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Competitiveness among Nandi female husbands

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In the Nandi society in Kenya, custom establishes that a woman's "house property" can only be transmitted to male heirs. As not every woman gives birth to a male heir, the Nandi solution to sustain the family lineage is for the heirless woman to become the "female husband" to a younger woman by undergoing an "inversion" ceremony to "change" into a man. This biological female, now socially a man, becomes a "husband" and a "father" to the younger woman's children, whose sons become the heirs of her property. Using this unique separation of biological sex and social roles holding constant the same society, I conduct competitiveness experiments. Similar to Western cultures, I find that Nandi men choose to compete at roughly twice the rate as Nandi women. Importantly, however, female husbands compete at the same rate as males, and thus around twice as often as females. These findings are robust to controlling for several risk aversion, selection, and behavioral factors. The results provide support for the argument that social norms, family roles, and endogenous preference formation are crucially linked to differences in competitiveness between men and women.

gender differences | competitiveness | social norms | endogenous preferences | stereotypes

Significance

Differences in competitiveness between men and women have been hypothesized as a potential explanation for important differences in education and labor market outcomes. Central to the literature is whether these differences are innate or learned. I take advantage of the distinct cultural institution of "female husbands" (biologically females but socially men) in the Nandi society in Kenya to study this question. By keeping biological sex constant, holding the society constant, but altering the social gender at an adult age, this unique setting advances our understanding of these differences. Specifically, the results support the hypothesis that competitive inclinations are channeled through social roles and the family. Social norms and social identity critically matter to tackle differences between men and women directly.

> No, I don't carry things on my head. That is a woman's duty and nothing to do with me. I became a man and I am a man and that is all. Why should I assume women's work anymore?
>
> —Taptuwei, a Nandi female husband (Oboler, 1980)

Understanding the link between sex, gender, work, and competition is important for social scientists trying to obtain insights with the potential to help explain significant puzzles in economics and in social sciences more generally. Men and women, for instance, often have very different educational and labor market experiences. A number of possible explanations for the observed disparities and their changes over time have been proposed and studied in the literature (1–6). The distinction between biological sex and social gender (as referred to the social norms and roles) is in fact widely studied in the social sciences and beyond (7–10).

Over the past few years, social scientists have become increasingly interested in investigating whether differences in competitiveness, that is, in attitudes toward competition, may contribute to explaining why labor market and other differences between men and women persist. A number of prominent studies show that, in fact, men appear to opt to compete more often than women, even controlling for performance, risk attitudes, beliefs, feedback, and other aspects (11, 12). A review of this important literature concludes that "although differences in competitiveness has been quite robustly established, more work is needed to assess [their] importance in accounting for educational and career outcomes" (ref. 13, and see also refs. 6 and 14–17). It has been noted (18) that "the important and interesting question about these differences [in competitiveness] is whether they are ingrained (nature) or taught (nurture). The research question going forward should be the relative weights of these two factors and their interaction."

Motivated by this open question, this paper is concerned with the study of why we observe differences in competitive inclinations. The basic objective is to gain a deeper understanding of the extent to which preferences for competition are innate or instead may be nurtured and are influenced by social norms of behavior in society. Clearly, differences in observable characteristics between men and women within and across societies mean that it is important to control for as many observable factors as possible. However, even after this is done, there might remain a critical set of unobserved variables that vary between the societies other than the role of women. This issue is central to inference made from data gathered across different societies.

The goal in this paper is precisely to pursue this question by taking advantage of an almost ideal variation in gender roles holding constant biological sex in the same society. A unique aspect of the traditional Nandi society in Kenya is that certain

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female–female marriages are the only socially approved way for a woman to take over the social and economic roles of a husband and father. Although homosexual unions are condemned, an age-old tradition among the Nandi is that these marriages must be used to transmit the "house property" to male heirs in cases where a woman either has no children of her own or has daughters only. This customary arrangement is the way to work around the problems of infertility or a lack of male heirs, arguably both with strong random components. After a public "inversion ceremony" to "change into a man," this biological female, now socially a man, becomes a "husband" to a younger female and a "father" to the younger woman's children.

In this paper, I use this unique separation of sex and gender roles and implement standard controlled experiments to explore whether there are differences in selecting into competitive environments across males, females, and female husbands. In what follows, "males" refers to biological and social men, "females" to biological and social women, and "female husbands" to biological females who have socially changed into men after the inversion ceremony. The goal is to gain a better understanding of the underpinnings of the factors hypothesized to be determinants of the observed differences in selecting into competitive environments.

Specifically, to be as close as possible to existing literature, I conduct an experimental procedure in which the design basically involves a new, simple, and unfamiliar task where learning and imitation is not possible, and with no sex or gender stereotypes on task. In this task, no differences in performance are expected and, similarly, no significant correlations between task proficiency and the decision to compete are expected either. Both will be confirmed in the data.

The evidence reveals interesting differences in competitiveness. First, consistent with student data drawn from Western cultures in several studies in the literature, I find that females are less competitive than males (about half as competitive). Second, and a main result in this study, I find that this result reverses for female husbands: They opt to compete as much as males, and thus at roughly twice the rate of females. The same basic differences remain after controlling for a number of observable factors in various ways and in several robustness tests.

I view these results as providing insights into the crucial link between social norms and behavioral traits that influence economic outcomes. In this unique Nandi setting, keeping biological sex constant, keeping the nurturing of the biological sexes constant, and holding constant the same society but altering the social gender at an adult age, results in highly different competitive inclinations. As such, social norms significantly matter for explaining competitive inclinations. These reactions to a new social role also relate directly to the important literature on endogenous preference formation and identity (19–21), cultural origins of gender roles (22, 23), and the sex vs. gender distinction in the social sciences (7–10).

The remainder of this study proceeds as follows. The next section provides an overview of the Nandi society and its traditions. Subsequent sections cover the experimental design, the main results, and discussion, with additional supporting evidence included as *SI Appendix*, and the final section provides a conclusion.

Societal Background

Regina Oboler (24–27) presents some of the most complete ethnographic studies of the Nandi. This section benefits and borrows from the detailed descriptions in these studies.

The Nandi. The Nandi are part of the Kalenjin ethnic group in Kenya. They traditionally have lived and still form the majority in the highland areas of Nandi County, a former part of the Rift Valley Province in Western Kenya. The county's major area is covered by the Nandi Hills. It has three local authorities (Kapsabet Municipal Council, Nandi Municipal County Council, and Nandi Hills Urban Council). It is divided into six administrative districts (known as *emet*), which are subdivided into administrative divisions (known as *bororiet*), and these are further divided into villages known as *kokwet*. It also has six constituencies or subcounties (Mosop, Emgwen, Aldai, Tinderet, Nandi Hills, and Chesumei). Although there are other tribal communities, the majority of the people in this area belong to the native tribe called Nandi. The Nandi speak Kalenjin. Kalenjin languages are part of the Nilotic subbranch of the Chari-Nile subfamily of the Nilo-Saharan language family.

The Nandi have traditionally been classified as a pastoral or semipastoral people who keep cattle, sheep, and goats. In the 19th century and early 20th centuries, when cattle were central to their economy, the cattle-to-people ratio was as high as 5:1 (27). They were known for their military organization and aggressive cattle raiding practices. Cultivation, however, has always played a major role in their economy. In the 20th and 21st centuries, they have become settled cash-crop farmers, who produce tea, maize, coffee, and a variety of vegetables for national and international markets. Although the poverty rate may be as high as 40 to 50% by some accounts, and even higher in remote villages, increasing incorporation into a more open economy has brought material wealth to many Nandi. The Nandi are perhaps best known for having produced, like other Kalenjin people, an unusually large number of world-class athletes since the 1960s. These include several Olympic, World Championship, and World Cross Country medalists, as well as world-record holders, in track and field distances ranging from 800 m to the marathon.

Gender. Ethnographic studies (26) report that the Nandi acknowledge two sex and gender categories, male and female, and that the cultural ethos is definitely one of male dominance. The ethnographer views men as both physically stronger than women and stronger-willed and more decisive. Men have a very strong sense of pride in their manhood. It is manly to be courageous and very decisive, particularly in the area of herd management. Women, on the other hand, are held to be subordinate to men and a submissive demeanor is appropriate for younger women:

> Though Nandi mothers denied that male and female babies are inherently different at birth, substantial adult gender differences in basic character traits are acknowledged. Men are said to have greater physical endurance; to be *korom*, "fierce" (courageous in confronting enemies or wild animals—women must also be courageous and stoic in childbirth and in coping with injury or grief); to be more intelligent, foresightful, and decisive; to be more inclined than women to forgive without holding a grudge. Women are seen as more empathic than men, more capable of feeling "pity" (*rirgei*, "cry together") (ref. 26, p. 12).

A central Nandi institution, and a most important event in the life of an individual, is adolescent initiation, known as "*tumdo*." The main feature of initiation for both sexes is genital modification—circumcision for men and clitoridectomy for women: "They are extremely painful, as they are meant to be, and both sexes are expected to display courage under the knife.

They are expected to be brave, quiet, and unemotional throughout" (ref. 26, p. 13), men to prove the courage and toughness needed for the hardships of the warrior life (now a thing of the past), and women to prove that they are able to face childbearing without fear. Boys and girls are initiated between the ages of 12 and 18 y, typically 14 or 15 for girls and 15 or 16 for boys.

Another important difference concerns property and management of the means of production. It is an extremely important canon of the Nandi that the most significant property and primary means of production, traditionally livestock and nowadays land, should be held and managed exclusively by men.

Marriage. For women, marriage has traditionally taken place shortly after initiation, and still does. The average age at marriage for women in the Kenya census is just below 20, and typically younger in rural areas, around 16 to 17. Ethnographers document that young men, following initiation, used to spend a period of about 12 to 15 y as warriors and did not marry until most of this time had elapsed. Today, with peace, men's average age at marriage is younger, in the early 20s.

Typically, a girl following initiation waits for people to come seeking her as a bride on behalf of a young man. On a first visit, the "engagement party" includes the prospective groom's parents, uncles, aunts, older siblings, and close friends, at least some of whom know both families well. On a second visit, the girl's family also has relatives and friends assembled. The two groups get down to negotiating details of the proposal, including information on how many cattle, sheep, and goats the groom has or stands to inherit, where the couple will live, and so on.

There is no formal marriage contract. The payment of bridewealth by the groom's family to the bride's family is the central act that creates a marriage among the Nandi and other East African pastoralists.

Marriage is considered to be a once-in-a-lifetime event for a Nandi woman. As in most African societies, however, marrying more than one wife was and still is a mark of status for a Nandi man. Studies (25, 26) report that wives have no right to object to their husbands marrying other wives. Traditionally, around 17 to 25% of married men were polygynists. In recent times, with private land ownership, it is becoming difficult for a man to provide adequate land inheritance for the family of more than one wife and, consequently, polygamy is becoming much less frequent. In my data it is 12%.

The ethnographer also reports that marriage was not considered irrevocable until after the birth of the first child. After that point, divorce is commonly considered to be impossible. A Nandi woman, once married, is forever the wife of the man who first married her, and all children she bears are considered his children, even if she has not seen him for years. A widow is not free to remarry; if she has further children, the father is considered to be her original husband (ref. 26, p. 23):

> Not being able to divorce or legitimately remarry seems like a great infringement of a woman's freedom. However, the other side of the situation is that once-in-a-lifetime marriage gives her and her children exceptionally strong rights in her husband's property.

House Property, Inheritance, and Transmission. At the time of her marriage, a woman is automatically endowed with a share of her husband's property. In particular, she is given some of her husband's cattle to serve as the basis of her "house-property" herd. This herd also includes animals her relatives give her as wedding gifts and grows through natural increase, further allocations from her husband, the addition of cattle she can sometimes acquire herself, cattle the family acquires through proceeds from their cash crops, and bridewealth given for daughters. In any decisions concerning house-property cattle, a wife must consult with her husband. He also is not supposed to sell, give away, or do anything with them without consulting with her. When a man has more than one wife, each of the man's wives is the founder of a separate "house." A husband usually has cattle that have not been allotted to the house of any of his wives, and these are his to do with as he pleases. Cattle that husbands inherited were traditionally allocated as house-property in equal numbers to all wives. Today, this norm extends to forms of property such as land and money.

In Nandi ideology, women's rights in land and cattle (the means of production) are very limited. As indicated earlier, only men can hold and manage land and livestock. However, among the Nandi these are transmitted through women and rights therein devolve to a woman's house at marriage and can never be revoked.

As it is inappropriate for a woman to hold property, the woman's house cannot be passed to daughters. Only sons, never daughters, may inherit property. The Nandi are a patrilineal society, and the property of a woman's house can only be transmitted to male heirs. So, inheritance flows through mothers to the sons. Thus, women, though mostly barred from administering the family estate, are critical in its transmission.

This ancient custom would appear to create a contradiction between men's and women's rights in the house-property complex, at least in some cases. The reason is that not every woman gives birth to a male heir.*

So, what if the house has no male heir?:

> A possibility is that the house property goes to sons of co-wives or of the husband's brother. But this is considered wrong and very unfortunate if this should happen. … The Nandi consider this a very distasteful alternative. What to do?" (refs. 24, p. 74 and 26, p. 23)

The Nandi tradition considers that there is just one right solution, discussed next.

Female Husbands. The Nandi solution "to keep the fire" and sustain the family lineage is for the heirless woman to become the "female husband" to a younger woman. As just noted, women who live in a polygamous marriage are eligible to become female husbands even if co-wives bear a son. A woman who marries another woman for this purpose has to undergo an "inversion" ceremony to "change" into a man. As in a standard marriage, she also has to provide a bride-price to her wife's family. This biological female, now socially a man, becomes a "husband" to a younger female and a "father" to the younger woman's children. The sons of the younger woman then become the heirs of her house. A woman who has taken a wife

*Adoption of children born to unwed mothers was relatively rare back in the 1960s and 1970s, and even then it was disappearing (ref. 24, pp. 74–75): "It was easier to adopt a child in the past than presently [1980s]. Today, unwed mothers usually raise their own children. Moreover, by the time a woman resigns herself to the fact that she will not bear a son, she is often too old for adoption to be a realistic option." She also notes that an innovation that probably started in the 1970s but did not gain much popularity (and is probably nonexistent today) was "marrying the house" by which the youngest daughter was retained at home and her "husband" was said to be the house. This daughter would become daughter-in-law and have children by self-selected sexual partners who would inherit the house's property. Consistent with ref. 24, in my dataset no female subject has married the house.

is said to become a man (*kagotogosta komostab murenik*, literally "she has gone up to the side of the men"). This is an established traditional family institution in Nandi customary law, and as such a practice that is protected under Article 11 (1) of Kenya's Constitution: "The Nandi culture insists that the female husband becomes a man" (ref. 26, p. 24).

The female husband is expected to renounce her female duties (such as housework) and take on the obligations of a husband. Additionally, she acquires the social and public privileges and prerogatives of men such as the right to speak in public meetings. She is also qualified to attend the male initiation (circumcision) ceremony and she normally stops attending female initiation. She would also be expected to adopt to some extent male dress and adornment.

With regard to sexual relations, no such relations are permitted between the female husband and her new wife (nor between the female husband and her old husband). Rather, the female husband may chose a male consort for the new wife (she is also free to engage in sexual liaisons with men of her own choosing) so she will be able to bear children. The wife's children consider the female husband to be their father, not the biological father, because she (or "he" now) is the socially designated father.

Ethnographic studies report that the division of labor is said to be much the same as in male husband-headed households, except for the absence of the sex act. The relationship between a female husband and her wife is not very different from that between a male husband and his wife, except from the greater sexual and social freedom just noted. The female husband is totally in charge of important household decisions (e.g., farm management and money allocation) and in the same position of authority over her wife as a male husband. All surveyed wives in ref. 24 agreed that they must ask permission from their female husbands to go away from the compound, except for local, short-term activities such as going to the market and visiting neighbors. Yet, the greater sexual and social freedom may explain why some informants in ref. 24 indicate that "female husbands are said to be less likely to question their wives' coming and goings" and that "are less likely to quarrel with their wives and beat them" (*SI Appendix*).

Female husbands also behave as men in reserving most of their afternoons for socializing, and they and their wives also behave exactly as a standard family when entertaining visitors:

> When a visitor comes, I sit with him outside and converse with him. My wife brings out maize-porridge, vegetables, and milk. When we have finished eating I say, "Wife, come and take the dishes." Then I go for a walk with the visitor (ref. 24, p. 77).

Female husbands assume the formal role of father to their wives' children. The relationship between fathers and their young children is normally reserved and distant, and the relationship between female fathers and their children is no different. Female fathers, like male fathers, are responsible for the discipline of their wives' children and children reportedly respect and fear female fathers as much as they would male fathers. One of the most important areas of significance of the father role is the father's responsibility to care for the wife's children materially. That female husbands meet this requirement was constantly stressed in the surveys of ref. 24.

In the social and public spheres, the female husband makes her greatest attempt to conform to male behavior, and the Nandi go to great rhetorical lengths to argue that female husbands are, in fact, men:

> … strongly insist that a woman who takes a wife becomes a man and (except for the absence of sexual intercourse with her wife) behaves in all social contexts exactly as would any ordinary man (ref. 24, p. 80).

> Everyone is of course aware that the female husband is not really a man but it is a grave insult for anyone to call attention to this fact. What, then, is the claim that the female husband is a man intended to encode? What does the female husband have in common with a man that makes it essential for her to be defined as such? The often reiterated statement of the female husband's masculine identity is a cultural dogma. It is an ideological assertion which masks the fact that the female husband is an anomaly: she is a woman who of necessity behaves as no woman in her culture should. Her situation forces her to assume male behavior in areas that are crucial to the cultural definition of the differences between the sexes. These areas have to do with the management and transmission of the family estate: her role in the domestic division of labor, as husband to her wife and father to the wife's children (ref. 24, p. 83).

Experimental Procedure

As the aim is to capture insights into initial competitive inclinations, rather than to observe choices in familiar situations where preferences may easily be bundled with stereotypes on task and the like (28, 29), I choose an experimental design that involves an unfamiliar task where traditional skills do not advantage one sex or gender over the other. This design has a simple and clean structure and a number of desirable properties and useful characteristics (30–32). The experimental task is to toss a tennis ball into a bucket that is placed 3 m away. Participants were informed that they had 10 chances. A successful shot means that the tennis ball enters the bucket and stays there. The task is simple to explain and implement, and no sex or gender differences in ability are expected (something that will be confirmed in the results presented below). Since this experimental game is like no other task in which the subjects had participated, this design does not generate strong priors on whether those who are more efficient at the task will choose to compete. Although the basics of throwing an object a short distance may not be novel, I expect to find no significant correlation among the Nandi and, in fact, as will be shown, I found none: There is a lack of statistical difference between men's and women's abilities in their performance. Also, no sex or gender appears to have a more accurate sense of their relative abilities in this task.

The experiments were conducted in different villages mainly in Nandi County during June 2016 to August 2018, with most subjects recruited in remote villages at high altitude, typically above 2,000 m. In each session, participants were recruited in advance. At the recruitment stage, I obtained basic information on the subject: name, gender (male, female, or female husband), identity of the head of his or her household, and village. A code was assigned to each subject. No more than one subject was recruited per household. A random sample of males and females was then selected to match the sample size of female husbands to participate in the experiment. The protocol has been approved by the London School of Economics Research Ethics Review and the Universidad del País Vasco Comité de Ética. Written informed consent was obtained from all participants.

Selection problems are greatly attenuated since everyone was interested in participating in the experiment after they were made aware of the relatively high pecuniary incentives involved: a show-up fee of 150 Kenyan shillings (about one and a half days' wages) plus, potentially, an additional amount that would depend on their actions in the experiment. I did not disclose further monetary details of the experiment in light of the results in ref. 33 discussed below, and to attenuate the risk of being manipulative. As in several studies with similarly large amounts in the experimental literature, coercion does not appear to be an issue (13, 14, 18, 30).

In the research community studied in ref. 25, 3.5% of households were headed by female husbands, and the ethnographer conjectured that the incidence of woman–woman marriages was probably increasing in the 1980s. Female husbands head slightly below 9% of households in the villages in my sample. In total, 302 subjects were selected: 101 males, 103 females, and 98 female husbands.

The main experiments took place during June 2016. On the day of the experiment, each experimental subject was asked to arrive at a specific place (the "meeting place"), typically a central public place (e.g., the school or the clinic), at a specified time in a specific village different from his or her own. When multiple subjects were recruited from the same village, they were asked to go to different villages and arrive to the corresponding meeting place on the same day and at the same time so that they could not interact after they departed for the experiment.

Upon arrival to the meeting place, the participant was greeted by two experimenters (one male and one female). These two experimenters, who were to stay with the subject for the entire experiment, then took the subject to the "experiment place," typically a nearby building different from the meeting place, where the actual experiment would be conducted. Subjects were requested to come to the experimental place without friends or relatives to prevent the type of social pressures to share income found in ref. 33. The two subjects that would participate in each experimental "session" were randomly selected and matched from the sample of subjects. They were convened at different meeting places and coordinated by the experimenters carrying synchronized watches to arrive to the experimental site building at slightly different times (typically a 2- to 3-min difference) so that they could not meet or see each other. To further make sure that this was the case, they also entered the building from different sides, where each side was private and could not be observed from the other sides. At the experimental site, I was able to use two empty rooms isolated from each other, one for each subject, to conduct the experiments. Participants did not know the identity of the other participant in the other room and were given no opportunity to know it.

The setup was identical in every session. When the participant arrived at the room where the experiment would be conducted, the two experimenters explained the task. The instructions are reproduced in *SI Appendix, SI Appendix A*. They were translated from English to the local language, Kalenjin, and checked by having a different person translate them back into English. The instructions were read aloud to the individual participant by the two experimenters (one male and one female). Each experimenter read a different paragraph, alternating the paragraphs. The reading order was randomly determined from subject to subject.

Participants were told that they were matched with another participant who was performing exactly the same task at the same time in another room in the same building. Both subjects were informed that their identities would remain anonymous. The only decision participants were asked to make concerned the way they would be paid for their performance.

They made this choice before performing the task, but only after they fully understood the instructions and the payment schemes. The two options participants were asked to choose between were 1) X per successful shot, regardless of the performance of the other participant, or 2) 3X per successful shot if they outperformed the other participant. They were told that in case they chose the second option and scored the same as the other participant they would receive X per successful shot. I set X to 100 Kenyan shillings, roughly a full day's wage.

After choosing the incentive scheme, participants completed the task and were told how the other participant performed. Then they were asked to proceed to another location in the same building (a different one for each participant) where they provided personal information in an exit survey (*SI Appendix, SI Appendix B*) and were paid their earnings in cash, including the show-up fee. Exit times were also coordinated so that they could leave the building at different times. As the location was different for each subject, as promised, participants were never given the opportunity to learn with whom they were paired.

The experimental procedure just described includes two features that facilitate the empirical analysis and provide additional robustness:

1) Sex of recruiters and experimenters. In order to keep the sex of the recruiters and the experimenters neutral, I always had the same number of male and female recruiters in the recruiting stage (typically two) and always had two experimenters (one male and one female) at all times with each subject in each session. This implies that there could be no "experimenter effect" whereby subjects could be differentially likely to compete when the experimenter was of a specific sex. Further, the experimental instructions were read by both experimenters, one paragraph each in alternating order, which was randomly determined for each subject.
2) Sex distribution in and around the experiment. The experimental design keeps the identity of the subject's potential competitor neutral. In principle, however, subjects could make an inference on the sex distribution in the experiment (that is, on the composition of potential competitors) by what they observed in their own surroundings if samples are unbalanced across sexes and if subjects are put in groups. To avoid any such concerns and make sure that it was not possible to deduce the distribution of potential competitors, the experiments were not done in groups but individually. Doing it individually is also useful in terms of the heterogeneity across sexes in the impact of social pressure to share income with kin and neighbors found in ref. 33, also in rural western Kenyan villages. The matching of competitors was also done randomly using the identity codes obtained in the recruiting stage. As noted earlier, subjects were also asked to arrive at different meeting places. They were coordinated to enter the experimental site at slightly different times and from different sides so that no visual contact was possible. Although perhaps unlikely, it is at least conceivable that subjects may have made an inference on potential competitors based on the mix of nonexperimental subjects they remembered to have observed in the surroundings outside the experimental site. To address this aspect, two observers discreetly recorded the number and sex distribution in the surroundings at the time of the experiment using two counters

in their pockets. It turns out that this potential issue is insignificant in the data.

Importantly, randomization in the recruiting stage means that samples were essentially balanced across social genders and biological sexes within villages. Also, as all subjects from a given village participated in experiments conducted in different villages on the same day and at the same time, no interactions could take place between subjects who had and had not done the experiment.

Results

Summary data from the postexperiment exit survey are presented in Table 1. It includes a number of queries on the subjects and their households, including sex, gender, age, education, marital status (marriage date if married), relation to the head of household, information on family composition, wage-earning activities, wages earned, source of inherited house property, and others. For female husbands, I also obtained the date when the subject acquired the social role of a male.

The average subject is in the 40- to 45-y age range. Average educational attainment is in the range of 4 to 5 y of education, slightly higher for men. Income levels show similar patterns: Nandi men earn more than Nandi women (about 25% more). Activities, marital status, and relation to head of household are consonant with census data and anthropological evidence. Polygamy, an old tradition practiced among the Nandi, is in decline relative to past decades and in the sample just 12%. Importantly, as expected, no men inherited property from co-wives of their fathers, from aunts or others [a "distasteful" alternative that is considered "wrong" and "very unfortunate" (24, 26)], only from their mothers.

Table 2 provides a summary of competitive choices, balls successfully tossed in the bucket, and earnings across sex and genders. Fig. 1 complements these summary data with a visual representation of the observed choices.

In terms of task proficiency, subjects made 28.14% of their attempts, and the success rates are similar across biological sexes and social genders. On average, 46% of the experimental subjects choose to compete. When broken down by males and females, the result that is typically observed in the literature is evident: Whereas 54% of males choose to compete, only 28% of females select the competitive incentive scheme. More importantly, as Fig. 1 highlights, the main finding in the raw data is apparent: The rate at which female husbands select the competitive environment (56%) is not statistically different from the rate chosen by males (54%), and thus it is about twice the rate that females choose.

Although this raw data summary provides some evidence of the variation in behavior across biological sexes and social genders, it does not control for observables—such as age, education, and income—that might influence behavior. To do so, I estimate various regression models in which the individual choice to compete is regressed on a dummy variable for biological sex (male), a dummy variable for social gender (female husbands), and the observables collected from the survey detailed

Table 1. Participant characteristics

Individual characteristics	Male	Female	Female husbands
Age, y	40.5	41.1	45.14
	(10.1)	(9.2)	(7.8)
Education, y	4.83	4.34	4.16
	(2.87)	(3.19)	(2.65)
Income (1,000s of Kenyan shillings)	44.71	35.01	46.87
	(41.97)	(24.72)	(30.54)
Activity			
Farmer	0.92	0.58	0.96
Student	0.02	0.00	0.00
Teacher	0.00	0.03	0.00
Housewife	0.00	0.34	0.00
Other	0.06	0.04	0.04
Unemployed	0.00	0.00	0.00
Marital status			
Single	0.09	0.06	0.00
Married (monogamous)	0.76	0.89	1.00
Married (polygamous)	0.12	—	0.00
Married (to the house)	—	0.00	—
Widowed	0.02	0.05	0.00
Divorced	0.01	0.00	0.00
Relation to head of household			
Head of household	0.93	0.06	1.00
Spouse	0.00	0.89	0.00
Son/daughter	0.05	0.05	0.00
Brother/sister	0.02	0.00	0.00
Father/mother	0.00	0.00	1.00
If inherited house property, source			
Mother	1.00	—	—
Co-wives of father, aunt, other	0.00	—	—
N	101	103	98

Mean and SD in parentheses for age, education, and income (in 1,000s of Kenyan shillings). Proportions for all other characteristics.

Table 2. Participant choices and outcomes

	Male	Female	Female husbands
Experiment summary			
Compete	0.54	0.28	0.56
	(0.50)	(0.45)	(0.49)
Success	2.77	2.84	2.82
	(1.40)	(1.66)	(1.64)
Correlation (compete, success)	0.005	0.006	0.006
Earnings	414.8	375.7	434.6
	(462.2)	(411.9)	(523.5)
N	101	103	98
Those who chose to compete			
Success	2.78	2.86	2.83
	(1.72)	(1.59)	(1.89)
Won–loss–tie	26–26–3	12–11–6	25–27–3
Earnings	530.9	610.3	563.6
	(590.0)	(684.7)	(656.6)
Earnings if choice reversed	278.1	286.2	283.6
	(124.3)	(154.9)	(149.3)
Those who chose not to compete			
Success	2.76	2.83	2.81
	(1.78)	(1.88)	(1.76)
Won–loss–tie	23–19–4	31–36–7	15–24–4
Earnings	276.0	283.7	269.7
	(144.8)	(163.8)	(160.5)
Earnings if choice reversed	554.3	520.2	460.4
	(558.8)	(618.4)	(622.4)

Mean and SD in parentheses. "Compete" denotes whether the subject opted to compete. "Success" denotes the number of successful attempts in the experiment out of the 10 tennis balls tossed. "Earnings" denotes the money earned during the experiment, and "Earnings if choice reversed" the money that the subjects would have earned had they chosen differently, both in Kenyan shillings. "Won–loss–tie" denotes the frequencies with which the subject won, lost, or tied when he/she chose to compete, or that would have won, lost, or tied had he/she chosen to compete. Two-sample *t* tests assuming equal variances reject the hypothesis that the rate at which males (M) compete or female husbands (FH) compete is different from that at which females (F) compete (*P* values are <0.001 in both cases). The hypothesis that M and FH compete at the same rate cannot be rejected at the standard significant level (*P* value = 0.776). With respect to success rates, it is not possible to reject the hypothesis that they are the same for M, F, and FH, neither in the aggregate nor conditional on the choice of whether to compete or not, at standard significance levels. In all cases, *P* values are >0.74. *F* tests indicate that the hypothesis of equal variances cannot be rejected in any of the competition or success tests at standard significance levels.

in Table 1. I present estimates from both logit and probit models.

Empirical results from different specifications are contained in Table 3. The two leftmost columns can be considered the most parsimonious specification, including only variables that provide the unconditional effect of social gender and biological sex on competition. The next two specifications add the individual-level variables—age, education, and income—that might be most expected to influence competitive tendencies. The last specification includes, in addition, the full set of controls—work activities, marital status, relationship to head of household, and age–sex and age–gender interactions.

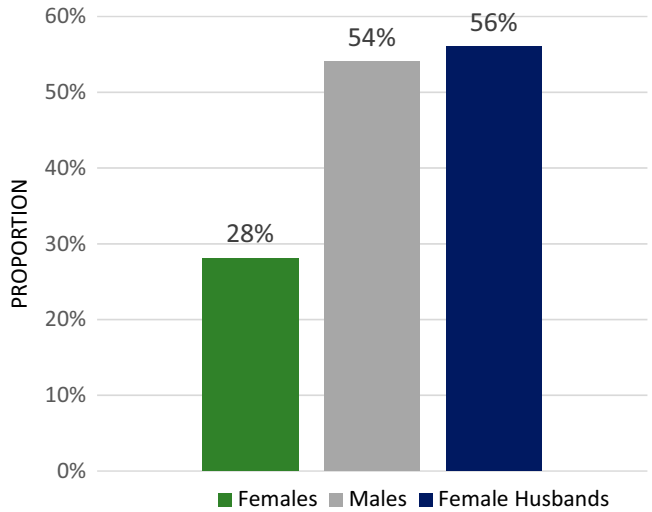

Fig. 1. Competitive choices across social and biological genders. Percentage rates at which subjects choose to compete.

The results show that regardless of which specification is preferred, both males and female husbands compete significantly more often than females. The estimates do not deviate much from what is already observed in the raw data. They indicate, for example, that males are roughly 25 to 26 percentage points more likely to compete than females (that is, almost doubling their 25 to 28 percentage rates) and, similarly, that female husbands are 28 to 32 percentage points more likely to compete than females, therefore just about doubling the females' rates. Thus, the differences in competitiveness with respect to females are rather substantial.[†] Differences between males and female husbands, on the other hand, are not significant at conventional levels, suggesting that unconditionally there is no strong evidence that female husbands compete more or less often than males. In the most complete specifications, age, income, and education are not statistically significant. Needless to say, some variables may themselves be influenced by competitiveness. In the last column none of the control variables is significant

[†]These are estimates of the differences in the extensive margin. Recent evidence suggests that differences in the intensive margin may be even larger between men and women, at least in some settings (34).

Table 3. Regression estimates

	Logit	Probit	Logit	Probit	Logit
Constant	−0.944***	−0.582***	−1.084*	−0.674*	−1.476*
	(0.22)	(0.13)	(0.61)	(0.38)	(0.82)
Male	1.104***	0.683***	1.104***	0.683***	1.159***
	(0.29)	(0.18)	(0.30)	(0.18)	(0.357)
Female husband	1.226***	0.759***	1.213***	0.751***	1.152***
	(0.30)	(0.183)	(0.306)	(0.18)	(0.350)
Age	—	—	0.002	0.002	0.008
			(0.013)	(0.008)	(0.016)
Income	—	—	1.61e-07	7.31e-08	4.14e-06
			(3.67e-06)	(2.28e-06)	(4.35e-06)
Education	—	—	0.002	0.001	0.001
			(0.041)	(0.025)	(0.042)
Other controls	No	No	No	No	Yes
χ^2	21.03	21.03	21.09	21.09	27.79
Log-likelihood	−196.6	−196.6	−196.5	−196.5	−193.2
McFadden R-squared	0.050	0.050	0.050	0.050	0.067
Schwarz criterion	410.3	410.3	427.4	427.3	454.9
N	302	302	302	302	302

The dependent variable is "Compete." It takes the value of 1 if the participant opts to compete and 0 otherwise. Variables are as defined in Table 1. Given that many cells are not well-populated for "Other controls," I considered categories with at least five observations, excluded categories in which p(compete = 0category = 1) = 1, and include dummy variables for Occupation (housewife, other, student) and marital status (single, married polygamous, and widowed). Interactions between age and gender and sex and gender are also included. ***$P < 0.01$, *$P < 0.1$.

below the 5% level (alpha = 0.05), including occupation, marital status, and age–sex and age–gender interactions, although of course it is challenging to include many controls given the sample sizes.

Fig. 2 reveals an interesting source of heterogeneity among female husbands.

Although just a simple description, the percentage of female husbands in the raw data who choose the competitive scheme increases with the years they have lived as female husbands, beginning from around a 48% rate for those 0 to 5 y in the new social role to around a 66% rate for those above 15 y. This increase is statistically significant at the 5% level (alpha = 0.05) when controlling for age. It suggests that competitive inclinations may not only be drastically altered but that they also do develop over time, therefore suggesting a process of habituation and socialization in which the new husbands internalize the behavior, beliefs, and actions of their new gender role.[‡] This positive relationship speaks directly to the "nurture" aspect of competitiveness. Interestingly, as some female husbands may eventually become more competitive than the average male, it is not unreasonable that this socialization aspect may include a demand for "acting male," perhaps much as has been observed in the literature on the economics of race (e.g., "acting White").

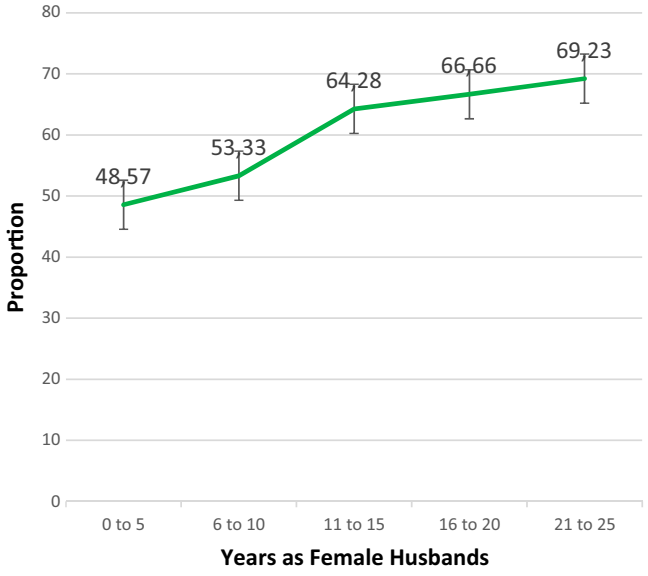

Fig. 2. Proportion of female husbands who choose to compete. Sample sizes are 35 (0 to 5 y), 30 (6 to 10 y), 14 (11 to 15 y), 6 (16 to 20 y), and 13 (21 to 25 y). Error bars represent ± SE.

As indicated earlier, when women get a new role for which other social norms apply, the new norms come with being in charge of household decisions (e.g., farm management and money allocation) and responsibility to care for the wife's children materially. This new responsibility was very much stressed in the surveys of refs. 24 and 25. These results, therefore, are in line with the findings in ref. 35, which finds that women are more willing to compete when they compete for resources that directly benefit their children (in their study, they use a scholastic bookstore voucher for the child as prizes, rather than cash). Finally, although differences in competitiveness are wide and firmly established (11, 12), this is by no means a universal phenomenon. For instance, there is evidence suggesting that nurture/culture plays an important role in girls in single-sex schools (36) and that females may reserve their most intense competitive behavior to ensure reproductive success and survival and thriving of the offspring (37–39) and in matrilineal societies (30). Nature may play a role in competitiveness as well, as female competitiveness over cash seem to vary over with hormone levels (40, 41).

An important aspect studied in the literature is whether differences in competitiveness might be driven in part by

[‡]The correlation between years of marriage and competitiveness is close to zero (−0.02 for male husbands and 0.07 for female wives) and statistically insignificant at standard confidence levels. I also observed three biological females both before and after the inversion ceremony in which they changed social gender. They are part of the sample of females in June 2016. I did the same experiment to them in January 2018 after they had become female husbands. Although a negligible sample size, the number of subjects who chose to compete doubled from one to two of these three subjects.

heterogeneous risk postures. Differences in risk aversion is a different dimension from differences in a taste for competition, and the tournament payment scheme in the experimental task is not only competitive but also more uncertain than the piece-rate scheme. The psychology and experimental economics literatures send a very moderate message about the potential relevance of differences in risk attitudes (11, 12). First, while differences in risk-taking exist, and women are more risk-averse than men, those differences are small and often nonexistent. Second, differences in risk aversion cannot typically account for the gender gap in competitiveness in many studies. Finally, differences in risk aversion between men and women tend to disappear in experimental treatments with high payoffs (as those in this study).

Nevertheless, it is important to measure risk postures among the Nandi to explore this issue. I do that using a simple procedure that measures the propensity to take risks, namely a standard risk game where subjects take a decision between two incentive schemes that mimic the uncertainty in payment without actual competition taking place. The risk experiment has subjects play a one-shot game in which they are endowed with 100 units (worth 200 Kenyan shillings). The subject must decide what portion of this endowment [0, 100] he or she desires to bet in a lottery that returned three times the bet with 50% probability and nothing with 50% probability. As illustrated in the experimental instructions (*SI Appendix, SI Appendix C*), subjects were made aware of the probabilities, the payoffs, and the fact that the lottery would be played directly after choices were made. The term "lottery," which would be foreign to them, is not used in the instructions. Therefore, subjects were aware of the fact that they could earn anywhere between 0 and 300 units from this task. They were also informed that monies earned would be paid in private at the end of the experiment.

Two noteworthy items must be mentioned. First, I chose the stakes to overlap with the stakes over which the ball-tossing game is played (the initial amount is equal to two successes if the subject chooses piece rate, and the maximum amount is equal to two successes if the subject chooses competition and he or she wins). Second, experimental subjects for this risk-aversion task are again drawn randomly from the population. In a first panel (Panel I), the subject pool has no overlap with the subject pool that played the ball-tossing game to avoid potential contamination effects. In a second panel (Panel II), I select a random sample from the same sample studied in the previous section. The experiments were conducted during June 2017.

Table 4 presents the summary choices, split by sex and gender. Essentially, I find no differences in either panel: male, female, and female husbands risk ∼62 to 65% of the total endowment in each of the two panels. A two-sample t test does not reject the hypothesis that the gambled amount is the same across biological sexes and social genders at the one percent significance level (alpha = 0.01) in both panels.

Thus, the results show no statistically significant differences in risk preferences. This is consonant with the results in much of the experimental literature (11, 12), in particular involving high stakes, and also with evidence from a few traditional societies such as the Sangu (Tanzania), Mapuche (Chile), Khasi (India), and the Maasai (Tanzania) (30, 42).

Table 4. Proportion bet in risk aversion game

	Proportion bet (SD)		
	Male husband	Female wife	Female husband
Panel I	62.1	62.0	61.7
	(8.3)	(7.8)	(8.7)
N	51	52	17
Panel II	65.0	64.5	64.1
	(5.2)	(5.8)	(6.1)
N	52	50	51

Average (SD) amounts bet out of 100. Two-sample t tests assuming equal variances cannot reject the hypothesis that the proportions bet are the same across sexes and genders. In Panel I, the P value of the test that compares the proportions bet by male husbands (MH) vs. female wives (FW) is 0.94, for MW vs. female husbands (FH) it is 0.86, and for FW vs. FH it is 0.89. In panel II, the P value of tests are 0.64 (MH vs. FW), 0.42 (MH vs. FH), and 0.73 (FW vs. FH). Thus, in all cases P values are substantially above standard significance levels for rejection 0.10 or 0.05. F tests indicate that the hypothesis of equal variances cannot be rejected at standard significance levels.

Discussion

Under the assumption that the female husband status is randomly allocated, we can interpret the results as causal. This customary arrangement is the way to work around the problems of infertility or a lack of male heirs, arguably both with strong random components. Yet, this assumption needs a careful discussion, and it is important not to overstate the degree of randomness before a deeper study.

Intuitively, a first important characteristic is that selection issues appear to be strongly mitigated by the traditional Nandi custom: it establishes just one specific norm about the transmission of the "house property" and just one specific socially admissible "solution" (change to a male social role) that must be pursued in the situations in which the norm creates a problem (lack of own male heirs). As indicated earlier, other potential solutions are considered "wrong" and "very unfortunate" (24, 25) and as such are strongly discouraged and stigmatized. Hence, selection on who becomes a female husband would appear to be small or negligible in this setting.

Consistent with these intuitions, no male subject in Table 1 reported ever receiving any house property inheritance from someone different from his mother (e.g., from aunts or co-wives of his father). This is an important fact. Notwithstanding this valuable evidence, however, several potential selection channels both on the supply and demand sides are studied in detail in *SI Appendix*. These include differences in observable characteristics, in reasons to become female husbands, in fertility decisions, and in endogenous factors such as land in the 1954 Swynnerton Plan that may have determined the incidence of woman–woman marriages decades ago. None appear to be a relevant source of selection.

Perhaps the most important piece of evidence on potential endogeneity aspects may come directly from the Nandi society itself. To do so, I dug deeper into the ethnographic nature of its traditional custom and gathered their own views about the potential endogenous treatment of this norm in two surveys (*SI Appendix, SI Appendix D*).

Survey 1. The first survey took place during February 2018 among the general adult Nandi population ($n = 117$), from the set of subjects recruited in advance, none of whom had participated in the experiments. This survey asks about the main reason why in their view a female without male heirs will not eventually become a female husband. The results shows that "bad luck" is overwhelmingly the main reason they indicate (above 96%). Although a minimum of house property is clearly necessary to pay for bride-wealth, no subject mentions lack of

income or small property, poor employment prospects, bad character, no desire to change social status, or similar unmeasured characteristics as a cause for not becoming female husband. These answers are consistent with the evidence presented in Table 3.

Importantly, the initial exit survey (*SI Appendix, SI Appendix B*) also has two questions, one for the single females and the other for the female husbands, showing that no offers were ever turned down. This is necessary but not sufficient for a lack of selection issues, as preliminary discussions and explorations may mean that no offers are made if they will be likely turned down. Survey 1 is also useful to address this issue. It turns out that about 40% of the 96% of subjects who answered "bad luck" also gave examples of bad luck (other than the potential bad luck causing the other options) in the survey line reading "Please give examples of bad luck." Essentially, all of their answers explicitly point to a "thin" local marriage market for potential female husbands. For example, they write "not unmarried women in the area with boys," "not unmarried women in the area that could have boys," etc. A thin local marriage market is likely exogenous to one's infertility or having only daughters.

Survey 2. The second survey was implemented during August 2018 with subjects recruited from members of various Councils of Elders in different villages ($N = 87$), again who had not participated in the experiment. It asks them about potential changes in preferences for sons or daughters over time in the Nandi society. They systematically answer that in their tradition the preference for sons has always been strong, neither strengthening nor weakening over time.[§]

I conclude that to the extent that responders were able to understand the surveys, their answers represent strongly suggestive evidence that any variation in the female husband treatment is essentially due to random factors.

As a summary, the Nandi custom does leave little room for selection issues to be meaningful. Its custom must be pursued with no other socially admissible options in cases that have a strong random component (infertility, no male heirs). Consistent with this, the different pieces of empirical, ethnographic, and survey evidence show that the potential threats to estimation posed by selection into treatment do not appear quantitatively important. Had it been otherwise, the Nandi would have likely provided some indication to the contrary in the different surveys. Perhaps, they would have even altered their tradition over time if the cultural norm was "gamed" and did not have the intended result. On the contrary, the norm has experienced no variation over decades, and it is now protected by Kenya's Constitution. Accordingly, I take the evidence on risk aversion postures and the different channels for selection studied as robustness checks of the significant impact that a change in social gender role at an adult age has on competitive inclinations.

These results are also consistent with recent findings that suggest that risk aversion and other behavioral parameters, broadly framed by genetic endowments, can be ruled out as sources of sex and gender differences in the response to incentives (44). To the extent that competitive inclinations are found to be channeled through the social roles in the family and society, the findings also lend support to refs. 6, 45, and 46: "There is, however, one potential determinant of gender differences on which the experimental literature seems to have been almost completely silent: the role of the family and in particular of the division of family chores within the family. My own research on this leads me to suspect that here is where we should search for the sources of gender differences in labor markets. … Family related issues should be a main part of the future research agenda on gender issues." Finally, to the extent that social norms are endogenous, the results also contribute to, and are consistent with, the important literature on endogenous preference formation and identity (19–21).

Concluding Remarks

The past few years have seen the development of a vibrant literature that studies sex and gender differences in competitiveness. Reviews of this literature (11, 47) conclude that it "suggests that preferences for competition are not fully innate but may be influenced by the manner in which we are raised. Thus it may be possible to nurture women to become more competitive." The findings in this paper support this suggestion quite strongly. By keeping biological sex constant, holding the same society constant, and keeping the nurturing of biological sexes constant, but altering the social gender at an adult age, the unique setting the Nandi provide advances our understanding of competitive inclinations in humans. In particular, the Nandi provide support for the hypothesis that social norms, identity, and endogenous preference formation critically matter to tackle gender differences directly.

The results also contribute to a deeper understanding of the distinction between sex and gender (7–10) and to the origin of cultural norms and beliefs regarding the role of women in society (22, 23). Studies have shown the continuity of cultural norms over long periods of time and how the relative costs and benefits of different cultural traits affect the evolution of these norms (48–50). Research supports the hypothesis that differences in gender roles have their origins in the division of labor, such as, for example, the form of agriculture traditionally practiced in the preindustrial period (plow agriculture). The plow requires significant physical strength, which meant men had an advantage in farming relative to women. This division of labor then generated norms about the appropriate role of women in society (22). Among the Nandi, ethnographers document that young Nandi men, following initiation, used to spend a period of about 12 to 15 years as warriors. They were known for their military organization and aggressive cattle-raiding practices. War requires physical strength, and "it is manly to be courageous in the area of herd management" (26). Both of these aspects impact the division of labor. The findings in this paper add to this line of inquiry.

Data Availability. All study data are included in the article and/or *SI Appendix*.

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[§]See ref. 43 for an important study on differential fertility in a society with a strong preference for sons.

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