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An Economic Analysis of Polygyny: The Case of Maiduguri¹

by AMYRA GROSSBARD

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Nearly all Sub-Saharan and most Muslim countries permit polygyny.² In parts of Sub-Saharan Africa, as many as 35% of married men take simultaneously more than one wife (Dorjahn 1959), so that the majority of the population participates in a polygynous household at some time. I shall offer insights into the determinants of polygyny through an analysis of a predominantly Kanuri city in northeastern Nigeria that makes use of economic theory and econometrics (the testing of economic hypotheses).

Economic theory contributes to the understanding of some aspects of cultural phenomena. Its applicability extends beyond the domain of industrial production to encompass the everyday decisions of mothers, children, lovers, or marriage-brokers,

¹ This paper is based on my dissertation research as a candidate for a Ph.D. in economics. I am deeply indebted to Gary Becker and T. W. Schultz for inspiring my interest in anthropology and to Ronald Cohen for demonstrating tolerance for economics and generosity with his data. The material kindly offered by Jean Steckle and Linda Ewanyk provided the initial stimulus to the research.

² The only Muslim countries limiting polygyny are Turkey, Tunisia, and Pakistan. Egypt is in the process of joining them.

without distinction as to language or country. This broad focus follows from the definition of economics as the study of the allocation of scarce means to competing ends. Economic theory initiates an analysis of individual behavior in the process of constrained choice by making simplifying assumptions. Economists assume very simple rules of psychology, not because they naively overlook nuances of individual motivation, anxieties, or rationalizations, but because they hope that these simple abstractions will be sufficient approximations for the purpose. The criterion is that the theory work—that it produce reasonably accurate predictions.

A central behavioral assumption made by economists is that people are rational. Man, as pictured by economists, tries to utilize his resources in such a way that at the margin he achieves optimal allocation; if he is a worker, he equates the marginal benefit of supplying one more hour of work to its marginal cost in terms of the alternative allotments of time. Economists do not claim, however, that workers (or businessmen) actually reach their decisions by consulting curves or functions showing marginal cost and revenue. Similarly, when the proponents of the "new home economics" (see Becker 1965, Lancaster 1966) develop concepts like the marginal cost of children or the marginal revenue from seeking a husband, they do not claim to discover new behavioral rules. The validity of the assumption of rationality lies, not in its descriptive accuracy, but in the fulfillment of the theory it helps generate. Put another way, the principle is that the adequacy of a theory must be judged not by assessing the realism of its assumptions, but by examining the

fit of its logical consequences with the phenomena it is designed to explain.

The analysis presented here is "economic" in that, following Becker (1974) and Gronau (1970), it considers marriage as a situation of constrained choice. In contrast, most anthropological students of polygyny have used "economic" in a more restricted sense. Murdock (1949:36), who stresses the "basic importance of economic factors" in explaining the incidence of polygyny in a society, includes in his concept of "economic" labor in agriculture, trades, and crafts, preparation of food, and political and religious functions. While Murdock excludes certain domestic activities, Boserup (1974) leaves them all out. It is the same restricted concept of "economic" that Goody (1974: 189) has in mind when he criticizes Boserup, maintaining that the "reasons behind polygyny are sexual and reproductive rather than economic and productive." "Economic" as I have defined it invalidates Goody's dichotomy: the economic analysis of polygyny treats both its productive and its reproductive aspects.

I shall consider marriage as a framework for domestic production and reproduction valued by the members of a society who follow rules of optimization. Individuals determine the extent of their participation in a polygynous household according to endowed and acquired attributes. The application of economics as a heuristic methodology is the primary objective of the analysis. The testable hypotheses inferred relate to male and female characteristics on which information was collected in the city of Maiduguri. Regressions based on that information and on economic theory account for a positive, but small, proportion of the variation in polygyny among men and women.

MAIDUGURI

Maiduguri was selected for a study of polygyny on two fundamental grounds. First, approximately at the same time three separate informative surveys were carried out in that predominantly Kanuri city. In 1969, Ronald Cohen conducted interviews for his study of divorce among the Kanuri (Cohen 1971). In 1973, Jean Steckle and Linda Ewanyk surveyed the city for their study of consumer preferences in grain utilization. That same year Margaret Hardiman undertook a household survey requested by city planners. The opportunity to use the raw data collected by Cohen and by Steckle and Ewanyk and to refer to Hardiman's survey partially compensated for the lack of personal fieldwork. Second, polygyny is common in Maiduguri. In the surveys of Cohen and Steckle and Ewanyk, the average number of wives exceeds 1.5 (table 1).

Maiduguri, the capital of Nigeria's Northeastern State, also functions as the center of the Bornu-Emirate, homeland of the Kanuri people. Despite a recent influx of animist and Christian migrants from the south and the west, the majority of the 165,000 inhabitants adhere to Islam. According to Hardiman's survey, Maiduguri is 52% Kanuri, while other Muslims—Hausa, Fulanyi, and Shuwa Arabs—account for 25% of the population.

One of the principles of Islam limits the number of wives to four, a regulation strictly respected by Muslims and even non-Muslims: none of the households surveyed by Steckle and Ewanyk and Cohen had more than four wives.

According to Cohen (1967, 1971), Islam pervades all aspects of Kanuri life. Women lead a separate social existence and take no part in public life. They are considered inferior and sexually untrustworthy, which results in ideas of seclusion and the "code of modesty." Table 1 suggests that well over half the wives of urban Kanuri men are secluded. A woman's sexual activities, her reproductive power, and some stipulated parts of her economic potential are transferable to her husband at marriage. The children belong to the father, and when divorce occurs they remain with him, unless they are not yet weaned. Divorce is extremely widespread and occurs approximately four times

as often as in the United States (Cohen 1971:125). As table 1 shows, 69% of all marriages of the 45 men had ended in divorce, and the average duration of a marriage (including extant marriages!) was 7.7 years. From a comparison of the average numbers of wives and marriages it follows that the latter figure is high (5.1 marriages per man) as a function of the high divorce rate. This partially reflects the simplicity of divorce; it occurs automatically if a husband tells his wife "I divorce you" three times. Cohen's total sample reported approximately 450 divorces, only 3% of which involved recourse to the courts.

Maiduguri's economy relies on an old tradition of commerce with the East (Steckle and Ewanyk report [p. 21] that 33.6% of all men are traders and businessmen) and on a large sector of public services (12.1% are civil servants, 7.3% Koranic teachers, and 3.4% teachers and professionals). Only a small proportion of the population still owns a grain farm (16%), and even fewer are farmers and fishermen (5.4%).

With so many teachers in the city, it is not surprising that a large segment of the population has received some schooling.

TABLE 1
MEANS AND STANDARD DEVIATIONS IN TWO SETS
OF DATA ON MAIDUGURI

VARIABLE	STECKLE AND EWANYK		COHEN	
	Mean	SD	Mean	SD
wives	1.53	0.8	2.0	1.1
seclusion ^a			0.65	0.48
divorce			0.69	0.46
duration			7.7	6.8
number of husband's marriages			5.1	4.4
income ^b	3.19	1.86	3.9	1.3
wealth ^c			2.5	0.79
grain farm ^a	0.16	0.85		
houseowner ^a	0.75	0.64		
waterstandpipe ^a	0.35	0.48		
age of husband at time of interview	[mode: 36-45]		49.0	11.3
age of husband at last marriage			32.3	9.9
age of senior wife	[mode: 25-35]			
age of last wife at mar- riage			17.4	5.3
children ^d	2.5	2.3	2.3	
housewife ^a	0.87	0.34		
education of husband ^e	0.82	0.74		
education of senior wife	0.34	0.5		

NOTE: Number of observations is 754 for Steckle and Ewanyk, 207 marriages reported by 45 men for Cohen. Cohen's data are all for Kanuri; in Steckle and Ewanyk's, Kanuri are 57.6% of the sample.

The slightly higher mean number of wives and of children reported by Cohen may be the result of the higher age and Kanuri background of his respondents. From a comparison with Hardiman's (1973) survey, conducted on a sample more than three times as large as Steckle and Ewanyk's, their average age of household heads seems representative, but they seem to over-represent the Hausa tribe, homeowners, and owners of waterstandpipes; these last two differences may result from the restriction to married households and the greater wealth of the Hausa.

^a Dichotomous (dummy) variable; takes the value 1 or 0.

^b Estimated on the basis of occupation. Ronald Cohen advised me on the relative ranks of occupations. The scales in the two sets are similar, but not identical, because of the different categories available. The Steckle and Ewanyk data are ranked from 0 to 5 (unemployed, general laborer, skilled craftsman, farmer, civil servant or teacher, trader). The Cohen data are ranked from 1 to 6 (laborer, craftsman, farmer or small trader, civil servant or teacher, trader, noble).

^c Estimated by man interviewed; ranges from 1 to 4.

^d Steckle and Ewanyk's definition is number of children under the age of 14 living with the head of the household; Cohen's definition is total number of children born to a man by the time of his last marriage.

^e Based on years of secular and religious schooling.

According to Steckle and Ewanyk (p. 20), two-thirds of the men and one-third of the women have undergone formal schooling, most of it Koranic. Although few Koranic schools are recognized by the Ministry of Education, the skills they provide—including reading and writing ability—make them a worthwhile investment. In economists' language, schooling seems to raise individual productivity in terms of earning capacity and/or ability to produce goods in the home. For instance, a woman with Koranic education may be more skilled as a hostess or mother than a woman who did not go to school.

Most families (75%) live in their own homes. Generally there is no waterstandpipe in the compound, so many women and children have to carry water; otherwise the family buys water from carriers.

Most of the woman's life centers around her husbands and children. She usually marries very young; by the age of 15 she has probably been married at least once. In contrast, most men do not marry before age 20 (Cohen 1971).

Women are most likely to bear children between the ages of 19 and 25 (Hardiman 1973, Steckle and Ewanyk 1973). Hardiman (1973: table 12) estimates the average fertility rate for women over 35 to be 3.2. The average number of children currently living in a man's household is reported by Steckle and Ewanyk as 2.5; Cohen gives the average number born to a man before and during a particular marriage as 2.3.

While on the decline, child mortality is still very high. Hardiman estimates the mortality rate of newborns at 212 per 1,000 live births. Deaths of women at childbirth do not appear to be very common, since only 2.3% of 265 urban Kanuri men's marriages ended with the death of the wife (from all causes).

After age 34 a woman has a high probability of becoming a divorcée or a widow. In contrast, males' marriages last longer. The survival of divorcées and widows depends on relatives, usually children. It appears from Hardiman's survey that many urban divorcées do not receive any support and die prematurely, especially if they are childless.

Limited labor-force participation increases woman's reliance on husband and children. Of the senior wives in the Steckle and Ewanyk sample, 87% are full-time housewives.

Invoking simple price theory, I shall now examine the effect of each variable reported in table 1 on an individual's propensity to belong to a polygynous household.

THEORY

Firms transform purchased inputs into marketable output. In similar fashion, creative men and women transform scarce inputs into a valuable output; they produce meals, religious rituals, card games, children, etc. Some creations originate from the work of one individual, and some require cooperation. Some obtain public recognition in terms of a market value or a moral judgment, while for others appreciation only comes from the creators. The concern here is with marriage, an institution for domestic production requiring the cooperation of at least one woman and one man. The theory views people as optimizing agents. Women supply wife-services demanded by men, and polygyny will be determined by the individual's relative position in the market where the aggregate demand and supply for wife-services intersect.

Following Bohannon's (1949) distinction between uxorial and genitricial rights, one could introduce the concepts of a woman's uxorial services—including housekeeping and sex—and her genitricial services. Men also perform services. Although in most societies, and certainly in Maiduguri, the husband's contribution to housekeeping is negligible, fathers often participate in their children's education. For purposes of discussion, I shall ignore alternatives to marriage through which men and women can fulfill certain of their needs for housekeeping, sex, and offspring.

No creation is costless. Men and women spend time, energy, and, in most cultures, money for the privilege of conducting parental and other domestic activities. These costs limit the amounts produced. With no market prices reflecting the value of these activities, their value will only be subjective. A person's evaluation of marriage may encompass the benefits from that institution mentioned above, as well as a taste for love, dominance, or harmony. Assuming that people choose what makes them happy, the more they value the benefits from marriage, the larger the share of resources they will devote to it. For instance, if a man's only resource is time, he will commit proportionately more of it to his family directly as he values the family (he will pay more attention to them, instead of pleasing himself alone, and work harder, to provide for them).

The output produced in marriage is limited by the costs involved. There are three categories of costs: premarital, marital, and postmarital. Premarital costs include the time spent searching for an appropriate partner, the costs of establishing a household, premarital transfer payments, and marriage celebrations. Marital costs are the costs of actual production in marriage. An important factor of production is the time devoted to the process of creation. Here again, price is not necessarily market price (market wage). If one does not participate in the labor market, the opportunity cost of time in the home, or shadow wage, is determined implicitly. Postmarital costs refer to the monetary and readjustive costs of dissolution.

The simple apparatus of supply and demand analysis can be used to derive predictions concerning polygyny. Supply and demand analysis is a means of classifying a limited number of variables that assist in the explanation of the phenomenon under study. In this particular case, it is convenient initially to think of attributes of men and women in terms of their effect on the demand and supply of wife-services, and eventually on polygyny. These attributes will be discussed with an eye to their empirical applicability, which limits the analysis even further.

Although both men and women supply and demand services to and from each other, I will simplify the discussion by considering women as suppliers of uxorial and genitricial services and men as demanders of these services. Both men and women, however, follow the same principle of optimization. Subject to their own valuation of their production with or without spouse, and considering the costs of production within or without marriage, they reach a maximal total production value.

First let us consider men's demand for wife-services. In order to concentrate on male attributes, let us assume temporarily that there is only one type of woman. In figure 1 the horizontal axis represents the number of hours of daily uxorial and genitricial services performed by women in a household. The

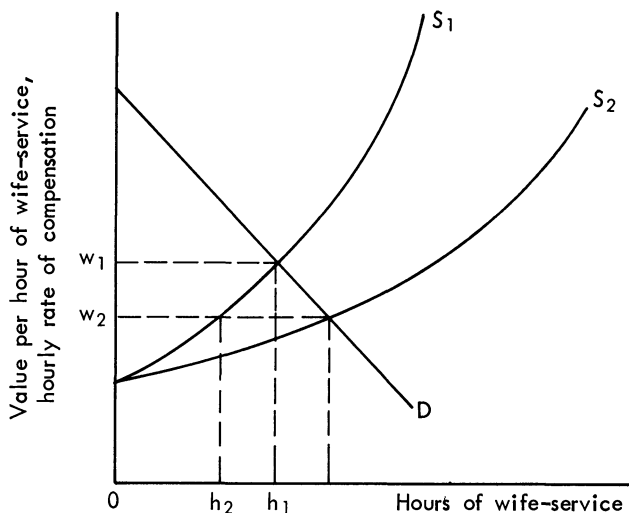


FIG. 1. The market for wife-services.

vertical axis plots the value of an hour of wife-services. The demand schedule is downward-sloping, reflecting successive diminishing values of wife-services.³

Next, let us consider the supply of wife-services by a representative woman. The vertical axis can now be reinterpreted as the compensation a woman requires for every hour of uxorial and genetricial service she supplies. That compensation may take the form of provision for her comfort, rights to the marital product, bridewealth, or a combination of these. The more a woman individually desires to be a wife and a mother, the lower the compensation she will require for the first hours of wife-service, and therefore the lower will be the supply schedule.⁴ For instance, the greater a woman's attachment to her own kin, the more she will value her time outside of marriage and the higher will be her supply schedule.

If polygyny itself is costless, the combined supply of wife-services by two identical women is simply the horizontal sum of their individual supply schedules (S_2 in fig. 1). Similarly, one can obtain an aggregate supply curve of three or more wives.

The intersection of the demand with the supply determines the number of hours of service a woman provides a husband who simultaneously demands that number. Thus far the analysis does not indicate whether the husband whose demand appears in figure 1 will marry one, two, or more of these identical wives. The husband will prefer two wives to one wife, provided that his valuation of the second wife's services is at least equal to the compensation she requires. A woman, however, will prefer monogamy because her total income, the product of her hours of work and the hourly compensation, is clearly larger under monogamy (w_1h_1) than under bigamy (w_2h_2). Therefore, the man and each of the two women have conflicting interests.

The issue is resolved when each participant in this "market" for wife-services becomes aware of his or her alternatives. This interdependency between people is expressed through the market mechanism. In the hypothetical culture described here, each man and woman defines his/her own demand and supply. Consequently, the equilibrium hourly compensation, or "wife-wage," is determined at the intersection of the aggregate demand by men and the aggregate supply by women. If this equilibrium wife-wage is larger than w_2 and smaller than w_1 , the individual man represented in figure 1 will be monogamous. If the wife-wage equals or is less than w_2 , he will be polygynous. Were the wife-wage higher than w_1 , this poor man would not marry at all; other men, who might demand more wife-services than he, would drive up the wife-wage, thereby preventing him from getting married. Given her alternatives, none of the identical women will consider marriage to somebody who compensates her less for her efforts.

In order to identify the male determinants of polygyny, one

³ The comparative value of the first unit will be higher when a man cannot obtain certain services in any other way than through a wife. This substitution between wife's services, on the one hand, and husband-time, purchased inputs (like commercial bread or refrigerators), and other women's services, on the other, is one reason for the negative slope of the demand curve. A second kind of substitution reinforces the negative slope. Wives contribute to the production of a restricted range of men's desires, including house-keeping, sex, and offspring. The negative slope also results from a substitution of satisfaction of these desires with others.

⁴ In supplying her wife-services, a woman effects a double substitution: between her uxorial-genetricial and other desires, on the one hand, and between marriage and alternative ways to satisfy her needs for being a wife and mother, on the other. In contrast to their effect on men's demand for wife-services, these substitutions lead to an upward-sloping supply schedule: after performing a certain amount of wife-services, the woman enjoys it less and less and requires higher compensation for her efforts. After a certain point she will refuse to perform any more daily wife-services—at which point the supply schedule becomes vertical.

must isolate the factors accounting for the amount of wife-services demanded by various men participating in the same marriage market. In that process, female attributes must be kept constant. This may be done by referring to the simple model with identical women, varying one male attribute at a time and analyzing its effect on the demand for wife-services.

First, the higher a man's income, the more wife-services he will demand. (Graphically, a higher income shifts the demand schedule upwards.) Second, education increases one's resources, in terms of both income and the ingenuity with which time is utilized; thus a man's education also generates an upward shift in his demand for wife-services. Third, if a man is limited in his ability to borrow funds when young, and if his income grows over time until it peaks, his demand for wife-services will increase with age until a certain point of maximum productivity. As polygyny is a function of the demand for wife-services, three hypotheses may be offered:

Hypothesis 1. Polygyny is a positive function of male income.

Hypothesis 2. Polygyny is a positive function of male education.

Hypothesis 3. Polygyny varies over a man's life-cycle; it maximizes when the man attains peak productivity. This curvilinearity in the relationship between husband age and polygyny contrasts with the positive linear effect of age on polygyny identified in other studies.⁵

Next, let us look at the effects of variations in female attributes on the number of wives in the household. Differences among women are partially reflected in their productivity as wives. For instance, more educated women are probably more efficient in running a household and are capable of providing better education for their children. From another perspective, certain women are more fecund, partially as a function of age. The productivity of a woman in marriage helps to explain the number of co-wives that she will have. This may also be expressed in terms of supply and demand analysis.

Let us consider a man's demand for hours of wife-services where the productivity of wife-services is that of the least productive women in the market for wives. The supply of wife-services by one woman representing this lowest class is represented by S_1 in figure 1. Two women of this kind will supply S_2 . A third woman who is twice as productive as the first woman can perfectly substitute for two low-productivity women. Thus her supply schedule in terms of the first woman's productivity is S_2 . Each hour of work that she supplies to the household is worth two hours of the work of the low-productivity woman. Following this simple analysis, it is predicted that more educated, more fecund, and more fertile women will have fewer co-wives. This conclusion should be qualified (1) by questioning the validity of considering only cases where women of different productivity can be substituted for each other and (2) by considering variability in women's demand for marriage.

In cases where women of different productivity do not substitute for each other, they complement each other. For example, an educated woman managing a household where the other women are not educated may complement her co-wives. In such cases, educated women would have more co-wives. A priori, it is not clear whether women of different levels of education are complements or substitutes. More educated women are probably more efficient in various tasks like child raising, entertaining guests, or provision of emotional support to their husband, so that they may replace a larger number of other women. The gain from substituting a small number of the former for a larger number of the latter will probably not be completely neutralized by the advantages of an educated female's managerial predominance.

⁵ Clignet (1970) is one study in which elders are viewed as the traditionally privileged segment entitled to polygyny. At a theoretical level, no mention is made of a maximum seniority beyond which a man becomes less polygynous.

More educated women may also have fewer co-wives because of their greater demand for marriage. The more a woman values being married, the lower her supply schedule. The lower her supply schedule, the fewer co-wives she is likely to have, for at the market wife-wage adjusted for her skills she is willing to work more herself. An educated woman usually comes from a high-status family, controls more resources independently of marriage, and is likely to attach more importance to being married (assuming that higher income leads to more demand for goods produced in marriage). She also wants her husband to devote more attention to her, an additional factor responsible for educated women's having fewer co-wives.

Despite the countereffect of complementarity, these considerations suggest the following hypothesis:

Hypothesis 4. Female education relates inversely to polygyny.

Women differing in fertility correspondingly vary in (1) their supply of wife-services and (2) their demand for marriage.

There is no reason to expect complementarity between women varying in fertility. Therefore, if, given his resources, a man aims for a specific number of children, the possibility of polygyny widens the range of substitute routes towards that target. The identical number of offspring can be obtained with one unusually fertile wife or with a number of wives of lower expected fertility. There may exist a timing factor: if after a few years it becomes apparent that the first wife is not able to bear the desired number of children, the husband may start to look for a second wife.

A woman of higher fertility may also use that asset to acquire more privileges for herself. This, in turn, may persuade her to choose a husband with fewer wives. Combining these two considerations brings us to another hypothesis:

Hypothesis 5. Women of higher fertility have fewer co-wives.

A direct way to test this will be to assess the relationship between completed fertility per wife and number of wives. Alternatively, an element of expected fertility, the age of a woman, may be examined and tested to generate another hypothesis:

Hypothesis 6. Women at an age of peak fecundity have fewer co-wives.

So far, I have discussed the differential impact of individual male and female characteristics on the propensity for membership in a polygynous household. Clearly, people live within a culture imposing constraints on their individual choices. These constraints affect a man's decision to marry in addition to other men's wife demands and the aggregate supply of wife-services by women. If his culture effectively prohibits polygyny, this man will be limited to choosing one wife at a time. Observers have noticed that, on a worldwide scale, cultural background and religion considerably affect the legal status of polygyny (see Murdock 1949).

In Maiduguri, however, once the attributes mentioned earlier are accounted for, the religious and ethnic background of a man or a woman should not have much impact on polygyny. The entire city belongs (to a certain degree) to a single polygynous marriage market. Indeed, no ethnic group living in Maiduguri prohibits polygyny. The geographical proximity imposes similar pressures on all men and women. Even though most people usually marry within their own group (Steckle and Ewanyk 1973:14), the absence of an absolute prohibition on intermarriage implies that the entire city belongs to one market for wife-services. For instance, were there an acute shortage of men in one ethnic group, some of the women belonging to that group would marry men from other groups. This suggests a seventh hypothesis:

Hypothesis 7. Where all coexisting ethnic groups allow polygyny and intermarriage, there will be no major effect of ethnic group on the number of wives.

Major sex imbalances among the tribes, due to demographic or political factors, would probably create differences in polygyny rates. In the region of Maiduguri, the Kanuri dominate

the Shuwa Arabs politically, one result of which is an asymmetric intermarriage rule: Kanuri men may marry Shuwa women, but Shuwa men and Kanuri women are not allowed to marry (Cohen and Middleton 1970:14). The consequent higher sex ratio among marriageable Shuwa may lead to a lower degree of polygyny.

Like all the preceding hypotheses, Hypothesis 7 states a partial effect: tribes generally do not differ in polygyny once other attributes of men and women are taken into account. In groups with more wealth and education, however, men may have more wives.

According to sociological theory, the strength of a marital relationship is a direct function of the attraction within the marriage (Levinger 1968:580). In terms of an economic theory, fewer returns from marriage increase the likelihood of divorce (Becker, Landes, and Michaels 1975). To the extent that polygyny reduces the attraction within each marriage contracted by a polygynist and diminishes its returns a final hypothesis may be suggested:

Hypothesis 8. Polygyny will lead to more divorce.

Cohen (1971:142) indicates the same prediction by using "simple logic."

An increasing number of co-wives increases the probability that an individual marriage will end in divorce, for women marrying a polygynist are likely to have lower productivity and lower demand for marriage, thus creating a smaller total marital output and fewer returns from marriage.

These eight hypotheses concerning polygyny will now be tested.

RESULTS

When testing for the effect of male and female attributes on the number of wives in the household, the characteristics of the mate(s) have to be kept constant. For example, if a man is indifferent as to whether he marries two average women or one gifted one, given their relative wages and productivity, little can be inferred about the number of his wives by simply comparing his endowments with other men's endowments. The following hypothesis is more informative: Given that a man has one average wife, his attributes lead us to expect him to have more than one wife. Consequently, the regressions simultaneously include male and female attributes. Table 2 presents the results obtained with the two data-sets. The method of estimation was Ordinary Least Squares.

The positive income effect predicted in Hypothesis 1 is verified in both linear regressions. Regression 1 estimates income through occupation and ownership of a waterstandpipe, a grain farm, and a house. All coefficients are positive and significant.⁶ Regressions 2 and 3 reflect the same effect with occupation as the measure of income.

Hypothesis 2, predicting that education of the husband raises the number of wives, is confirmed by Regression 1. Given the poor quality of the proxy for income, however, education may affect the demand for wives through its effect on earnings.

Hypothesis 3 was that at the age of peak productivity a man is likely to be married to more wives. In all regressions, older men appear to have more wives, but Regression 3, including variables of "age of husband at last marriage" and "age of husband at last marriage, square," also shows that the peak of polygyny occurs between ages 43 and 46,⁷ which seems consistent with a lifetime earnings profile.

⁶ A variable is significant at the 95% level if its *t*-statistic in the regression exceeds 1.96.

⁷ In mathematical terms, a peak is a maximum. Let us call the variable "wives" Y and the variable "age of husband" X and abstract from the other variables. The regression equation can then be written as $Y = aX + bX^2$. The first-order condition for a maximum (and a minimum) is that the first derivative equal zero, or $a +$

TABLE 2
REGRESSIONS OF "WIVES"

VARIABLE	1 Steckle and Ewanyk data	2 Cohen data	3 Cohen data
<i>Male attributes</i>			
occupation	0.05 (3.52)	0.18 (4.52)	0.17 (4.07)
waterstandpipe	0.32 (5.99)		
grain farm	0.23 (3.5)		
houseowner	0.23 (3.85)		
age of husband at time of interview	0.11 (4.82)	0.02 (4.24)	0.02 (4.02)
age of husband at marriage		0.25 (7.47)	0.22 (6.06)
age of husband at marriage, square		-0.0029 (6.1)	-0.0024 (4.85)
education of husband	0.02 (2.7)		
husband Hausa ^a	0.04 (0.6)		
husband Shuwa	-0.26 (2.63)		
husband Middle	-0.03 (0.28)		
husband Other	-0.19 (1.36)		
husband Yoruba	-0.39 (1.93)		
husband Banan	-0.2 (1.05)		
wealth			0.16 (1.96)
<i>Female attributes</i>			
age of wife at interview	0.023 (0.66)		
age of wife at marriage		-0.12 (1.9)	-0.13 (2.1)
age of wife at marriage, square		0.0029 (1.81)	0.0028 (1.88)
education of senior wife	-0.03 (2.54)		
average fertility	-0.07 (4.61)		
wife's children		-0.14 (3.45)	-0.15 (3.3)
average number of children by previous wives			-0.08 (2.43)
seclusion		0.24 (2.03)	0.24 (2.13)
Constant	0.88	-4.33	-3.87
R ²	18.6	50.6	53.3

NOTE: Number of observations is 897 for Steckle and Ewanyk, 207 for Cohen. The parameters in parentheses are the *t*-statistics. The method is Ordinary Least Squares.

^a Hausa, Shuwa, Yoruba, Banan, Middle, and Other are names of tribes or groups of tribes; the remaining are the Kanuri. Cohen's data are for Kanuri only.

Another male attribute included in Regression 2 is the husband's age at the time of the interview. The number of wives is probably a positive function of the length of time since marriage. We expect the number of women to whom a man who is now 70 years old was married when he was 25 to be larger than the number of wives married now to a man who is 25. The first base for that hypothesis is the health component. If a man living in Maiduguri has lived 70 years, he is probably healthier than average. That is an endowment leading to more marital output and more wives. Secondly, there may be a cohort effect. If there has been some modernization in Maiduguri, polygyny may be decreasing over time. This hypothesis is verified: the age of husband at the time of the interview is significantly positive in both regressions.

Ethnic-group membership appears to have little effect on the degree of polygyny. As expected in Hypothesis 7, Regression 1 shows that most tribes do not have a significantly different number of wives than the Kanuri. While Hausa are Muslim, Middle and Other (aggregations) are mostly animist or Christian; compared to the Kanuri they are equally polygynous. One exception, however, is that Shuwa Arabs, subject to disfavorable marriage rules imposed by the Kanuri, have fewer wives.

Table 2 also shows the effect of female attributes on the number of wives in the household. Regression 1 confirms Hypothesis 4: the more educated the senior wife, the fewer her co-wives. This suggests that some men substitute marriage to one highly educated wife for marriage to a number of uneducated wives. Alternatively, this result may be interpreted as a greater demand for marital services on the part of educated women.

Regression 3 shows that young and old women have more co-wives. As is predicted in Hypothesis 6, women at their age

of peak productivity have fewer co-wives. That peak age computed from the regression is 21 to 23,⁸ which is consistent with the description of fertility patterns in Maiduguri.

The negative relation between fertility per wife and polygyny predicted in Hypothesis 5 is confirmed in all regressions. In Regression 1 fertility per wife is established as an average for the household; Regression 2 includes the number of children born to a particular marriage between one man and one woman, while Regression 3 includes this last variable as well as an estimate of the fertility of previous wives. All three estimates of fertility per wife show a negative sign. This result does not invalidate the interpretation of age in terms of fertility, since a woman's potential as a mother is a function of her age and differs from her actual number of children. A problem with the variable "average fertility" is the spurious correlation, since the number of wives appears on both sides of the equation. It is worth noticing that the two sets of data give similar results despite the difference in the definition of children.

The variable "seclusion," reported by Cohen, differentiates between women who are secluded and women who are not. Women who agree to marry a husband who will seclude them are giving up the right to leave the home except on special occasions, thereby reflecting either a lower productivity or a smaller demand for satisfaction inside and outside marriage. The significantly positive sign may therefore be another evidence of substitution between more women of lower quality and fewer women of higher quality. Seclusion could also be an additional proxy for husband wealth or a factor reflecting more taste for marriage on the part of the husband. The positive sign found in table 2 confirms any of these interpretations.

⁸ Following the procedure of n. 7, let us call the variable "age of wife" Z . The regression equation will be $Y = a'Z + b'Z^2$. At the minimum $a' + 2b'Z = 0$ or $Z = -a'/2b'$. Plotting the values of a' and b' , we obtain $Z = -0.12/(2 \times 0.0029) = 21$.

$2bX = 0$. Therefore, $X = -a/2b$. Regression 2 tells us that a and b are respectively equal to 0.25 and -0.0029 , so $X = 43$.

Cohen (1971) himself has shown a positive relation between divorce and polygyny. Using the method of cross-tabulation, he found that a higher percentage of polygynous than of monogamous unions ends in divorce. Within the polygynous family, Cohen's tables show that the two-wife family increases the probability of divorce of the younger wife, while the three-wife family increases the probability of divorce for the senior wife. Among urban males, Cohen also found a partial effect of polygyny on divorce. A dichotomous variable of monogamy accounted for a sizeable fraction of the variation in divorces. In his multivariate analysis of the probability that a marriage will end in divorce, Cohen found an effect of monogamy in addition to the effect of fertility of the present union and the effect of the secretiveness of the husband towards his wife.

Table 3 explains the likelihood that a marriage will end in divorce in terms of the number of senior wives, attributes of the husband (age, wealth), attributes of the wife (age and age square), the duration of marriage, and the number of children (the direction of causality in the last two variables is ambiguous). While in his multivariate analysis Cohen used a dichotomous explanatory variable "monogamy," I use a continuous variable "wives," which local custom limits to 4. In addition, a dummy variable "wives = 4" is included to capture differences between households with four wives and other households. The method used is Probit, a maximum-likelihood method of estimation especially designed to deal with dichotomous dependent variables; in this case a linear regression model and the Ordinary Least Squares method would be inappropriate.

Cohen's finding is confirmed: polygyny has a positive effect on divorce. Like Cohen, I find a negative effect of fertility. In addition, table 3 shows a significant negative effect of husband's age and wealth.

SUMMARY AND CONCLUSIONS

An economic analysis seems to contribute helpful insights into the determinants of polygyny. The simplifying assumption of rationality is the basis for hypotheses which have been tested and verified from data on the domestic sector of a preindustrial community.

I have viewed people as determining their needs for marriage in terms of their personal values and resources and the costs involved in marriage. On the basis of additional assumptions, I have considered women as suppliers of marital services and men as demanders of these services. Men were expected to marry more wives when their income, education, and age led them to demand more wife-services. A productivity and a demand effect on the supply of wife-services generated the prediction of an inverse relationship between polygyny and female education and between polygyny and fertility. Ethnic-group membership was not expected to affect polygyny significantly.

TABLE 3
REGRESSIONS OF "DIVORCE"

VARIABLE	1	2
wives	0.97 (3.72)	0.85 (2.40)
wives = 4		0.46 (0.50)
age of husband	-0.10 (3.88)	-0.10 (3.80)
age of wife	0.13 (0.61)	0.12 (0.55)
age of wife, square	-0.00 (0.40)	-0.00 (0.35)
wealth	-0.61 (2.20)	-0.61 (2.19)
duration	-0.14 (3.80)	-0.14 (3.83)
children	-0.55 (2.64)	-0.54 (2.59)
constant	4.52 (1.84)	4.64 (1.89)

NOTE: From Cohen data. The parameters in parentheses are the *t*-statistics. The method is Probit.

Finally, it was hypothesized that polygyny engenders divorce. All of these predictions were tested and most of them confirmed.

The novelty of this study lies not in the discovery of an income effect on polygyny, but in the hypotheses generated by considering housewives as producers. The predictions of a life-cycle effect and of minor tribal effect on polygyny are also indicative of the fruitfulness of an economic approach. The results depend crucially on simultaneous consideration of male and female attributes affecting the demand and supply of uxorial and generitrial services. Methodologically, regression techniques of Ordinary Least Squares (table 2) and Probit (table 3) proved as useful in explaining polygyny and divorce as they have been in accounting for paradigms of market economics. The low coefficients of determination (R^2), however, reflect the limitations of an economic analysis. More knowledge of the culture and more culturally meaningful data are necessary to improve the results.

This study demonstrates, I think, the advantages of interdisciplinary cooperation. An economic analysis vitally depends on the thorough cultural understanding anthropologists develop through fieldwork. Without the information on Maiduguri generously transmitted by Ronald Cohen and the insights on polygyny previously published by other social scientists, this paper would not have been written.

The application of economic and econometric tools need not be restricted to a study of polygyny in Maiduguri. The same analytical framework can be applied to the study of polygyny in other cultures. Furthermore, the economic approach can be extended to other aspects of kinship.

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