THE ECONOMICS OF POLYGAMY

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INTRODUCTION

Polygamy can take the form of polyandry (several men share a woman) or of polygyny (a man marries several women). The latter form is more common, as nearly all sub-Saharan and most Muslim countries permit it. In parts of sub-Saharan Africa, as many as 35% of married men are polygynous (Dorjahn, 1959), so that the majority of the population participates in a polygynous household at some time.

This paper uses economic theory to offer insights into the determinants of polygamy. Since I will try to establish some correspondence between theory and facts around the world, the focus will be on the more common type of plural marriage, polygyny.

The theory developed in the first section is based on Becker's economics of marriage. Although anthropologists (for instance, Goldschmidt, 1974) and sociologists (for instance, Rosenthal, 1970) have previously used the concept of marriage market, they have not developed the theoretical implications of

that concept to the extent that Becker has in his "A Theory of Marriage." This paper expands on Becker's analysis of polygamy both in theory and in empirical work. An extensive review of cross-cultural evidence, largely based on studies by anthropoligists and sociologists, hopefully provides some new insights (Section IV). The nature of these international data and findings makes serious econometric analysis difficult, if not impossible, but the abundance of some of the evidence hopefully compensates for its lack of robustness.

Previous applications of the economics of marriage to a specific culture related to that of the Untied States: Silver (1965) looked at marriage rates and the business cycle, Freiden (1974) at the interstate differences in percentage of women married, and Keeley (1974) accounted for variation in age at marriage. In contrast, this paper applies the economics of marriage to a less developed country. The empirical work derives from African data collected by an anthropologist, Ronald Cohen, who also helped two food technicians, Jean Steckle and Linda Ewanyk, make a later study in the same Nigerian city of Maiduguri. The data's lack of detail presents a major impediment, but it does not preclude testing of the theory. The results include some interesting findings reinforcing the conclusion that economics is a helpful tool for analyzing polygamy.

I. THEORY—GENERAL

Marriage is viewed as a joint enterprise whereby man and woman produce goods and services for their own consumption. Generally, in particular in the Western hemisphere, marriage involves one man and one woman. What are the factors promoting plural marriage? The following theoretical discussion sheds some light on some implications and causes of polygamy, with special emphasis on polygyny.
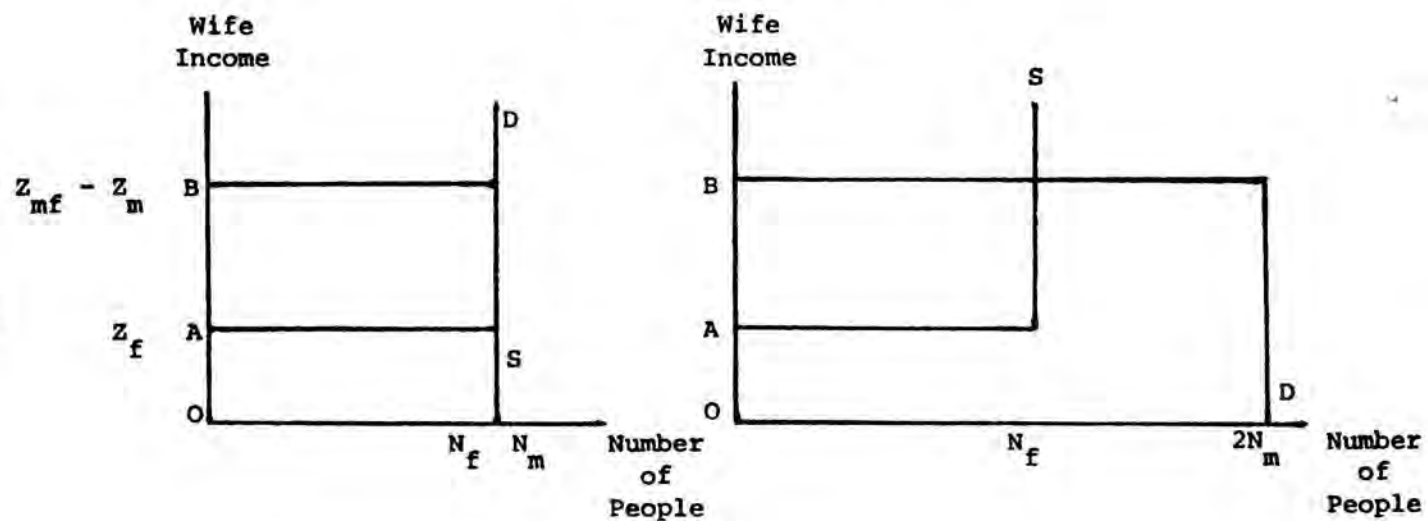
Unless otherwise specified, consider N_m identical men and N_f identical women. A marriage market is constructed (see Figure 1) following Becker (1974, p. 323). The horizontal axis denotes the number of women involved, while the vertical axis gives their value under different circumstances and their equilibrium income. No woman will accept a marital income of less than Z_f, her income when single. Hence the supply curve is horizontal at that level up to N_f, where there are no more women available for marriage and the supply becomes vertical.

The highest payment men are willing to transfer to women in order to entice them to marry, is the additional income men would experience if they marry one wife instead of remaining single, i.e.,

$$Z_{mf} - Z_m,$$

where Z_{mf} denotes marital income of one man and one woman, and Z_m denotes m's income when single. If the number of men equals that of women

Figure 1: Marriage Market

Wife Income

$Z_{mf} - Z_m$

Z_f

Number of People

(a) Sex ratio equal to 1

Wife Income

Number of People

(b) Sex ratio larger than 1 and monogamy <u>or</u> sex ratio equal to 1 and <u>polygyny</u>

$(N_m = N_f)$, and no polygamy is allowed, Figure 1[a] is obtained. The market for wives shows no single equilibrium income. The women would like to obtain OB, while the men will try to give them OA only, and the actual result of that bargaining will probably lie somewhere in between.

In this case, would polygyny occur if it were permitted? After some identical men are married once, they may consider marriage to a second wife. If there is a constant marginal product from increasing the number of wives, i.e.,

$$Z_{mf} - Z_m = Z_{mff} - Z_{mf}$$

(where Z_{mff} denotes the income of a two-wife marriage), then bigyny extends the demand for women with an additional horizontal section at the same level OB (Figure 1[b]). Now the market unambiguously establishes an equilibrium wife-income at OB. The indeterminacy in distribution of income prevailing under monogamy evolved to the advantage of women after the demand for their service rose. In this simplistic model, a new indeterminacy now arises: who will be the husbands? All men may marry just once, half the men may marry twice, or the outcome may lie somewhere in between. The problem could easily be expanded to allow for marriages with three or more wives. It already becomes apparent that women are better off when men compete more for their wife-services. Only in the unlikely case where the bargaining situation described in Figure 1[a] resulted in a complete advantage to women would their income be unchanged after polygyny is allowed. As will be seen below, different assumptions do not modify the first proposition:

Proposition 1. Women are better off when polygyny is permitted (Becker 1974). Conversely, the institution of polyandry is detrimental to women. When men can share a wife, the total demand for wives is smaller and the intersection of demand and supply is more likely to occur at the lowest income women would accept.

Next, let us assume that the sex ratio is smaller than unity, i.e., the number of women N_f exceeds the number of men N_m, as illustrated in Figures 2[a] and 2[b]. When monogamy is imposed, the equilibrium wife-income is now unequivocally established at the lowest level acceptable to women: Z_f, their single income. This reflects the fact that some women have to remain single, since they cannot all find a husband, and in equilibrium a woman will be indifferent between the two kinds of marital status. As seen in Figure 2[b], bigyny will unambiguously improve wife income (unless there are more than twice as many women as men). Allowing men to take more than two wives would then enable women to receive the highest income men are willing to pay for the privilege of marrying them. This simple case of a sex ratio smaller than 1 reinforces Proposition 1. Women

Figure 2: Marriage Market: Sex Ratio Smaller than 1

(a) Monogamy

(b) Bigyny
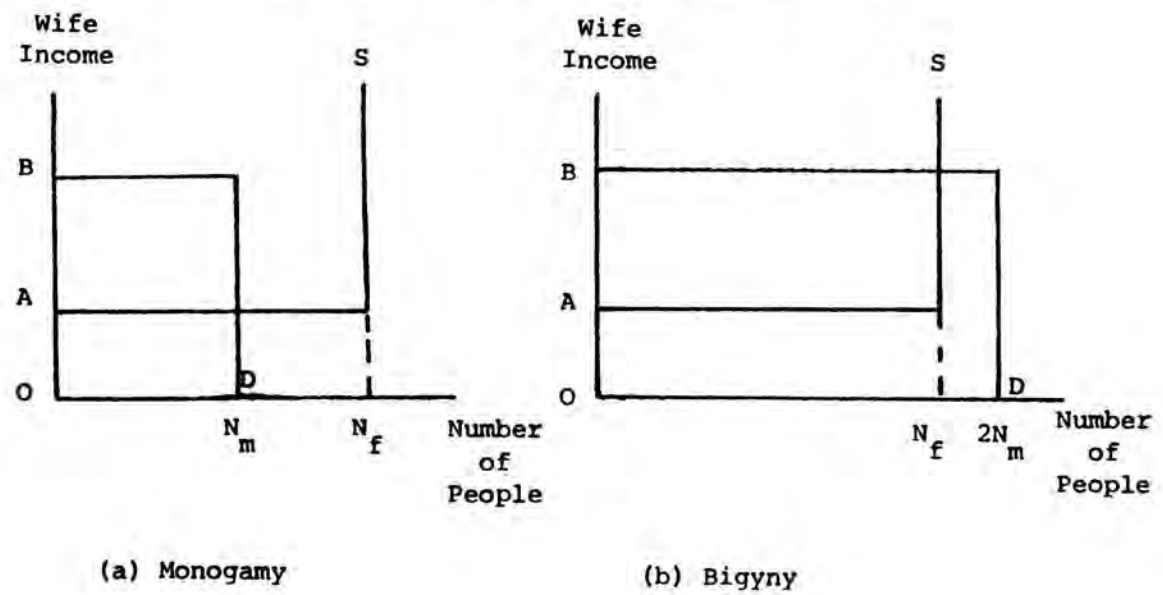
are unequivocally better off with polygyny. In addition, a second proposition may be derived from a comparison of Figures 1 and 2.

Proposition 2. When the sex ratio is initially smaller than or equal to one, the smaller the sex ratio the more women and society in general benefit from polygyny, and the more polygyny is likely to occur. In Figure 1, where equal numbers of men and women entered the marriage market, equilibrium under imposed monogamy could possibly have been the same as under a system allowing for polygyny. Women could have remarried at the same level of income, or improved it. When their number exceeds that of men (Figure 2), women are always better off in polygyny. In Figure 2, the rise in wife-income due to polygyny equals AB, while in Figure 1 it probably only involved part of AB. While women gain, men lose, but society as a whole is better off.

The social gain from marriage consists of the combined producer and consumer surplus, i.e., the area under the demand curve and above the supply curve (men can be considered as consuming wife-services). When the sex ratio equals one, allowing for polygyny changed the distribution of income only—between men and women, and among men. The total surplus produced in marriage remains unchanged after removal of the monogamy constraint. When the sex ratio is smaller than unity, however, society as a whole benefits from polygyny, as appears from a comparison of Figures 2[a] and 2[b]. By allowing for polygyny, society now enables $(N_f - N_m)$ previously unmarried women to add to the total production in marriage, each identical marriage producing AB. With more women than men, it is more advantageous for society to allow polygynous marriage. In such circumstances polygyny is also more likely to be observed.

In addition, as long as we continue to assume identical men and identical women, and the sex ratio is initially smaller than unity, the size of the social gain from polygyny rises when the sex ratio falls. Under monogamy, the initial number of unmarried women is larger; polygyny enables most women to enjoy benefits initially unavailable to them. Any factor raising the surplus from marriage (AB) is likely to promote polygyny. This is especially clear when the sex ratio is smaller than unity. Each additional marriage, possible only when polygyny is instituted, then yields a larger gain, and society as a whole benefits more from polygyny.

The gain from marriage, the difference between total income as married and the combined incomes of the spouses if they remain single, varies from one society to another. (If individuals were not assumed identical, it would also vary from one individual to another.)

Proposition 3. The larger married household production compared to single household production, i.e., the larger the gain from a marriage, the more a

society is likely to experience polygyny. In graphical terms, a larger gain from marriage is reflected in an upward shift of the derived demand for wives. Even when there are equal numbers of men and women (Figure 1), a larger gain from marriage may induce men to try harder to get a second wife at the expense of another man.

The gain from marriage depends on (a) complementarity between husband and wife (an important component of which is their complementarity in procreation and childrearing), (b) the availability of substitutes to a wife's services in the household (for instance, food preparation services, servants, or prostitutes), and (c) women's earnings in the job market relative to men's. The more men and women complement each other in marriage, the fewer substitutes to wife's services are available, and the lower the ratio of women's to men's earnings, the larger the gain from marriage and consequently the more profitable to institute polygyny.

II. THEORY—INTRODUCING DECREASING MARGINAL PRODUCTIVITY

All previous implications were derived with the simplest conceivable assumptions, one of which being constant marginal productivity of wives. However, there are two main reasons to expect decreasing marginal productivity of additional wives. First, conflicts may arise among co-wives married to a same man, thus reducing Z_{mff} in comparison to Z_{mf}. Second, the constraint of a fixed number of men leads to decreasing marginal productivity of additional wives. If there is only one man in the marriage, increasing the number of wives increases the supply of wife-time relative to that of the fixed factor husband-time, which leads to diminishing marginal productivity. In other words

$$Z_{mff} - Z_{mf} < Z_{mf} - Z_m.$$

In addition, men's demand for wives is determined by the value of marginal productivity, and there may be decreasing marginal utility from the products of marriage. Only one man is enjoying the benefits from marrying a number of wives, and his capacity to appreciate child services is limited, for instance. Depending on the target number of children he aims at and on the fertility of each wife, the second wife may have little to contribute.

Figure 3, a variant of the previous figures, incorporates diminishing marginal productivity of wives. As it relates to one aggregate Z, it does not capture decreasing marginal utility of particular commodities like number of children. Z units can easily be translated into value units, in analogy to the usual concept of a derived demand.

The demand for wives in bigyny now has a step $OC = Z_{mff} - Z_{mf}$. If the sex

Figure 3: Polygyny and Decreasing Marginal Productivity
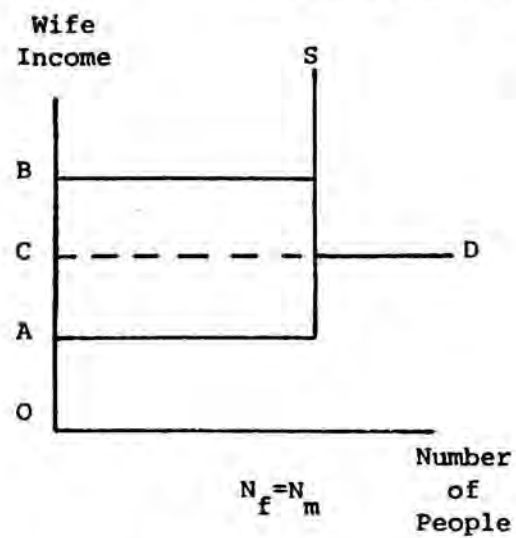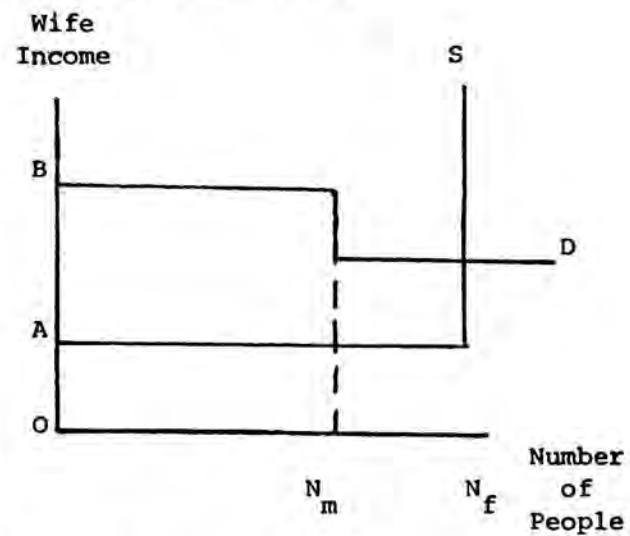
ratio equals one, monogamy will occur even if polygyny is permitted. No man will be able to offer more to a second wife than what an identical man offers her if she were his first wife. But, as seen in Figure 3[a], it still follows that allowing for polygyny tends to improve the bargaining position of women (Proposition 1). Whereas under imposed monogamy the distribution of marital income could occur anywhere in the range AB, permitting polygyny reduces that range to the upper portion BC. Intuitively, no man can offer his wife less than an income OC, for otherwise she will prefer to be the second wife to a man willing to pay her up to OC. Comparing figures 2[b] and 3[b] shows that decreasing marginal productivity reduces women's benefit and the total surplus from marriage, but that does not affect Proposition 3 concerning the impact of sex ratio on occurrence of polygyny.

A comparison of figures 2[b] and 3[b] leads to an additional proposition:

Proposition 4. In societies where the value of marginal productivity of each additional wife decreases more, polygyny is less likely to occur. When productivity decreases more abruptly, the second step on the demand for wives (OC in Figure 3[b]) is lower, i.e., closer to Z_f, and women and society in general stand to benefit less from polygyny. Consequently, polygyny should be less prevalent.

The effect of decreasing marginal productivity of wives on the prevalence of polygyny has its equivalent in zoology. According to Orians (1969), the larger the difference in mean reproductive success of females in monogamous and bigamous matings in equivalent environments, the smaller the likelihood that polygyny will evolve. Factors influencing reproductive success under conditions of monogamy and polygyny, i.e., the extent of diminishing marginal productivity of female mates, are (1) the extent of male parental care, (2) the possibility for successive females of a male to be staggered in their breeding so that the periods of dependence of their offspring overlap little or not at all, and (3) the nature of food resources controlled by males (p. 594).[1] Factor 1 parallels the reasoning for diminishing marginal productivity due to fixed husband-time (however, the present analysis is not exclusively restricted to productivity in childrearing). Factor (3) could be related to fixed physical resources owned by the husband.

III. THEORY—INTRODUCING INEQUALITY

The next assumption to be relaxed is that of homogeneity. First assume that males differ in attributes, while women remain identical. It can be shown that

Proposition 5. In a society with more inequality in productivity-augmenting male traits, one is more likely to find polygyny. Similar statements are

found in Becker's theory of marriage (1974, p. 334) and in Orians' theory of mating systems in the animal world—the latter's terms being "equality in the quality of the territories of the males of a species" (1969; p. 593). The following formal exposition has been inspired from Becker (1975).

When men differ in any attribute affecting the gain from marriage $Z_{mf} - Z_m - Z_f$, it becomes possible that even with decreasing returns to scale, a more productive man will produce more with a second wife than a less productive man with his first wife. In that case, even with equal numbers of men and women and decreasing returns to scale, polygyny may originate because of differences in marital productivity among men. This is illustrated in Figure 4. Consider two categories of men, m_1 and m_2, differing in marital productivity such that

$$Z_{m_1f} - Z_{m_1} > Z_{m_1ff} - Z_{m_1f} > Z_{m_2f} - Z_{m_2} > Z_{m_2ff} - Z_{m_2f}$$

In other words, the first type of man obtains a larger gain from his second marriage than the second type from his first marriage. Figure 4[a] assumes that the m_1 men outnumber the m_2, so that no m_2 get married. The benefits from polygyny could also be enhanced by male inequality even if

$$Z_{m_2f} - Z_{m_2} > Z_{m_1ff} - Z_{m_1f}$$

as is illustrated in Figure 4[b], assuming N_f exceeds N_m (more women than men). The dotted line denotes the demand for wives in a society with homogenous men, while the heavy line represents that demand in a society with two types of men but the same average productivity in marriage. It can be seen that by prohibiting polygyny, the society with more male inequality stands to lose more, since the more productive men would all marry twice while only a fraction of the other men would, so that total additional surplus after polygyny is larger in the society with unequal distribution of productivity. The more unequal the distribution of productivity in marriage, the more the gain from a second marriage by a high-productivity man is likely to exceed the gain from a first marriage by a low-productivity man, so that polygyny is more advantageous even under more general assumptions concerning the marriage market. Another proposition follows from this analysis:

Proposition 5'. Within a polygynous society, men generating a higher gain from marriage are likely to have more wives. As has been discussed and illustrated in previous economic analyses of marriage, higher male income and education raise the gain from marriage. The prediction that men with higher income have more wives has already been stated by Becker (1974, p. 334).

Until now, women were assumed to be identical; however, relaxing this assumption yields the following proposition:

Figure 4: Marriage Markets with Two Types of Men

(a) No m_2 get married

(b) Both m_1 and m_2 marry
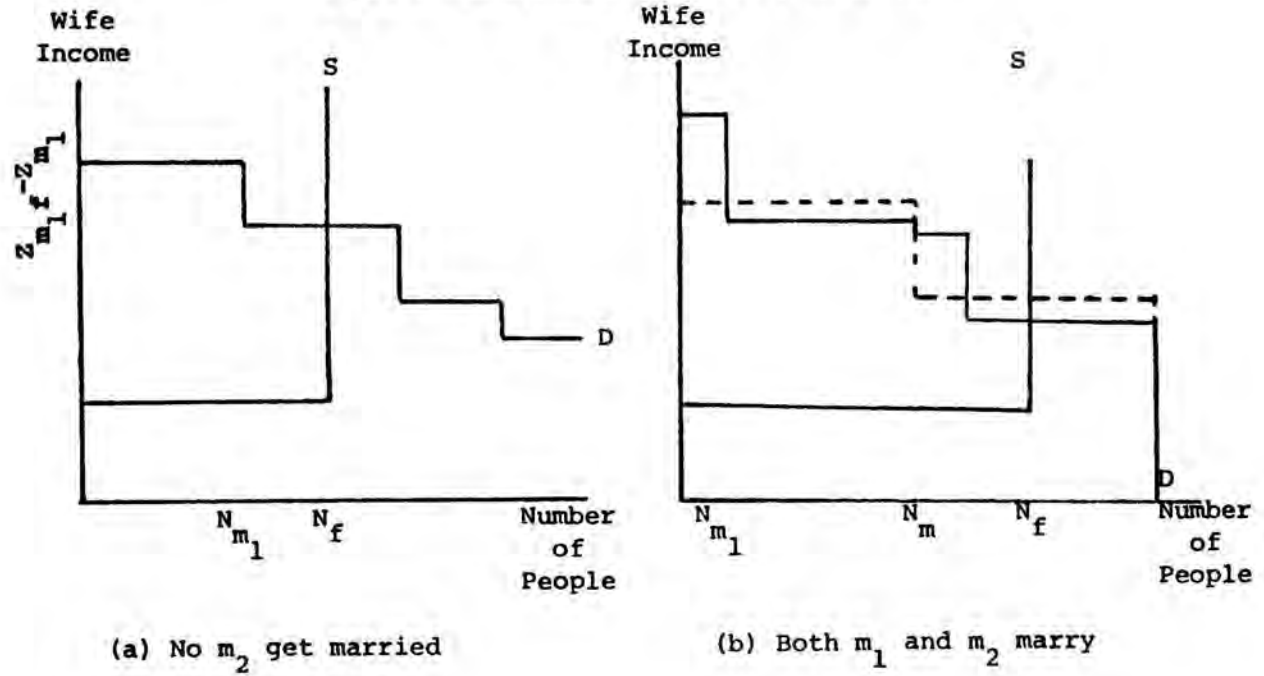
*Proposition 6. Because of positive sorting, female inequality in pro-
ductivity-augmenting traits is likely to dampen the positive effect of male
inequality on the incidence of polygyny.* As pointed out in Becker (1974,
p. 316), positive sorting is a powerful prediction from economic theory that
has received ample support from empirical evidence, e.g., men marry
women of similar income, height, and education. Allowing for polygyny
may mitigate against the tendency for positive sorting, for it may now
become optimal for a very productive man to marry a second wife of lower
productivity who would otherwise marry a man with traits similar to hers.
A demonstration of Proposition 6 appears in the Appendix.

A *corollary* of Proposition 6 is that societies prohibiting polygyny will
have more positive sorting. Two measurable dimensions of female inequal-
ity are fertility and education that augments wife-productivity.

Within a polygynous society one derives from Proposition 6 that:

Proposition 6.[1] *Women generating a high gain from marriage tend to have
fewer co-wives.* The males demanding high productivity in terms of
fertility or services that benefit from a wife's previous education (hosting or
childrearing, for instance) are either likely to sort with a high productivity
female or marry a larger number of women with lower productivity,
providing him with an equivalent total product. This interaction between
positive sorting and polygyny[2] implies that in a study of the determinants of
polygyny within a polygynous society, one has to simultaneously look at
male and female attributes.

The next section brings cross-cultural evidence to bear on this theory of
polygyny. Then, after an introduction to Maiduguri, the theory is tested on
data from that Nigerian city.

IV. CROSS-CULTURAL EVIDENCE

Findings of previous researchers are one possible source of evidence for the
theory of polygyny outlined in Sections I to III.

Three kinds of evidence can be brought to bear on the first proposition,
namely that women are better off when polygyny is permitted (also see
Grossbard, 1978a).

1[a]. Nobody has yet given a complete explanation on why bridewealth is
paid by husbands in some societies, while elsewhere the bride's family
provides a dowry. Whenever such general theory will evolve, it will have to
incorporate polygyny among the explanatory factors. According to an-
thropologist Goody (1973), "dowry is strongly linked with monogamous
(and polyandrous), marriage." Similarly, sociologist Clignet (1970) writes
that "the institution of brideprice is more often found in polygynous than in
monogamous African societies."

These findings make sense if bridewealth versus dowry is seen as an indication of women's share of marital income. Bride payments can be considered as lump sum transfers through which men compete for wives when the equilibrium incomes of married women exceed the income they actually receive after marriage.[3] Conversely, women or their families would pay dowries prior to marriage in order to obtain a husband when the income they actually receive exceeds the equilibrium income they would get in a free marriage market. If the discrepancy between actual and equilibrium share of women in marital income were greater the larger their equillibrium incomes (as suggested by Becker, 1977) "the frequency and magnitude of brideprices would be greater . . . when poly [gyny] is more common." Conversely, when the equilibrium share of women in marital income is low, their actual income may be higher, especially if inflexible shares derive from the indivisibility of commodities like children (Becker, 1977, p. 4). In turn, it was shown in Section II that prohibition on polygyny reduces the female share in marital income. It is clear that the presence of polyandry detriments women's bargaining position even more, for once men can pool their resources to marry a common wife, the demand for wives is even lower than in monogamy, and consequently the equilibrium income of married women even less favorable. The concept of a marriage market therefore illuminates these observations by Goody and Clignet.

Economist Bronfenbrenner (1971) has reached a similar conclusion based on his analysis of Indian marriage markets. He observed that in India, "while monogamy and dowries prevailed, there were certain subcastes, such as the laundrymen of Calcutta, in which the master married his labor force. Under these circumstances, not only polygamy but brideprices were found" (see also Tambiah, 1973). He therefore thinks that "the probability of a positive brideprice (or negative dowry) will be greater when *inter alia* the number of wives per husband exceeds unity."[4]

Not only does it seem that the probability of finding bridewealth versus dowry varies directly with the presence of polygyny, but evidence also suggests that bridewealth payments are higher in more polygynous societies. Comparing two Sebei communities in Eastern Uganda, anthropologist Goldschmidt (1974) found that the bridewealth was considerably higher in the more polygynous community (p. 316). Encouraged by his findings among the Sebei, Goldschmidt then cross-tabulated thirteen separate societies in East Africa by polygyny data (over 150 women/men and 150 and under) and brideprice (high and low) and found that only three out of thirteen societies were not in the high polygyny-high brideprice or low polygyny-low brideprice categories (p. 327).

1[b]. The age at marriage is another indication of benefits from marriage. The more one stands to gain, the younger one is likely to enter marriage (see 7). Proposition 1, therefore, leads us to expect that women will marry

younger in polygynous societies. Since women gain relative to men, a larger sex differential in age at marriage should be found where more polygyny occurs. Simple comparisons provide evidence for the theory: women marry younger in countries allowing for polygyny. For instance, women's average age at marriage is 13 or 14 among the Hausa and the Kanuri of Eastern Nigeria, societies with widespread polygyny. (Among the Hausa, 36% of all men of marriageable age were polygynous; see Mair, 1953). The Tallensi, another West-African tribe, are slightly less polygynous (30% of marriageable men had more than one wife; see Mair, 1953) and their daughters marry somewhat later: here the average female age at marriage is 16 and 17. On the whole, women marry considerably earlier in polygynous areas like Africa and the Muslim world than in monogamous Europe and America. In addition, while in the United States the husband is an average two years older than the wife, that difference rises to seven years in the Arab world and to ten years in some heavily polygynous African societies like the Kanuri.

Using data from sixteen districts of Congo, Brass et al. (1968) found a simple correlation of .8 between an index of polygyny (number of married women per 100 married men) and the difference in mean husband's and wife's age at marriage, evidence for a positive correlation between degree of polygyny and difference in age at marriage. Moreover, the South African government's efforts to limit polygyny (e.g., by imposing taxes on each wife) led to a later female age at marriage (Mair, 1953, p. 25). Recently many Muslim countries have simultaneously restricted polygyny and age at marriage. One explanation for this joint treatment is that, once polygyny is limited, the age at marriage will rise anyway, so that the second restriction becomes less costly.

1[c]. Not only will polygyny encourage women to marry earlier, but it will lead a larger proportion of women to marry at all ages. Comparing two ethnic groups in Abidjan (Ivory Coast) and its hinterland, Clignet (1970) found 42% unmarried Abopuré females as opposed to 30% unmarried Bété females. Not surprisingly, the Abouré are less polygynous: in Abidjan married men were 91% monogamous, while that percentage was 81% among the Bété (p. 110). Likewise, better marital income opportunities open to women will lead widows to accept being "inherited" by relatives of their husband, as is specified in the institution of "levirate." In South Africa (Mair, 1953), the restrictions on polygyny also led widows to "refuse much more often than in the past to be 'inherited' by relatives of their husband" (p. 25), which can be interpreted as the result of a smaller differential between married and widowed income. The same sixteen districts of the Congo also showed a negative correlation of −.45 between polygyny and the proportion of married women among women 15 to 45 years old (Brass et al., 1968).

2. Proposition 2 hypothesized an inverse relation between the sex ratio and polygyny. One of the most dramatic demonstrations of sex ratio effect on polygyny occurred in Paraguay in the nineteenth century. After a major war against neighboring countries, the shortage of marriageable males was so drastic (males were only 13% of the total population of Paraguay), that for a limited period Paraguay overruled the prohibition against polygyny (Becker, 1974, p. 333). Equally convincing is the case of the South Fore, a New Guinean tribe, where an increase in the male/female ratio due to the sexual selectivity of a neurological disorder led to drastic reductions in the male marriage rate and the rate of polygyny (Glasse, 1969). Wagner (1972) finds a positive relationship between availability ratio (wives per marriageable men)[5] and polygyny ratio (wives per married men) in a study of twenty-three units of settlement among the Daribi of New Guinea.

If polygyny may result from a sex ratio smaller than one, does it follow that a relative scarcity of females leads to polyandry? While polygyny is very widespread, polyandry is extremely rare (perhaps because, as Becker (1974, p. 305) suggests, men like to maximize the likelihood of fathering their own genetical products). But in both cases of polyandry on which I obtained documentation, the sex ratio exceeded one: among the Todas of India (Murdock, 1949), scarcity of females resulted from female infanticide. In 1951, the polyandrists of Jaunsar-Bawar (Himalaya) had 20% more men than women, probably still a result of female infanticide that was prevalent until 1935 (Majumdar, 1962). These mountaineers also had a custom of declaring certain women as witches, whereafter they were often killed—another way to increase the sex ratio.

While the sex ratio is a determinant of polygyny, its contribution in accounting for actual polygyny rates is limited. In the most polygynous area of the world—sub-Saharan Africa—the number of females per hundred males varies between 95.9 and 136 for different countries and periods; in most cases that number exceeds 100 (Dorjahn, 1959, p. 106). As pointed out by Dorjahn, the effective sex ratio can be affected by the sex differences in age at marriage. Earlier I emphasized that differences in age at marriage may result from polygyny. But the observed correlations may also be interpreted in the opposite direction, and with the evidence presented here, there is no way to differentiate between the two interpretations. Viewing age at marriage as a determinant of the effective sex ratio, the Muslim governments' restrictions on age at marriage may act as a means to reduce polygyny.

3. With regard to the positive relation between gain from marriage and polygyny hypothesized in Proposition 3, it can be noted that in continents where more children are demanded, polygyny is more prevalent. A broad world overview also shows that the continent of highest polygyny, Africa, has limited markets for consumer goods and servant services[6] and that

household production uses a higher ratio of own time to market goods than is the case in monogamous regions like ours. The reduced reliance on wife's time in household work may be one explanation for the decline of polygyny in the Middle East (Daghestani, 1953).

Smaller markets for consumer goods may also be a cause of restricted job opportunities for women outside the home. In monogamous societies, many jobs performed by women substitute for wife time in the home (for instance, waitresses, seamstresses, salespersons in supermarkets). In Africa, women have fewer possibilities to be independent, and therefore the gains from marriage (and polygyny) are larger. Actual correlations between female labor force participation and polygyny are hard to interpret, for the low demand for wives in more monogamous societies may force women into the labor market. Keeping this in mind, the finding that among the more polygynous of two Ivory Coast tribes women participated less in the labor force, is not necessarily a proof of this proposition (Clignet, 1970, p. 205). To Goode (1953), one of the reasons for the "reduction in the proportion of the adult population living under concubinage or some form of polygamy" is that "the female . . . now . . . has alternative modes of employment." In terms of economic theory, the creation of alternative modes of female employment raises the ratio of female to male market productivity, reduces the gains from marriage, and thus reduces polygyny.

4. The fourth proposition relates the prevalence of polygyny to marginal returns from an additional wife. The possibility of sharply decreasing marginal returns from wives because of frictions between co-wives endangers polygyny to such an extent that all polygynous societies have taken active measures to minimize these intramarital conflicts. Four types of arrangements are used to reduce frictions in polygynous households: (1) separate dwellings for each wife, (2) supervisory authority in the hands of the senior wife, (3) customs requiring that the husband cohabitates with each wife in regular rotation, and (4) sororal polygyny, whereby sisters share a husband. The latter custom was reported in 70 out of 193 polygynous societies surveyed by Murdock (1949, p. 30). Methods (1) and (4) appear to serve somewhat as substitutes. In 18 out of 21 societies with exclusively sororal polygyny, co-wives live in the same house, while in 28 out of 55 societies with non-sororal polygyny, wives live in separate dwellings. Clignet and Sween (1974) found that one way urban dwellers in Cameroun practice polygyny is by having one wife in the city and one in their village of origin. Higher residential costs in African cities tend to discourage polygyny, because it becomes harder to keep wives in separate dwellings.

In practice, there is evidence of both frictions and widespread cooperation among co-wives. For instance, co-wives cooperate in childrearing. Out of a sample of 759 co-wives interviewed in the Ivory Coast, only 25.2% exerted authority on their children separately from their co-wives, while three-

quarters raised children under some form of shared or accepted authority (Clignet, 1970, p. 149).

Reliable cross-cultural data to substantiate Propositions 5 and 6 dealing with inequality among men and women is hard to obtain. In contrast, there exists evidence for cross-sectional comparisons within one culture. Proposition 5' stated that men generating a higher gain from marriage are more polygynous.

5'. A positive income effect on polygyny is well documented, as already reported by Becker (1974, p. 334). In addition to the evidence quoted in Becker, Clignet (1975) found that in Yaoundé, Cameroun, 84% of the household heads working as manual laborers in the private sector and having three wives or more owned their house in 1972, whereas only 76% of those with two wives and 57% of those with one wife did so. In three Nigerian towns, it was found that men with the highest incomes had the largest households and more wives, irrespective of occupation (Ware, 1974). Even in the polyandrous society studied by Majumdar (1974, p. 78), men of the higher castes had more wives: 40% of the members of the higher castes were polygynandrous (i.e., a number of brothers were jointly polygynous), while a much lower fraction of the lower caste husbands had more than one wife.

Male education, considered as a proxy for income, should have an encouraging effect on polygyny. But the little evidence available, based on simple comparisons, is ambiguous. Clignet finds men with some primary education to be more polygynous than the illiterates, and those going beyond primary schooling more than men who completed their primary education, but those who completed primary are less polygynous than those with some primary (1970, p. 122). In Clignet's opinion, as well as in Goode's (1963, p. 102), education modifies the traditional values of polygyny among the educated population. But he also quotes a Liberian study (Goode, 1963, p. 188) that found that over one-half of the literate husbands were polygynously married. In order to detect an effect of education separate from the income effect, a partial analysis is necessary. (Such analysis is presented in the next section). It is also desirable to specify how education modifies "values," if it does. For instance, it most probably does encourage more demand for child quality (in the United States, father's education is known to increase child's education), thus discouraging fertility and consequently polygyny.

Everywhere earnings vary over the lifetime and in the absence of reliable information on income, age can serve as a proxy for income (earnings). From cross-tabulations (Clignet, 1970, p. 112), there appeared a positive linear relationship between husband's age and number of wives (with a slight downturn at later ages when income may fall because of reduced productivity).

Proposition 6, relating positive sorting and polygyny, is not testable in its original form, but its corollary is: Since polygyny and positive sorting are two alternative strategies by which husbands can obtain more wife-services, societies prohibiting polygyny should have more positive sorting. In Maiduguri, I find a simple correlation between married male and female schooling of +.37. Holding age and wage rates constant, the correlation between husband and wife years of schooling was +.53 and +.56 for American whites and blacks respectively (Becker, 1974, p. 318. The lower correlation in Maiduguri may be due in part to the existence of the choice between polygyny and positive sorting.

Proposition 6' stated that more productive women have fewer co-wives. It would seem that this holds in terms of female fertility, although neither the causality nor the evidence is unambiguous (Grossbard, 1978c).

7. Available evidence suggests that more educated women have fewer co-wives. Simple tabulations show that 11% of Abouré women who were monogamously married had completed some primary studies or more, while the corresponding percentages were 8.4% and 9.8% for senior and junior co-wives. Among the Bété, these numbers were respectively 7.6%, 3.8% and 3.0% (Clignet, 1970, Table 16). In the Yoruba sample, 25% of the monogamous wives were completely illiterate, as compared to 39% and 47% of the women living in 2 wife and 3+ wife households (Yoruba Social Structure, 1976).

If there is indeed a substitution between positive sorting and polygyny, a prohibition of polygyny would benefit the educated women, for it will raise the demand for their services as a replacement for a larger number of noneducated women. Consequently, educated women in Africa and Egypt have often been active in political efforts to prohibit polygyny. Also, West African female students (Omari, 1960) were vocal against polygyny (but favored brideprice), while their male classmates favored polygyny (but were hostile to brideprice). But, as expected, uneducated women do not seem opposed to polygyny. While 12% of educated Yoruba women would not let their husband take a new wife under any circumstance, only 0.8% of the uneducated women said so (Yoruba Social Structure, 1976, p. 148).

To conclude this section, the evidence presented here consisted, for the most part, of cross-cultural comparisons by level of polygyny and one other variable, ignoring the many other factors that could intervene and transform an apparently causal relation into a spurious one. Differences in polygyny between Africa and the rest of the world, and among selected tribes in Africa, were used repetitively for different purposes, and it may very well be that in a complete empirical analysis some of the correlations would disappear. Similarly, most of the studies of interpersonal differences within a polygymous society that I quoted consisted of simple correlations or cross-tabulations, which leads one to be careful before reaching any

conclusions. Section VI is limited in its scope, for it only deals with a particular African city, but its conclusions, based on multivariate empirical analysis, will hopefully be less speculative. Before discussing any results, it is necessary to describe the setting.

V.   THE SETTING AND THE DATA

Two factors led to the selection of Maiduguri for a study of polygyny. First, approximately at the same time three separate informative surveys were carried out in the predominantly Kanuri city. In 1969, Ronald Cohen (1971) conducted interviews for his study of divorce among the Kanuri. 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. Second, polygyny rates in Maiduguri seem representative of Africa. Judging from Table 1, the average number of wives is 1.53 (Steckle and Ewanyk data), about the mean for sub-Saharan Africa (Dorjahn, 1959). But Maiduguri is not representative on a global scale. As Murdock (1967) points out, not only is prohibition on polygyny rare in sub-Saharan Africa, but a larger percentage of polygynous households is found in traditional African than in Eurasian (and Arabic) societies allowing polygynists: that percentage was 4.7% for rural Egypt in 1937 (Goody, 1973, p. 176) and between 10% and 12.6% for nineteenth-century Mormons (Smith and Kunz, 1976).

Maiduguri, the capital of Nigeria's northeastern state, also functions as the center of the Bornu Emirate, homeland of the Kanuri people.[7] Despite a recent influx of animist and Christian migrants from the south and 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 Araba—account for 25% of the population. All ethnic groups show a strong preference for endogamy, but allow intermarriage. A noticeable exception is the prohibition on Shuwa Arab men to marry women for the dominant tribe, the Kanuri, despite shared adherence to Islam.

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 admitted that they had more than four wives.

According to Cohen (1971, p. 93), 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.

> In general all men wish to have their wives remain in the compound as much as possible so that, in real attitudinal and behavioral terms, *kulle* (the Kanuri term for seclusion) is

more a matter of degree than of kind. However, several indicators provide a watershed between one set of conditions and something quite different. If a wife does not sell things in public, and/or does no agricultural work, and/or does not go to the well for water either because others go for her, or because a water source is available inside the compound, then she is in *kulle*. All women leave the compound to go to ceremonies and to visit kin. But, operationally, the Kanuri use the term *kulle* to refer to an obligation to remain inside the household unless permission to leave is granted by the husband. As noted, such unions involve no regular duties outside the compound. (Cohen, 1971, p. 75)

From such an operational definition, it can be inferred that men who can talk their wives into *kulle* (as is agreed upon in advance) have apparently more means than others. Table 1 suggests that well over half the wives of urban Kanuri men are secluded.

"A women's sexual activities, her reproductive power, and some stipulated parts of her economic potential are transferable to her husband at marriage" (Cohen, 1971, p. 93). 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 (p. 125). As Table 1 shows, 71% of all marriages of the forty-five men in the Cohen sample had ended in divorce, and the average duration of a marriage (including extant marriages) was 7.8 years. The average number of marriages per man (5.1) is high because 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. In Cohen's total sample (including both urban and rural interviews), only 3% of divorces involved recourse to the courts.

Maiduguri's livelihood relies on an old tradition of commerce with the East (Steckle and Ewanyk, 1973, report that 33% 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. According to Steckle and Ewanyk (p. 20), two-thirds of the men and one-third of the women underwent 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—seem to make it a worthwhile investment, judging from revealed preferences. Schooling probably raises 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

Table I: Means and Standard Deviations in Two Sets of Data on Maiduguri

	Steckle and Ewanyk		Cohen					
			All Marriages		Last Marriages		Marriages Lasting 9 Years or More	
Number of wives at marriage with particular wife			2.03[e]	(1.06)	2.07	(0.98)	1.82	(0.90)
Number of wives at divorce from particular wife (or at interview if still married)			2.28	(1.03)	1.72	(0.78)	2.06	(0.90)
Number of wives at interview	1.53	(0.8)						
Percent secluded			64		52		75	
Percent divorced			71				41	
Duration of marriage (years)			7.8	(6.70)	6.9	(6.30)	17.2	(6.90)
Number of husband's marriages			5.1	(4.70)	5.2	(4.70)	4.0	(3.30)
Income[a]	3.19	(1.86)	3.8	(1.30)	4.02	(1.27)	3.9	(1.40)
Wealth[b]			2.5	(0.80)	2.65	(0.74)	2.5	(0.60)
Grain farm[c]	0.16							
Houseowner[c]	0.75							
Waterstandpipe[c]	0.35							
Age of husband at time of interview	(Mode:36–45)		50	(12)	45	(11.3)	51	(10.4)
Age of husband at marriage with particular wife			32.1	(10.7)	37	(11.1)	31	(8.4)
Age of senior wife	(Mode:25–35)							
Age of particular wife at marriage			18.1	(7.6)	17.5	(7.6)	16.1	(4.7)
Children born in marriage to particular wife			.66	(1.35)	.85	(1.63)	1.9	(4.7)
Total children born to man at end of marriage with particular wife or at interview			2.2		2.96	(3.43)	2.9	
Percent childless marriages			71				33	
Children under 14 in household	2.5	(2.3)						
Housewife[c]	0.87	(0.34)						
Education of husband (years)[d]	3.8	(3.7)						
Education of senior wife[d] (years)	1.6	(2.3)						
N	754 households		202 marriages by 45 men		46 marriages by 46 men		51 marriages	
Kanuri	57.6%		100%		100%		100%	

Standard deviations in parentheses.

[a]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). Cohen data are ranked from 1 to 6 (laborer, craftsman, farmer or small trader, civil servant or teacher, trader, noble).

[b]Estimated by men interviewed; ranges from 1 to 4; 4 is the highest.

[c]Dichotomous (dummy) variable; takes value 1 or 0.

[d]Secular and religious schooling.

[e]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 overrepresent 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.

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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 husband and children. She usually marries very young; by the age of fourteen she has probably been married at least once.[8] In contrast, most men do not marry before age twenty (Cohen, 1971).

Women are most likely to bear children between the ages of 19 and 25 (Steckle and Ewanyk, 1973; Hardiman, 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; from Cohen, it appears that the average number born to men (of all ages) stands at 3. Even accounting for the short duration of marriage, an amazing 71% of all marriages were childless (Table 1). Kanuris are known for their low fertility and belong to the so-called "infertility belt" (Cohen and Middleton, 1970).

While on the decline, child mortality is still very high. Hardiman estimated the infant mortality rate at 212 per 1,000 live births. Yet maternal mortality rates appear to be rather low, only 2.3% of 265 Kanuri men's marriages ended with wife's death (from all causes).

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

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

VI. MULTIVARIATE RESULTS

The surveys by Cohen and Steckle-Ewanyk provide testing ground for implications of the theory of polygyny regarding male and female differences (Hypotheses 5′ and 6′ in Section III). Double checking permitted by the presence of similar variables in both surveys, partially compensates for the incompleteness of the data. For instance, neither survey reports a measure of monetary income, but both contain information on occupation and additional variables usable as possible proxies for income. To enhance comparability with Steckle and Ewanyk's survey of Maiduguri consumers, a subsample of urban males was created out of Cohen's data. With the same purpose in mind, in all regressions using Steckle-Ewanyk, the reference tribe is Kanuri, the group Cohen focuses on in his work.

Empirical testing of hypotheses concerning polygyny involves a number of problems. First, a problem arises due to the absence of single men in

either sample. It would be interesting to test the theory on men with a number of wives between two and four. In addition, with no man having more than four wives, the distribution is truncated on both ends. Ideally, methods especially designed for that purpose should be applied; they were not used here because of practical constraints. Second, the dependent variable—number of wives—is not continuous but polychotomous. However, I do not use any of the special statistical methods dealing with that; the number of wives regressions are estimated by ordinary least squares.

Finally, it is crucial to isolate the separate effects of male and female attributes, in view of the positive correlation (due to positive sorting) between husband and wife traits. However, little information is available on male and female productivity, making it hard to clearly identify demand and supply: varying a male or female characteristic will shift both curves because of correlation with unmeasured variables. However, although identification of demand by males and supply by females is far from perfect, the simultaneous inclusion of male and female attributes in a multivariate analysis is a substantive improvement in comparison to the methodology used in previous research (see Section IV).

Tables II and III present regressions of the number of wives in a household on the basis of the Cohen and Steckle-Ewanyk data respectively. The former data was also analyzed by duration of marriage, for this appeared to increase the power of explanation.

A positive male *income effect* can be assessed despite the scarcity of income data from Maiduguri. In the Cohen data, the proxies used for male income are an occupation and a wealth scale (the latter based on the man's own estimation on a scale from 1 to 4, where 4 is the highest). The two variables are not highly correlated (a simple correlation of approximately .2). Occupation also has a significantly positive sign in Table III using the Steckle and Ewanyk data.

From that Table, one can also see that educated men have more wives. This could possibly capture an income effect, and so is the case for three variables included in Steckle and Ewanyk's survey that simultaneously have a positive effect on the number of wives: the presence of a waterstandpipe in the compound, house-ownership, and grain-farm ownership.[9]

Finally, the positive effect of "seclusion," a variable present in Cohen's data (Table II), could also be capturing an income effect, for to seclude his wife (wives) effectively, a husband has to provide water, groceries, and other products directly to the home.[10]

Regarding differences in female attributes, Tables II and III show an inverse relationship between fertility per wife and number of wives, which can be interpreted as evidence that some husbands have more wives with fewer children per wife due to an initially low female fecundity.[11] This would then confirm Hypothesis 6', namely, that women generating a high gain

Table II: Ordinary Least Squares Regressions of Number of Wives [a]—Cohen Data
(t statistics in parentheses)

EXPLANATORY VARIABLES	All Marriage Durations (N = 202)						Duration Less or Equal to 4 Years (N = 105)					
	(1)		(2)		(3)		(4)		(5)		(6)	
Age of husband at marriage	.19	(5.57)	.20	(5.87)	.19	(5.49)	.1744	(2.86)	.1538	(2.53)	.1525	(2.5)
Age of husband at marriage, square	−.0022	(4.7)	−.0023	(4.98)	−.0021	(4.64)	−.00179	(2.04)	−.001526	(1.75)	−.0015	(1.71)
Age of wife at marriage	−.11	(3.71)	−.13	(4.29)	−.13	(4.14)	−.1086	(2.26)	−.088	(1.83)	−.086	(1.77)
Age of wife at marriage square	.0024	(4.42)	.0026	(4.9)	.0026	(4.86)	.0021	(2.31)	.0018	(1.97)	.0017	(1.88)
Wealth	.17	(2.1)	.19	(2.38)	.18	(2.27)	.26	(2.61)	.23	(2.33)	.23	(2.35)
Occupation	.11	(2.66)	.13	(3.0)	.12	(2.79)	.08	(1.46)	.076	(1.37)	.078	(1.39)
Age of husband at interview	.026	(5.07)	.027	(5.27)	.027	(5.25)	.03	(3.93)	.03	(4.19)	.03	(4.2)
Number of Wife's Children			−.13	(3.13)	−.14	(3.34)			.39	(2.10)	.42	(2.16)
Seclusion (dummy)					.22	(1.83)					−.08	(0.54)
Constant	−3.64		−3.55		−3.70		−3.62		−3.60		−3.60	
R²	48.90		51.40		52.20		57.80		59.70		59.80	

	4 < Duration < 8 Years (N = 46)					Duration > 8 Years (N = 51)					
EXPLANATORY VARIABLES	(7)		(8)		(9)		(10)		(11)		(12)	
Age of husband at marriage	.21	(3.38)	.22	(3.37)	.18	(2.69)	.249	(2.87)	.226	(2.76)	.1933	(2.28)
Age of husband at marriage, square	−.0028	(3.48)	−.0029	(3.48)	−.002	(2.82)	−.0033	(2.59)	−.0031	(2.56)	−.00261	(2.11)
Age of wife at marriage	−.04	(.52)	−.05	(.67)	−.0002	(.003)	−.077	(.53)	−.06	(.44)	−.08	(.58)
Age of wife at marriage, square	.001	(.92)	.001	(1.04)	.0007	(.58)	.0013	(.4)	.0007	(.23)	.0012	(.37)
Wealth	.21	(1.18)	.2	(1.15)	.15	(.86)	−.08	(.37)	.07	(.33)	.03	(.16)
Occupation	.066	(.66)	.08	(.78)	.05	(.46)	.2	(2.10)	.2	(2.29)	.17	(1.91)
Age of husband at interview	.04	(3.77)	.04	(3.42)	.04	(3.41)	.03	(2.19)	.03	(2.28)	.03	(2.51)
Number of Wife's Children			−.09	(0.52)	−.10	(0.65)			−.14	(2.59)	−.15	(2.65)
Seclusion					.69	(2.25)					.37	(1.37)
Constant	−5.00		−5.00		−4.88		−4.77		−4.46		−3.98	
R²	61.20		61.50		66.30		35.30		44.20		46.60	

[a]Number of wives present at time of marriage with a particular wife (45 men married 202 wives).
Other variables are defined in Table I.

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Table III: Regressions of Number of Wives (Steckle and Ewanyk Data)

	(1)	(2)
Male Attributes		
Occupation	.05 (3.80)	.05 (3.52)
Waterstandpipe	.32 (6.15)	.32 (5.99)
Grain farm	.24 (3.66)	.23 (3.50)
House owner	.25 (4.33)	.23 (3.85)
Age of husband at interview[a]	.11 (4.74)	.11 (4.82)
Education of husband	.02 (2.47)	.02 (2.70)
Husband's tribe:		
Hausa[b]		.04 (0.60)
Shuwa		−.26 (2.63)
middle		−.03 (0.28)
other		−.19 (1.36)
Yoruba		−.39 (1.93)
Banan		−.20 (1.05)
Female Attributes		
Age of wife at interview[a]	.02 (0.60)	.023 (0.66)
Education of senior wife	−.03 (2.40)	−.03 (2.54)
Average fertility per wife in household	−.07 (4.73)	−.07 (4.61)
Constant	.84	.88
R^2(%)	17.30	18.60

N = 897.

[a]In 10-year units.

[b]Reference tribe: Kanuri.

from marriage tend to have fewer co-wives. This hypothesis can also be tested in terms of the relationship between number of wives and education of the senior wife. As is shown in Table III, educated women have significantly fewer co-wives (in this case, junior wives). This is true despite the generally low level of schooling and a predominance of Koranic over general education.[12]

Among Maiduguri marriages, one can thus see empirical evidence of both a positive husband's income effect on number of wives and a negative substitution effect—a substitution between quantity and quality of wives.

If all tribes allow polygyny and intermarriage, one would not expect any major effect of tribe on the number of wives. From Table III it appears that, while most tribes do not differ significantly from the Kanuri, Shuwa Arabs are significantly less polygynous. Shuwa Arab men have been traditionally dominated by the Kanuri and are prevented from marrying Kanuri women while Kanuri men are allowed to marry Shuwa women. The resulting sex

imbalance in the marriage markets for Shuwa and Kanuri women is likely to be the reason behind the significantly negative sign on "Husband Shuwa" in Table III.

CONCLUSION

In conclusion, not only does the general theoretical approach allow us to get some understanding of the reasons for cross-cultural variation in the prevalence of polygyny, but it also throws a new light on the factors related to the characteristics of polygyny within a specific society. Polygyny can be studied with conventional tools of economic analysis and does not have to be relegated to exotic explanations. The same basic income and substitution effects stressed in our economic textbooks also appear to affect the marriage market in Maiduguri.

Studies of the economics of polygyny can potentially be useful in leading to a better understanding of the mechanisms behind fertility and female labor force participation in countries allowing polygyny.

The study of polygamy comprises an integral part of the study of marriage institutions, a field where theoretically grounded research is still the exception. It is hoped that the theory and subsequent empirical research presented here can contribute to the study of marriage in general.

ACKNOWLEGMENTS

FOOTNOTES

1. He finds evidence for his hypotheses on the basis of comparisons between different kinds of living creatures, birds in particular. I am indebted to Jack Hirshleifer for this reference.

2. Allowing for polyandry would complicate things even more.

3. In many societies, the income a married woman actually receives differs from equilibrium wife income because of regulations enforced through law and custom.

4. Other factors he considers are productive, skilled and/or arduous work expected of a wife; few or no legitimate extracurricular substitutes for wives as sexual partners; high sex ratio of men to women in the population of nubile age; and prospective husband's old age subsistence depending on numerous healthy sons.

5. Apparently, practically all marriageable women do get married in this society.

6. The question of substitution between wives and servants is particularly complex since a society's propensity to rely on servants simultaneously affects a woman's household productivity and her non-marriage productivity. The institutionalization of reliance on female

servants is in itself an economic question, perhaps related to the gains of household specialization among women differing in skills.

7. More on the Kanuri can be found in Cohen (1967).

8. In Table 1, the mean age of wife at marriage is between 17 and 18, but this includes remarrying women, some of them more than 30 years old. No data on women's age at first marriage was available.

9. However, the effect of each of these three dummy variables on the number of wives has an alternative interpretation. First, waterstandpipes and houses may be wife income components. The income a woman gets from marriage is principally nonpecuniary, for it consists of provision for room, board, convenience, etc. The more wives a man has, the more he needs room to provide for them—especially since in Maiduguri each wife lives in separate quarters —and the more he is likely to purchase a house. Similarly, the more wives, the more profitable to compensate all wives by saving them the trouble of fetching water or purchasing it from water-carriers. (This assumes increasing returns to scale in waterstandpipe installations.) Owners of grain farms may be wealthier, but they also need wives as farm labor in addition to the other needs shared by all men. Unfortunately, there is no way to differentiate between the different interpretations of these variables. Small simple correlations between possible wealth proxies emphasize that problem. The correlations between waterstandpipe on the one hand, and grain farm, house ownership, and occupation on the other hand are respectively — .07, .15 and .20. The low correlations between house ownership and occupation (.11) and waterstandpipe (.15) partially derive from the recent inflow of migrants who do not own houses but are wealthy enough to rent comfortable housing.

10. However, here too the causality could be inverse: polygyny could facilitate seclusion by adding more variety and companionship to the isolated wife's life. From Table II it appears that the effect of seclusion varies with duration of marriage. In the sample of all marriages, it is significantly positive at the 90% level, mainly a result of the strongly positive relation for marriages of intermediate duration.

11. For a more extensive empirical discussion of the relationship between polygyny and fertility, see Grossbard (1978c).

12. Indirect proof for the contribution of women's education to their productivity as wives can also be found in my research on Guatemala (Grossbard, 1978b).

APPENDIX

In order to demonstrate Proposition 6, compare two cases, involving each two men and two women. Man m_1 is more productive than m_2. In Case I, the two women differ; f_1 is more productive than f_2 and it is assumed that the effects of male and female traits on productivity are reinforcing or independent, so that positive sorting occurs (positive sorting would follow "even if [male and female traits] have offsetting effects provided these are weaker than a multiple of the direct effect"; Becker, 1974, p. 316).

In Case II, the two women are identical f_i. In order to create a basis for comparison between the two cases, it is assumed that if man m_1 marries the two women, he is equally well-off with the identical f_1 of Case II or with f_1 and f_2 of Case I (i.e., $Z_{m_1 f_i f_i} = Z_{m_1 f_1 f_2}$).

Polygyny occurs in Case I if the total output is larger in polygyny than in the optimal monogamous sorting (i.e., positive sorting), which means:

$$Z_{m_1 f_1 f_2} + Z_{m_2} > Z_{m_1 f_1} + Z_{m_2 f_2}. \tag{1}$$

Similarly, polygyny occurs in Case II if

$$Z_{m_1 f_i f_i} + Z_{m_2} > Z_{m_1 f_i} + Z_{m_2 f_i}. \tag{1'}$$

Female inequality would reduce the likelihood of polygyny if (1) were less likely to hold than (1'). The gain from polygyny is larger in Case II if

$$Z_{m_1 f_i f_i} - (Z_{m_1 f_i} + Z_{m_2 f_i}) > Z_{m_1 f_1 f_2} - (Z_{m_1 f_1} + Z_{m_2 f_2}). \tag{2}$$

By assumption

$$Z_{m_1 f_i f_i} = Z_{m_1 f_1 f_2} \tag{3}$$

so that what remains to be proven is

$$Z_{m_1 f_1} + Z_{m_2 f_2} > Z_{m_1 f_i} + Z_{m_2 f_i}. \tag{4}$$

Transferrring terms (4) becomes

$$Z_{m_1 f_1} - Z_{m_1 f_i} > Z_{m_2 f_i} - Z_{m_2 f_2}. \tag{5}$$

Since m_1 is more productive than m_2, that would tend to make the inequality hold, but since f_i is more productive than f_1 and f_2, the effect of the difference between f_1 and f_i on output would tend to be less than that between f_i and f_2 because of diminishing marginal product. This particular proof demonstrates Proposition 6 only under the assumption of mildly diminishing product. Note also that the existence of reinforcing effects between male and female productivity will make inequality (5) more likely to hold.

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