Market forces affect patterns of polygyny in Uganda

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Abstract

Polygynous marriage is generally more beneficial for men than it is for women, though women may choose to marry an already married man if he is the best alternative available. We use the theory of biological markets to predict that the likelihood of a man marrying polygynously will be a function of the level of resources that he has, the local sex ratio, and also the resources that other men in the local population have. Using records of over one million men in 56 districts from the 2002 Ugandan census, we show that polygynously-married men are more likely to own land than monogamously-married men, that polygynous marriages become more common as the district sex ratio becomes more female-biased, that owning land is particularly important when males are abundant in the district, and that a man's owning land most increases the odds of polygyny in districts where few other men own land. Results are discussed with reference to models of the evolution of polygyny.

Key words: Mate choice, biological markets, sex ratio, polygyny, humans

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Introduction

Most human societies historically have allowed polygyny, or the marriage of more than one woman to one man (1-2). However, within polygynous societies, many marriages are monogamous, and across polygynous societies, there is variation both in the mean and in the variance of the number of wives per married man. What, then, explains how many wives men marry?

The payoffs to polygyny are not symmetric across the two sexes. Men always increase their reproductive success by adding an extra wife. In African agriculturalist and pastoralist societies, for example, every extra wife a man has adds to his number of surviving offspring, and most of the variance in men's reproductive success is explained by variation in number of wives (3-6). For women, being polygynously married appears less beneficial, since each additional wife sub-divides household resources and male investment. Compared to monogamously married women, polygynously married women have lower fertility (7-9), increased child mortality (10), and poorer child growth and development (11-12). The latter two outcomes obviously affect the reproductive success of both parents, but fall disproportionately on women, for whom they are not offset by the increased offspring number that men experience in polygynous marriages. The costs of polygyny appear to fall particularly on women of later rank in the union, and their children (6, 13). Thus, it seems that polygynous marriage in African societies is most beneficial to men, and most costly to women, especially wives of lower rank.

Situations where individuals receive asymmetric payoffs from collaboration, and yet continue to collaborate, can be conceptualised using the theory of biological markets (14-17). Biological markets operate wherever there are two classes of individual (e.g. male and female), with distinct commodities to exchange (e.g. resources and fertility), and where each has the possibility of partner choice. This leads to competition within each class to attract members of the other class. The central prediction of biological market theory is that the ‘exchange rate’ between the two commodities will vary as a function of supply and demand. That is, where females are very common and males scarce, males will have greater market power, and achieve outcomes more favourable to their interests, whereas where females are scarce and males common, females will be able to drive a harder bargain and achieve outcomes more favourable to theirs (14, 18-20).

Market reasoning leads to the simple prediction that the frequency of polygynous marriages will increase as the local operational sex ratio (OSR) decreases (that is, becomes more female-biased; 10). However, it is not just the number of men available which is important, but also the resources that they offer. Resources, in terms of land or livestock, are sought-after in a potential husband, and have a positive impact on women’s lifetime reproductive success (21). Women may do better becoming the second wife of a man with abundant resources than the first wife of a man with few, leading to a threshold of inequality between men above which polygynous unions will begin to be seen (21, 22). Thus, we can predict that having more resources will increase a man’s chances of marrying polygynously, and also that the effect of having resources will vary according to the characteristics of the local market. Where the OSR is high (i.e. male-biased), then competition between men is intensified, and it should become even more important to have resources. The resources of a man’s local competitors will also moderate the effect of his own resources. That is, where many men in the local market have a given level of resources, that level of resources will be less effective at attracting more than one wife than in a market where few rivals can offer it.

Thus study examines market effects on polygynous marriage in contemporary Uganda. Uganda is a poor equatorial country (2007 GDP per capita estimated at $900), with most of the population rural (around 85%), and most people dependent on subsistence agricultural activity (estimated 80%; 23). The population (25 million in 2002) is divided amongst around 45 ethnic groups speaking Niger-Congo and Nilo-Saharan languages. Our data source is a 10% representative sample of households from the Uganda Population and Housing Census of 2002. The sample contains family-composition and socio-economic data for around 1,107,000 men aged 15 or over. The sample has limitations in terms of grain of responses – for example, our resources variable is simply owning land versus not owning it – but more than compensates for this by its unusually large size and national representativeness.

To examine market effects, we include compositional characteristics of the district in which the man lived, which we take to indicate the conditions of the local marriage market. Uganda was at this time divided into 56 districts. We calculated the OSR of each district, and the proportion of men within it who owned land, and entered these characteristics of the local market into a multi-level model alongside the individual-level characteristics of the man such as whether he owned land.

Our predictions, based on biological markets theory, were that, controlling for potential confounding variables such as age, education and urbanisation:

1. Owning land will increase a man's probability of being in a polygynous marriage.
2. Being in a district with a higher (i.e. more male-biased) OSR will decrease a man's probability of being in a polygynous marriage.
3. There will be an interaction between the district OSR and individual land ownership, such that owning land becomes increasingly important for the attainment of polygynous marriage the higher (i.e. more male biased) the local sex ratio.
4. There will be an interaction between a man's land ownership and the proportion of other men in the district who also own land, such that land ownership has a greater effect on the probability of polygynous marriage in districts where few people have land.

Results

Please insert Table 1 here

Please insert Table 2 here

The results for the model are shown in Table 2. There are significant main effects of several control variables, such as age, education and urbanisation. Here, we concentrate on the predicted effects. *Prediction 1* was for a main effect of individual land ownership. This prediction is confirmed. All else being equal, the odds of polygyny become 2.28 times larger if a male owns land compared to when he does not. *Prediction 2* was for decreasing OSR at the district level to increase the probability of polygyny. Again, the prediction is met. The odds ratio of 33.28 means that if the district OSR changes from 0.5 to 0.4, the odds of polygyny increase by a factor of 3.3, all else being equal.

Prediction 3 was for an interaction between OSR and land ownership. This interaction is indeed significant (Table 2). Figure 1 allows this interaction to be visualised by showing the predicted proportion of men married polygynously according to the district OSR and whether they own land. As the figure shows, in a district with more females than average, a relatively high proportion of men are expected to marry polygynously, and it makes little difference whether they have land or not (in fact, those without land are predicted to be polygynous slightly more often). As the sex ratio increases, though, the proportion of polygynous men declines more steeply for landless than land owning men, so that in a relatively male-biased district, landowners are substantially more likely to have multiple wives than the landless are.

Please insert figure 1 here

Please insert figure 2 here

Finally, *prediction 4* was for an interaction between the proportion of men owning land in the district, and individual land ownership. Again, the prediction is met (Table 2). Figure 2 shows that having land in a district where only a few men do dramatically increases one's odds of a polygynous marriage, whereas having land in a district where many other men do has a much smaller effect. This interaction effect is significantly stronger than the OSR* land ownership interaction (after standardization: $B_{land\ ownership*proportion\ ownership}$ = 0.038 (s.e.= 0.0097); $B_{land\ ownership*OSR}$ = 0.015 (s.e.=0.0062); Z= 1.997; $p<0.05$).

Discussion

Consideration of market forces, and the differing interests of men and women, led us to predict that the occurrence of polygynous marriage in Uganda would vary with men's land ownership, with the land ownership of his rivals, and with the local sex ratio. These predictions were borne out in a large sample of households within districts. Having land more than doubled men's chances of having more than one wife. As the district operational sex ratio became more male-biased, fewer men were able to marry polygynously. Such shifts affected all men, but the brunt fell on the landless particularly hard. Having land was particularly influential in districts where few other men had land, implying that what matters is not just the number of competitors but also their resources. This is suggestive of a polygyny threshold process, with women moving to become second wives where the resource offer of some men is much better than that of others. Overall, the predictions from the theory of biological markets were well supported within this large dataset, illustrating the utility of conceptualizing marriage in humans, as well as other forms of collaboration between unrelated individuals, as trading situations (15-17, 20).

There are some limitations to the current data set. First, we only measured whether the men owned land or not, whereas a continuous measure of quantity of land would allow more detailed and exact tests of polygyny threshold models. Second, we used the district level as our local market. Districts in Uganda consist of hundreds of thousands of people, and it may that greater variance in polygyny could be explained by measuring OSR at a more local level (e.g. the village). However, this was not possible in the current analysis, and the significance of the results suggests that district-level data provide at least some indication of the market competition men and women face. Finally, we were unable in this study to track the consequences for men and women's reproductive success of entering polygynous versus monogamous unions. This has been by some other studies (e.g. 6), but it would be desirable to do it in this Ugandan population, to follow through the biological market logic, which is that the sex with lower local bargaining power has to accept outcomes less conducive to their reproductive success than the sex with higher bargaining power. However, in the absence of longitudinal data, this is unlikely to be possible using this census.

There has been considerable debate in the literature on polygyny in humans and in other species about whether it is best viewed as the result of female choice or of male coercion (24-25). The theory of biological markets is based on the assumption that traders of both types are able to choose their partners, and thus the predictions derived here assume mutual choice (or, at least, that a woman's parents choose on her behalf). We cannot of course exclude that some coercion occurs, though it is not obvious that a coercion-based model would predict the patterns observed here. We note however that elements of the coercion view - for example, that polygyny tends to benefit men more than women, and that women avoid it if they have good alternatives – are shared by the current market model. The difference is that we view levels of polygyny as being driven up not by the direct coercive power of men, but rather from the subtler market power that stems from men, and high quality men in particular, being scarce relative to the number of women available. Where women are the scarce resource, they gain market power and can drive the level of polygyny down, and/or the level of resources demanded up.

Methods

The Ugandan Bureau of Statistics' Uganda Population and Housing Census was conducted by face-to-face interview during 7 days of fieldwork in September 2002, and aimed to reach all individuals present in the country. The 10% sample of households is made available by IPUMS-I (Integrated Public Use Microdata Series International; 26), and is designed to faithfully represent the complete census population. We selected all men aged 15 or over for whom data were complete from each of the 529,271 households in the 10% sample (n=1,106,737). For each man, we coded whether he was in a polygynous marriage or not. We did not further discriminate number of wives due to declining numbers of cases. We also coded whether men owned land or not, their age, whether their residence was urban or rural, and their completed years of schooling. We used the same data set to estimate the following characteristics of the district within which the men live: the mean age, the proportion urbanised, the proportion of men who own land, and the OSR. Although the OSR is strictly the ratio of individuals of each sex available for marriage, in a polygynous society all adult men are potentially available for marriage, and so we simply used the number of individuals of each sex aged 15 and 50 present in the district (as in often done in studies of OSR in humans; 20, 27). We calculate OSR as the number of males divided by the total number of people. A balanced sex ratio is thus 0.5 and higher ratios are more male-biased. The descriptive statistics for all the variables used are given in Table 1.

As our dependent variable (polygyny) is dichotomous, and our predictors are a combination of categorical and continuous variables, we used negative binomial logistic regression (NBR; 28). All variables listed in table 1 were entered into the model as main effects, and we also test for two predicted interaction effects: *land ownership*OSR* (prediction 3) and *land ownership * proportion of landowners* (prediction 4). The resulting model had absolute parameter, loglikelihood and Hessian convergence.

In case the effects found were due to one outlying district, we reran the analysis excluding respectively the most male-biased state, the most female-biased state, the state with the highest proportion of landowners and the state with the lowest proportion of landowners. In no case were the parameter estimates of these analyses significantly different to those presented below (data not shown).

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Figure legends

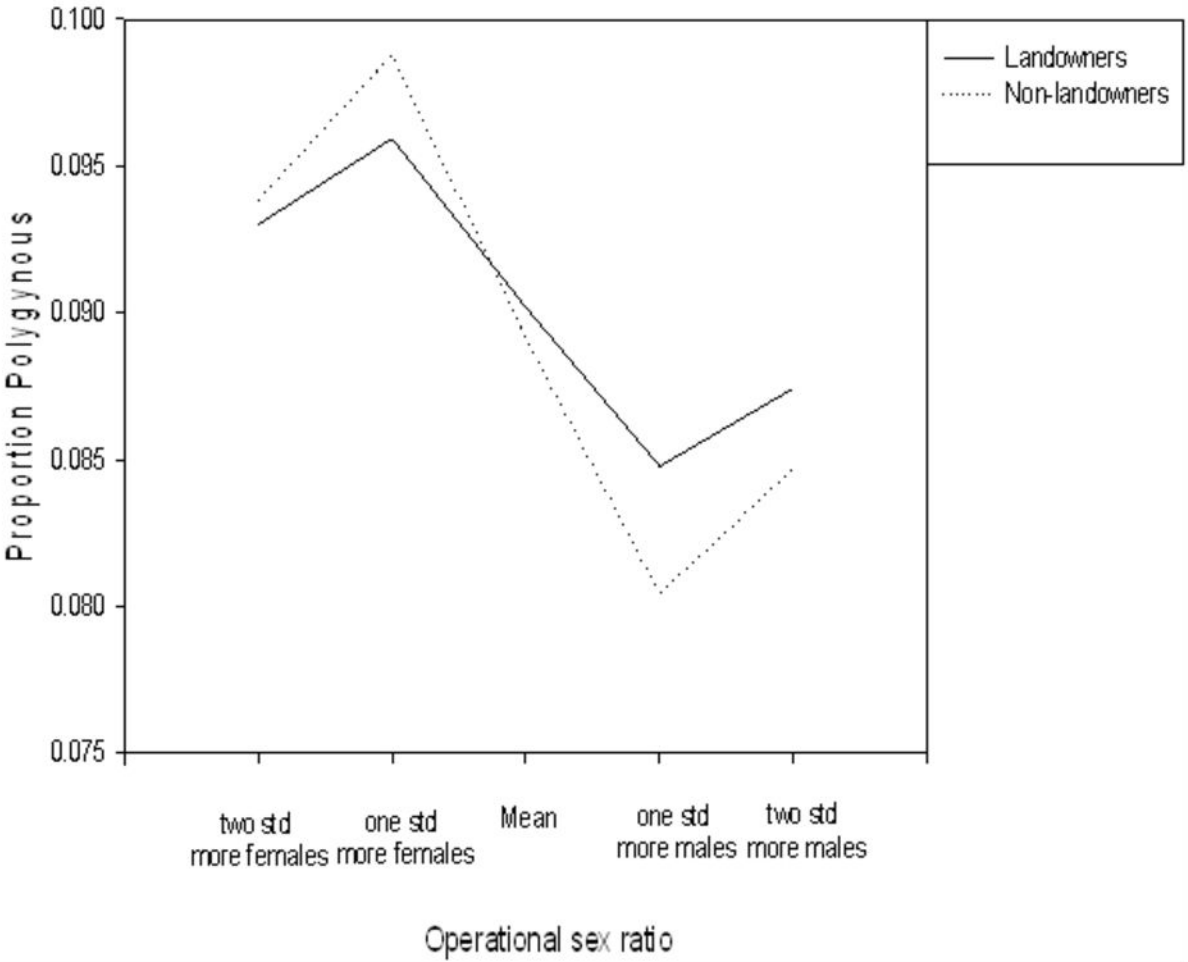
Figure 1: Operational sex ratio and predicted polygyny by land ownership.

Figure 2: Proportion of landowners at district level and predicted polygyny by ownership.

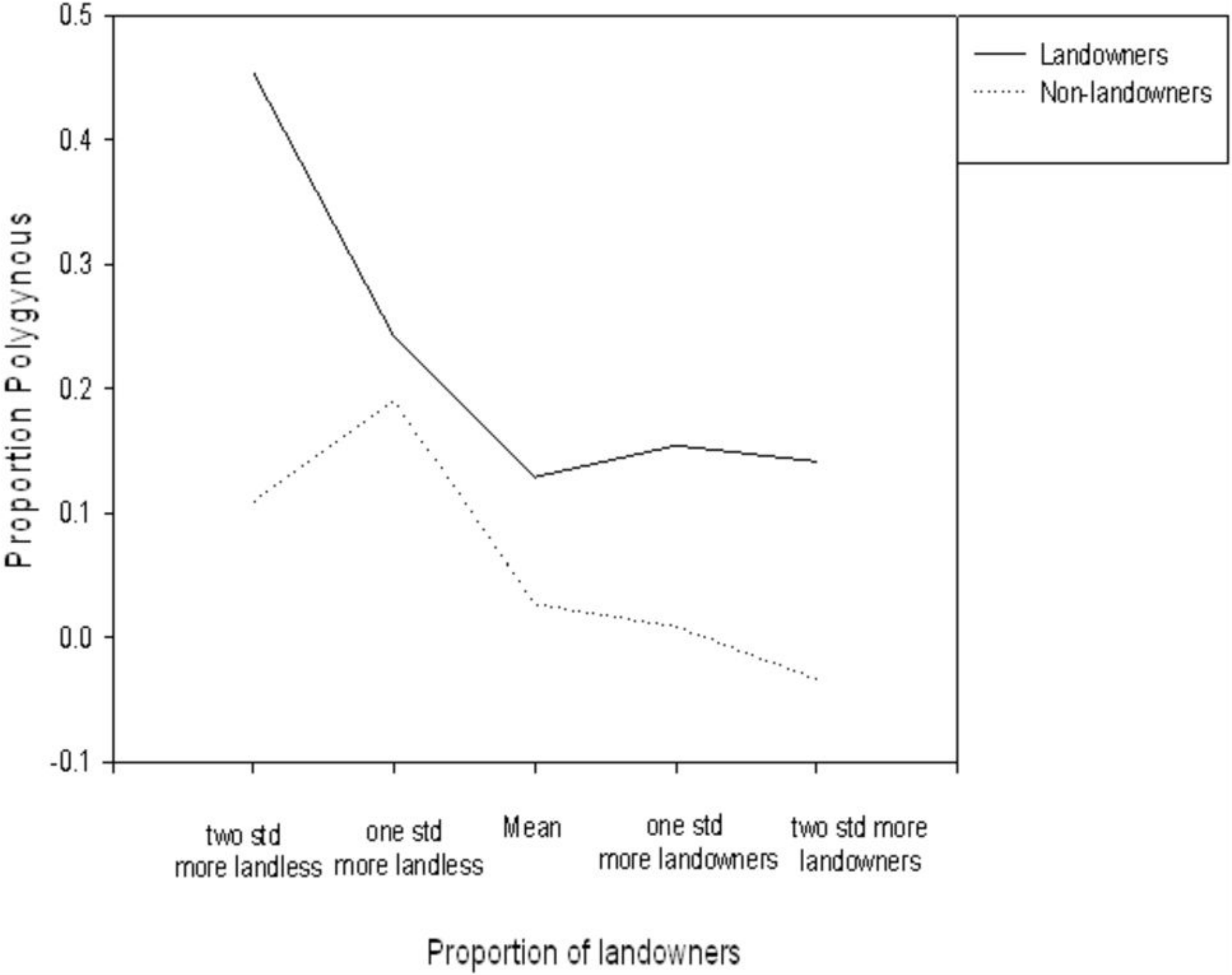
Table legends

Table 1. Descriptive statistics for the variables in the model (means and standard deviations for continuous variables, frequencies for categorical ones).

Table 2: Estimates of the parameter estimates in the negative binomial regression for polygyny. Exp(B) are the odds ratios. The Wald statistic allows evaluation of the significance of individual parameter estimates. Note that the parameter and odds ratio for OSR are for OSR decreasing from 1 to 0, rather than increasing from 0 to 1, for ease of interpretation.



0.100
0.095
0.090
0.085
0.080
0.075
Proportion Polygynous
Landowners
Non-landowners
two std more females
one std more females
Mean
one std more males
two std more males
Operational sex ratio



0.5
0.4
0.3
0.2
0.1
0.0
-0.1
Proportion Polygynous
Landowners
Non-landowners
two std more landless
one std more landless
Mean
one std more landowners
two std more landowners
Proportion of landowners

Continuous variables			**Mean**	**Std. Deviation**
District-level	Operational Sex Ratio (OSR)		0.49	0.01
	Urbanisation		0.58	0.12
	Mean age		32.88	1.64
	Proportion of landowners		0.70	0.24
Individual-level	Age		27.71	9.57
	Years of schooling		5.33	4.01
Categorical variables			**Frequency**	
	Polygyny	Polygynously married	110100	
		Not polygynously married	996637	
Individual-level	Urban-rural status	Urban	168850	
		Rural	937887	
	Landownership	Landowners	760384	
		Non-landowners	346353	

Table 1. Descriptive statistics for the variables in the model (means and standard deviations for continuous variables, frequencies for categorical ones).

Parameter		B	Std. Error	Wald	p	Exp(B)
(Intercept)		-4.2634	0.2594	270.1272	<0.0001	0.0141
Urban household	rural -->urban	-0.2591	0.0144	324.2463	<0.0001	0.7717
Mean age district	(year)	-0.0377	0.0027	194.8048	<0.0001	0.9630
Proportion of land owners	(0 -->1)	0.7414	0.0333	495.4211	<0.0001	2.0989
Landowner	no --> yes	0.8276	0.2849	8.4364	0.0037	2.2878
Operational sex ratio (OSR)	(1 --> 0)	3.5050	0.5057	48.0321	<0.0001	33.2822
Urbanisation (% Urban)	(0 --> 1)	-0.2961	0.0326	82.6585	<0.0001	0.7437
Age	(year)	0.0601	0.0003	34145.1404	<0.0001	1.0620
Years of schooling	(year)	-0.0388	0.0009	1953.9085	<0.0001	0.9619
Ownership* prop. landowners		-0.1576	0.0402	15.3918	<0.0001	0.8542
Ownership* OSR		-1.3938	0.5826	5.7240	0.0167	0.2481

Table 2: Estimates of the parameter estimates in the negative binomial regression for polygyny. Exp(B) are the odds ratios. The Wald statistic allows evaluation of the significance of individual parameter estimates. Note that the parameter and odds ratio for OSR are for OSR decreasing from 1 to 0, rather than increasing from 0 to 1, for ease of interpretation.