values.

III. ANALYSIS OF OUT-OF-UNION FERTILITY

The increase in predictive power of the Bongaarts model when the index of union is converted into an index of sexual activity suggests that the assumption that women who are not in union are sexually inactive may not hold true for the Paraguayan population. Thus, out-of-union births may

be one mechanism contributing to the under-prediction of the TFR. To further explore fertility occurring outside of unions, we present a multivariate logistic regression to determine significant predictors of out-of-union births.

Dependent Variable

The dependent variable in each model is a dichotomous variable for whether or not a birth occurred out-of-union. Because the intent is to capture patterns of out-of-union childbearing post-fertility decline, only first births during the seven years prior to the 2008 survey were considered for analysis (n = 2,991). Figures are based on the age in months at which first birth and the beginning of first union occurred. When first union occurred in the same month as childbirth, it is assumed to have occurred before the birth.

Independent Variables

Demographic, socioeconomic, cultural and economic predictors were selected for an initial exploration into the underlying patterns of out-of-union fertility. With the exception of nine missing cases in the responses to "Do you think that a man should always be the authority?", no other independent variables had missing cases. Those nine respondents were deleted from all analysis, resulting in a final sample size of 2,982.

Age. Age is an important predictor of out-of-union fertility. Women in the under 20 age group are less likely to be married and are therefore at greater risk of out-of-union fertility if they are sexually active. The previous calculation of ASFRs using Bongaarts and Stover's (1986) formulas shows that predicted ASFRs are farther from observed ASFRs in these early age groups. Thus, the model's failure to capture out-of-union fertility, hypothesized to be higher in these age groups, could be a primary reason for the under-prediction of the TFR. Age was coded into five groups, with the 35-39 and 40-44

age groups combined due to few cases of out-of-union births for those women. In addition, the 15-19 age group was expanded to include births to six women under the age of 15.

Language. Paraguay has a large Guaraní-speaking population—82% of those in rural and 45% in urban areas—that consistently occupies a position in the lower levels of socioeconomic strata (CEPEP 2004). The TFR of women who speak only Guaraní in their homes is higher (3.3 births) than that of women who speak only Spanish (2.2 births) or who speak both Spanish and Guaraní (2.1 births) (CEPEP 2008). Language was coded in four categories, according to what language women spoke in their homes: Guaraní, Spanish, both Guaraní and Spanish, and other, primarily Portuguese.

Region. While some regional differences in fertility determinants have disappeared over the years, others have not. Despite Paraguay's average TFR of 2.47 births, there is considerable regional variation in overall fertility. The Gran Asunción region, which includes the capital and surrounding districts, has a TFR of 2.0 births. In contrast, the North region has a TFR of 3.1 births, while the East region has a TFR of 2.6 births. Prevalence of contraceptive use, however, has seen a convergence in the past four years. Urban and rural areas have prevalences of 79.5% and 79.3%, respectively. While the Gran Asunción region has the highest prevalence at 80.9% and the North region is not unexpectedly the lowest at 75.1%, both the East and Central South regions have prevalences above 79%. Because there is more variation among regions than between rural and urban areas, this analysis focuses on the four regions outlined in the 2008 ENDSSR.

Education. Several studies have found a significant relationship between a mother's educational level and unwanted pregnancy, with those in the lowest educational levels (none/some primary) having more than half of all unwanted pregnancies (Heaton et al. 2002; Klimas Blanc 1982; Shapiro-Mendoza et al. 2007). In Paraguay, women with the lowest amount of education, zero to five years, have a TFR of 3.6 births. Women with seven to eleven years of education have a TFR of 3.0 births, and women with more than 12 years of education have a TFR of 2.0 births (CEPEP 2008). Approximately half of Paraguayan women have completed primary education. For this analysis, these women were combined with the few women who had no education and coded as the reference category. They are compared to those who had a secondary education or higher in order to be inclusive of all age groups—especially the under 20 age group that has not yet had a chance to complete the highest levels of education.

Church Attendance. Over 88% of Paraguayan women are Roman Catholic (CEPEP 2008). Levels of devotion and adherence to Catholic doctrine vary, however. Frequency of church attendance is often used as a measure of religiosity. Those who attend church services more frequently can be expected to be less likely to have an out-of-union birth due to their adherence to Catholic teachings against sexual activity outside marriage. Those who attend services once a month, less than once a month, or not at all, were coded as the reference category and compared to women who attend church services once a week or more.

View of Male Authority. Many out-of-union pregnancies and subsequent births necessarily occur because of the lack of contraceptive use. A woman's ability to bargain with her sexual partner can be affected by several factors; however, traditional bargaining

models are difficult to apply to the out-of-union framework because bargaining occurs outside the formal institution of marriage (Lundberg and Pollack 1996). In the 2008 ENDSSR, all women were asked, "Do you think a man should always be the authority?" This indicator captures a woman's view of male authority, thereby affecting her bargaining power both prior to conception in the decision to use contraception, as well as during pregnancy and after birth in her relationship with the father of her child. If a woman feels she must always be subordinate to male figures in her life, her bargaining power is decreased, which can affect her sexual behavior.

Wealth Index. Previous studies of fertility decline in Paraguay found that prevalence of contraceptive use was greater for women with higher socioeconomic status (Ishida et al. 2009; Quesada et al. 2004). Although education has already been considered, another important socioeconomic indicator is income.

The 2008 ENDSSR has neither expenditure data nor the wealth index common in other demographic and health surveys. In order to estimate wealth without this information, we construct an asset index based on Filmer and Pritchett's (2001) wealth proxy. A woman's wealth index is based on the house in which she lived at the time of the interview. Asset indicators include household ownership of consumer goods (telephone, radio, television, car), characteristics of the household's dwelling (toilet facilities, source of drinking water, building materials used, sources for lighting and cooking), and household landownership. To construct a wealth index, these indicators were summed. Then, for the regression, women were divided into quartiles based on their wealth indexes, with the lowest quartile serving as the reference category.

MULTIVARIATE ANALYSIS OF OUT-OF-UNION FERTILITY: RESULTS

Respondent Characteristics

Only 10% of first births occurred out-of-union in the seven years prior to the 2008 ENDSSR (Table 3). As predicted, the most variation appears at different ages. Most out-of-union births (68.1%) occur in the under 20 and 20-24 age groups. In contrast, only 38.7% of in-union births occur in these age groups. Very little variation is apparent based on the language spoken at home, although a slightly lower percentage of Guaraní-speaking women reported out-of-union births. The region most associated with out-of-union births is Gran Asunción, which accounts for 30% of all out-of-union births, compared to only 21% of in-union births. Church attendance also appears to be associated with out-of-union fertility, but in the opposite direction hypothesized. Approximately 61% of out-of-union births—compared to 53% of in-union births—occurred to women who attend religious services once a week or more. The relationship between out-of-union births and education and women's views of male authority appear to be weak. Finally, out-of-union births appear to be concentrated in the lowest two wealth index quartiles.

Multivariate Logistic Regression

Table 4 shows the results of multivariate logistic regression. All models control for age because its strong association with out-of-union fertility. The first model shows that, when controlling for age, those who speak both Spanish and Guaraní at home are 29% more likely to experience an out-of-union birth compared to Guaraní-speakers.

Model 2 includes two additional sociodemographic variables. Controlling for age and language, both region and education were significant predictors of out-of-union births. Women from North, Central South, and East regions of Paraguay were between 37% (East region) and 46% (Central South region) less likely to experience an out-of-union birth compared to women

from the Gran Asunción region. Education was not a significant predictor in this model. When adding controls for region and education, language loses statistical significance.

Model 3 adds two sociocultural variables (religiosity and view of male authority) and an economic variable (wealth index quartile). Four variables remain significant in this model: age, region, church attendance, and wealth index quartile. Church attendance appears to trend in the hypothesized direction, with women who attend church services once a week or more being only 78% as likely to experience an out-of-union birth when compared to those who attend services once a month or less. Women's opinions of whether or not men should always be in charge did not significantly predict the dependent variable. While the 3rd wealth quartile was not significantly different from the lowest, women in the 1st and 2nd quartiles were less likely to have out-of-union births by 41% and 39%, respectively, compared to women in the lowest quartile.

DISCUSSION

This study contributes to the literature on measurement of fertility in a Latin American context and identifies specific populations that may be more at risk for single motherhood. The Stover model accounting for sexual activity outside of marriage appears to improve upon the original Bongaarts model when predicting the actual TFR and ASFRs in Paraguay. While the Bongaarts assumptions could indeed be inaccurate for other elements of the model, this analysis shows that the index of union is especially problematic in measuring what it is meant to measure—sexual activity. Further analysis focusing on ASFRs identifies the two age groups for which the index of union is particularly inaccurate. The difference between predicted ASFRs based on index of union versus index of sexual activity is largest in the 15-19 and 20-24 age groups. Additionally,

both greatly under-predict the observed ASFRs for all age groups up through ages 30-34. Even more problematic is the recognition that these models continue to under-predict the TFR despite the severe over-prediction of the 40-44 ASFR. Without this over-prediction, the models would under-predict the TFR by an even greater margin. Possible reasons behind this under-prediction are difficult to determine but factors such as sterility, abortion or reduced coital frequency could have a greater effect on this age group. In addition, the age at menopause may be relatively low in Paraguay **(citation).**

As expected, women who have out-of-union births are more likely to belong to younger age groups because those are the ages at which they are less likely to be married. Given the relationship between out-of-union births and unwanted pregnancy, this finding indicates that the uptake of contraceptive use may not be as strong for younger women and/or that contraception is not used to delay age at first birth. Although much of the increase in prevalence of contraceptive use was attributed to use by younger women, a significant gap clearly still exists.

Gran Asunción, the most industrialized region in Paraguay, had the highest levels of out-of-union fertility. Gran Asunción also has the highest prevalence of contraceptive use and the lowest TFR among the four regions identified in the 2008 ENDSSR. Traditional norms of early marriage or taboos against premarital sex have been found to weaken over time due to increased modernization and urbanization (Heaton et al. 2002; Schwab Zabin et al. 2009). Thus, sociocultural factors related to modernization, sexual liberation and higher rates of sexual activity among teenagers may contribute to the higher rates of teenage childbearing in Gran Asunción. While contraceptive prevalence has increased in rural areas of Paraguay, perhaps it has stalled in the capital region, which could contribute to the lower levels of out-of-union fertility in outside regions compared to Gran Asunción. Additionally, women in other regions

have a younger average age at first marriage, meaning that births to younger women in those areas are more likely to occur within a union.

Language is only a significant predictor in the first model when age is controlled. In contrast, other studies have found that the language spoken at home is associated with both fertility and contraceptive use [**citation**]. Guaraní-speaking women have higher TFRs and lower prevalence of contraceptive use compared to women who speak only Spanish or both Guaraní and Spanish in their homes (Ishida et al. 2009). This analysis found that women who speak Guaraní at home were actually less likely to experience an out-of-union birth than those who spoke both Guaraní and Spanish. Because women who speak only Guaraní are more likely to live in rural areas, they are more subject to traditional norms including earlier age at first union and less sexual activity prior to those unions.

Of the two sociocultural variables added in the third model, only church attendance was significantly related to the dependent variable. Higher levels of religiosity were associated with a decreased likelihood of having an out-of-union birth. Because adherence to Catholicism is indicative of conservative social values, it follows that women who are very religious are more likely to marry at younger ages and are therefore less likely to engage in sexual activity outside of marriage. On the other hand, women's views of men as authority figures were not related to out-of-union fertility. This variable may not sufficiently capture the degree to which women bargain with their partners. In addition, bargaining outside a union could be fundamentally different from the framework set forth by Lundberg and Pollack (1996) to such a degree that it is simply not applicable to out-of-union relationships. This could be the case especially if union dissolution is the main threat employed by partners. Because single women have no formal

relationship to dissolve, applying a measure of the traditional bargaining model may therefore be inappropriate in this context.

Wealthier women were less likely to experience an out-of-union birth. This is consistent with the literature relating lower socioeconomic status to higher rates of unintended pregnancy (Ishida et al. 2009; Quesada et al. 2004). Although prevalence of contraceptive use has increased among all segments of the population since 1998, most measures of that increase used education as a measure of socioeconomic status. However, education was not found to be a significant factor. While this could be a result of coding education as a dichotomous variable, it could also be indicative of a larger trend in which education levels are converging while wealth inequality continues to be pervasive in Paraguayan society.

LIMITATIONS

1. This analysis only considers first births. Women who continue to have more out-of-union births may be qualitatively different from those who only had one out-of-union birth. This analysis is therefore careful to consider the results in terms of an exploration into the patterns and prevalence of out-of-union first births only. In terms of re-estimating the TFR using Stover's revisions of the Bongaarts model, all out-of-union births are theoretically considered because they occur to women who are sexually active whether or not they are in a union.
2. Because of a lack of reliable data on abortion in Latin America, we are unable to estimate an index of induced abortion. Despite the fact that abortion is illegal in most Latin American countries, it is still practiced and may have a significant impact on fertility. Sedgh and colleagues (2007) estimate the general abortion rate for South America to be 33 abortions per 1,000 women. Based on this information, Ishida et al. (2009) conclude that abortion has

likely had little effect on the fertility rate. However, illegal abortion is common throughout Latin America and, though difficult to measure because of its illegality, may indeed affect fertility in the region. In the case of Paraguay, a higher rate of induced abortion may decrease the predicted TFR even further, leading to an increase in the difference between the predicted and observed TFRs.

3. Unlike the demographic and health surveys, the ENDSSR does not calculate a wealth index. Although questions are asked as to the housing conditions and possessions (TV, radio, etc.), there is no clear way to assess a woman's income. Additionally, because many women who experience out-of-union births are young and do not yet have houses of their own, many are subject to the economic constraints of their parents. This makes analysis of economic predictors of out-of-union births difficult. The predictor chosen—wealth index quartile—cannot capture the full extent of a woman's economic situation.
4. Data from the ENDSSR are not nationally representative. This analysis applies only to the four regions outlined and is not representative of the Chaco region. While the Chaco comprises only 2% of the Paraguayan population, it is a population with relatively little access to the family planning programs concentrated in more populated regions. Because the population is small, it may not have a significant effect on the country's TFR; however, future surveys should consider this population as a way to obtain truly nationally representative data that capture all subgroups—especially those groups who could be marginalized by their lack of access to reproductive health care.
5. Based on the 2008 ENDSSR, the prevalence of out-of-union births has decreased from 21% in 2004 to 10% in 2008. Calculations of the 2004 data were conducted by Ishida et al. (2009) in an auxiliary analysis not described in that paper. This seemingly drastic reduction in out-

of-union fertility could result from three reasons. First, the authors' methods for calculating out-of-union childbearing differ. Our analysis used a conservative estimate by assuming that births preceded unions when they occurred in the same month. In addition, we considered all first births occurring in the past seven years. However, analysis of out-of-union births showed that the prevalence remained between 9% and 11% when considering births in the 36 months prior to the survey, 48 months prior to the survey, and all first births. Second, the low prevalence of out-of-union births based on the 2008 data is an artifact of data collection and not accurately representative of the population. Finally, there may indeed have been a significant decrease in out-of-union fertility between 2004 and 2008. The TFR decreased by 15%, and this may reflect a decrease in out-of-union childbearing.

CONCLUSION

Out-of-union births play an important role in fertility variation in Paraguay. In this study we show that allowing for sexual activity outside unions improves the predictive capacity of the Bongaarts model. Decomposing predicted ASFRs further supports the hypothesis that out-of-union fertility, most common at younger ages, contributes to the disjuncture between predicted and observed TFRs. Finally, regression analysis finds that young age, residence in the capital region, and higher levels of religiosity and wealth are significantly related to out-of-union fertility.

Future research is needed to explore why the most developed region with the highest prevalence of contraceptive use and lowest TFR has the highest levels of out-of-union births in Paraguay. In addition, the predictive capacity of the original Bongaarts model comes into question for this country. Further examination of factors affecting fertility—not only sexual

activity outside of marriage but also abortion—in Paraguay is therefore needed to determine exactly where the underlying assumptions and equations of the Bongaarts model have not held true. **[mention need for ethnographic/qualitative data?]**

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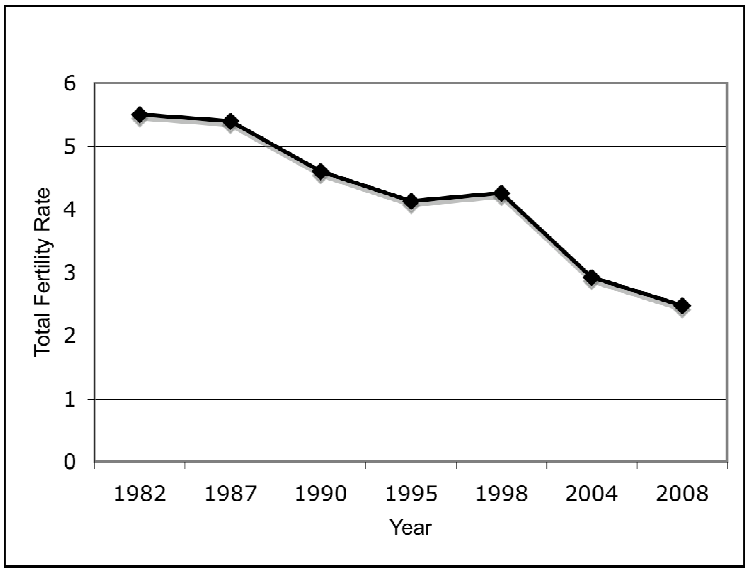
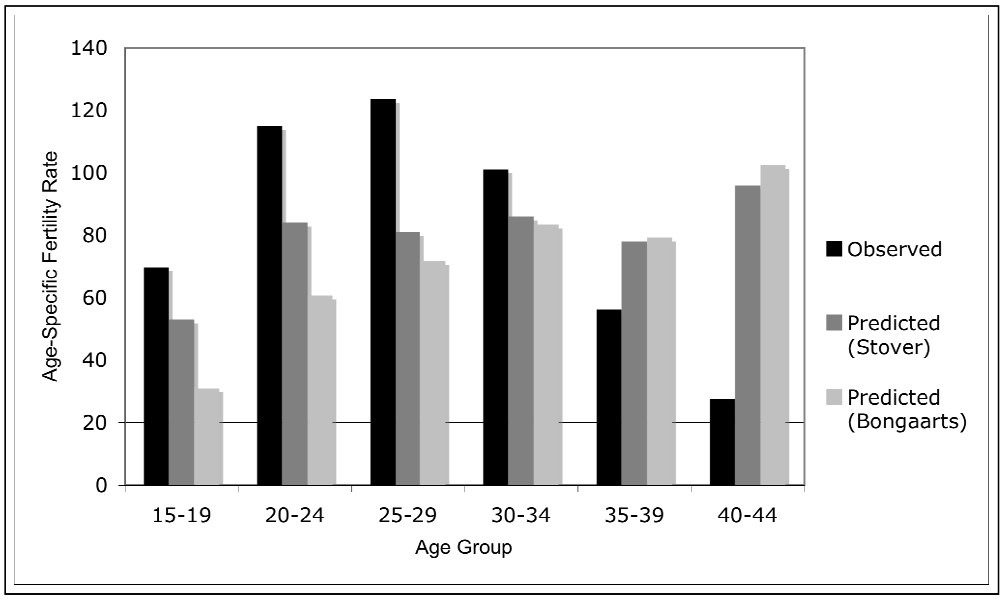


Source: CEPEP 2008

Figure 2. Observed and predicted ASFRs, Paraguay 2008



Source: Authors' calculations of ENDSSR 2008 data

Table 1. Indexes of proximate determinants of fertility, by survey data, Paraguay

Index	1995-96[4]	1998	2004	2008 (With *Cm*)	2008 (With *Cx*)
Union (*Cm*) or Sexual Activity (*Cx*)	0.703	0.613	0.537	**0.548**	**0.691**
Contraception (*Cc*)	0.470	0.431	0.293	0.208	0.208
Proportion using contraceptives (*u*)	0.536	0.572	0.730	0.806	0.806
Average use-effectiveness (*e*)	0.914	0.921	0.919	0.909	0.909
Postpartum infecundability (*Ci*)	0.833	0.830	0.820	0.861	0.861
Maximum potential fertility	15.3	15.3	15.3	15.3	15.3
Predicted TFR	4.22	3.35	1.97	1.50	1.89
Observed TFR	4.13	4.26	2.92	2.47	2.47
Difference (predicted – observed TFRs)	0.09	-0.91	-0.95	-0.97	-0.58

Indexes of Proximate Determinants Calculations:

Cm = ∑m(a)g(a)/∑g(a), where *m(a)* is the age-specific proportions in union and *g(a)* is the age-specific union fertility rates

Cx = s, where *s* is the proportion sexually active

Cc = 1-1.08*e*u

Ci = 20/(18.5+i), where *i* is the length in months of postpartum infecundability

Predicted TFR = Cm * Cc * Ci * 15.3

Sources: Bongaarts 1978; Ishida et al. 2009; Stover 1998; Authors' calculations of ENDSSR 2008 data

[4] The 1995-96, 1998 and 2004 indexes of proximate determinants are taken from Ishida et al. (2009). Only the 2008 ENDSSR data were available for this study.

Table 2. Application of the age-specific model of the proximate determinants of fertility to data from Paraguay, 2008

Age Group	*Cm*	*Cx*	*Cc*	*Ci*	*PF**	**Predicted ASFR (With *Cm*)**	**Predicted ASFR (With *Cx*)**	**Observed ASFR**
15-19	0.168	0.289	0.321	0.844	3.4	**31**	**53**	**70**
20-24	0.496	0.688	0.218	0.850	3.3	**61**	**84**	**115**
25-29	0.724	0.817	0.187	0.856	3.1	**72**	**81**	**124**
30-34	0.826	0.851	0.195	0.861	3	**83**	**86**	**101**
35-39	0.814	0.804	0.194	0.866	2.9	**79**	**78**	**56**
40-44	0.841	0.797	0.250	0.871	2.8	**102**	**97**	**28**
TFR	--	--	--	--	--	**2.14**	**2.40**	**2.47**

* *PF* = Potential Fertility = 60 months / average birth interval in the absence of fertility-inhibiting effects of the proximate determinants; average birth intervals estimated as 15-19 = 17.5; 20-24 = 18.3; 25-29 = 19.2; 30-34 = 20.0; 35-39 = 20.8; 40-44 = 21.7

Source: Authors' calculations of ENDSSR 2008 data

Table 3. Respondent Characteristics (percent)

Characteristics	Total	In-Union	Out-of-Union
First Births	100.0	90.0	10.0
Age			
Under 20	14.6	13.0	29.0
20-24	27.1	25.7	39.1
25-29	26.4	26.9	21.9
30-34	19.2	20.6	6.4
35-44	12.8	13.8	3.7
Language			
Guaraní	40.4	41.0	35.0
Spanish and Guaraní	34.4	34.4	37.7
Spanish	21.4	21.2	22.9
Other	3.8	3.7	4.4
Region			
Gran Asunción	21.9	21.0	30.0
North	29.1	29.4	26.3
Central South	23.9	24.4	19.5
East	25.2	25.3	24.2
Education			
Primary or less	51.7	51.8	51.2
Secondary or more	48.3	48.2	48.8
Church Attendance			
1/week or more	53.7	52.9	61.3
1/month or less	46.3	47.2	38.7
Men should be the authority			
Yes	34.4	34.3	34.7
No	65.6	65.7	65.3
Wealth Index Quartile			
1st	22.7	23.2	18.5
2nd	19.9	20.2	17.5
3rd	33.0	32.3	39.4
4th	24.4	24.4	24.6
N	2,982	2,685	297

Source: Authors' calculations of Paraguay ENDSSR Data, 2008

Table 4. **Odds Ratios and Standard Errors for Multivariate Logistic Regression Models of Out-of-Union Fertility in Paraguay, 2008**

Covariates	Model 1		Model 2		Model 3	
Age						
Under 20	--	--	--	--	--	--
20-24	0.670***	(0.105)	0.666***	(0.106)	0.654***	(0.105)
25-29	0.354***	(0.063)	0.356***	(0.064)	0.367***	(0.066)
30-34	0.138***	(0.036)	0.137***	(0.036)	0.143***	(0.038)
35-44	0.121***	(0.040)	0.117***	(0.039)	0.121***	(0.040)
Language						
Guaraní	--	--	--	--	--	--
Spanish and Guaraní	1.291*	(0.189)	1.215	(0.202)	1.326*	(0.230)
Spanish	1.307	(0.220)	1.143	(0.230)	1.370	(0.293)
Other	1.141	(0.363)	1.135	(0.374)	0.350	(0.455)
Region						
Gran Asunción	--	--	--	--	--	--
North	--	--	0.630**	(0.120)	0.612***	(0.118)
Central South	--	--	0.543***	(0.103)	0.541***	(0.103)
East	--	--	0.633**	(0.119)	0.635**	(0.120)
Education						
Primary or less	--	--	--	--	--	--
Secondary or more	--	--	0.876	(0.125)	1.056	(0.164)
Church Attendance						
1/week or more	--	--	--	--	0.798*	(0.104)
1/month or less	--	--	--	--	--	--
Men should be the authority						
Yes	--	--	--	--	--	--
No	--	--	--	--	0.893	(0.125)
Wealth Index Quartile						
1st	--	--	--	--	0.587**	(0.139)
2nd	--	--	--	--	0.610**	(0.137)
3rd	--	--	--	--	0.963	(0.168)
4th	--	--	--	--	--	--
N	2,982		2,982		2,982	

Note: Numbers in parentheses are standard errors
Source: Authors' calculations of Paraguay ENDSSR Data, 2008
*p < .10; **p < .05; ***p<.01