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Towards a Deeper Understanding of Female Competitiveness and the Gender Gap: Evidence from Patrilocal and Matrilocal Cultures*

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Abstract

In order to better understand why competitiveness varies systematically across genders and, in some cases, across cultures, we investigate competitiveness in a sample of females and males between the ages of 12 and 90 in two different cultures in rural Malawi. We show that women in matrilocal cultures are more competitive than women in patrilocal cultures and that, whereas there is a gender gap in patrilocal cultures (where women are less competitive than men), there is no such gap in matrilocal cultures. More importantly, women in patrilocal cultures change their willingness to compete at important fertility markers in their lives: adolescence, having a surviving child (older than six), and menopause. These changes in willingness to compete are not present in matrilocal societies. In fact, the *only* women in either society who are less competitive than the average male are post-adolescent women without a child over the age of 6 in patrilocal societies; all other women are as competitive as or more competitive than men. The data show that although the biological imperative of having surviving offspring has important consequences for women, competitiveness is not biologically predetermined because the return to competitiveness is conditioned by cultural attitudes towards childbearing and childrearing.

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1 Introduction

Most studies on the gender gap in the willingness to compete show that the average male seeks competition and the average female prefers to avoid it (Gneezy, Niederle, and Rustichini 2003; Gneezy and Rustichini 2004; Niederle and Vesterlund 2007; Flory, Leibbrandt, and List 2015). This gender gap, which exists across settings as diverse as rural Tanzania (Gneezy, Leonard, and List 2009) and urban Norway (Almås et al. 2012), suggests a natural or biological basis. In particular, Campbell (2002; 2004) suggests that because women are uniquely able to give birth and have significant advantages in the care of newborns, this may make competitiveness less advantageous to them. Findings that competitiveness in women appears to vary with age and hormonal cycle (Buser 2012; Mayr et al. 2012; Andersen et al. 2013; Wozniak, Harbaugh, and Mayr 2014; Flory et al. 2015)[1] seem to support a biological basis since preferences could be connected to lifecycle or cyclical changes in hormone levels. However, a smaller literature has found that the gender gap is not consistent across all cultural settings and that socialization may also matter (Gneezy, Leonard, and List 2009). If a society wishes to encourage women to enter competitive settings (jobs) in greater numbers, is it a matter of changing these settings such that women are willing to enter (see, for example, Heale and Pate 2011; Balafoutas and Sutter 2012; Niederle, Segal, and Vesterlund 2013), or socializing women in such a way that they are willing to enter the competitive settings as they currently exist (Bohnet 2015)? To successfully answer this and related questions, a deeper understanding of the causes of these behavior patterns is invaluable.

In this paper, we examine the relationship between culture and biology and provide new evidence on the manner in which culture mediates the biological imperatives that shape women's attitudes towards competition. We demonstrate the complexity of the relationship between motherhood, culture, and competitiveness by drawing from laboratory experiments on competitiveness with subjects from the age of 12 to 90 in cultures with two distinct sets of marriage and inheritance customs. As with Gneezy et al. (2009), Andersen (2013), and Gong and Yang (2012), the subjects are drawn from matrilineal villages that practice matrilocal marriage—where the couple resides with the wife's kin group—and patrilineal villages that practice

[1] Interestingly, Wozniak et al. (2014) and Buser (2012) each find significant but opposite results on the role of hormones in female competitiveness.

patrilocal marriage—where the couple resides with the husband's kin group.[2] Our choice to perform the research in Malawi enables us to better isolate the impact of culture from means of economic production because a history of successive invasions has left Malawi with highly differentiated cultural institutions regulating family structure and interaction in an otherwise similar economic environment.

Our findings show, first, that culture matters: there is no gender gap in competitiveness in matrilocal villages as a whole, and some matrilocal villages even demonstrate a gender gap reversal in which women are more competitive than men. However, as has been documented in almost all other papers on gender and competitiveness, there is a significant gender gap in each of the patrilocal villages. This confirms the basic result found in Gneezy, Leonard, and List (2009) that in some matrilineal cultures, women are at least as competitive as men (if not more so), while women in patrilineal cultures are significantly less competitive than men.

To better understand the implications of culture for competitive behavior, we focus on the institution of marriage (matrilocal versus patrilocal) and demonstrate our primary contribution, that women's preferences to compete in patrilocal villages appear to be sensitive to their fertility. Specifically, women become less competitive as they pass through adolescence and more competitive after menopause. We also show that having a surviving child changes women's attitudes towards competitiveness, making them more competitive in patrilocal villages. In particular, the strongest impact comes for women who have a child (of either gender) above the age of six. Notably, although both adolescence and menopause mark social as well as physiological changes in women, having a child survive infancy is not correlated with any physiological changes, suggesting a cultural influence.

We also show that none of these markers impact preferences towards competitiveness in matrilocal societies, evidence that culture mediates the relationship between lifecycle and competitiveness for women. Although these findings are inconsistent with a model in which female physiology drives preferences for competition, they are consistent with a model in which preferences for competition are guided by imperatives rooted in the underlying logic of evolution but which find different expressions in different societal types . In such a model, cultural

[2] In a matrilineal culture, inheritance follows the female lineage as opposed to a patrilineal culture where it follows the male lineage. All the matrilineal villages we study follow matrilocal practices, and all the patrilineal villages follow patrilocal practices.

institutions help articulate the role of competitiveness in maximizing the well-being of one's own child and children to whom one is closely genetically related.

The paper proceeds as follows. In section 2, we present the experimental design, and we examine the results of the experiment in section 3. In section 4 we discuss models that can help us understand the results. Section 5 concludes.

2 Experimental Design

The experiment follows the design of Niederle and Vesterlund (2007), in which subjects perform a task three times—once when they are paid according to individual performance, once when they are paid based on their performance compared to three other individuals, and once when they are given the choice whether to perform the task in a competitive or individual (piece-rate) environment. At the end, they are also asked whether they choose to submit past performance to a competitive setting. Our methodology differs from that of Niederle and Vesterlund (2007) only in the task and the choice of subjects. In Appendix 1 we show that the data collected in Malawi are similar to data collected using the same instrument and task in the US and that when both the sample in the US and the sample in Malawi are restricted to match the ages of individuals in the Niederle and Vesterlund (2007) experiment, the results are strikingly similar.

As Niederle and Vesterlund (2007) emphasize, an important stumbling block in identifying the effects of a given determinant (e.g., gender) on appetites for competition is the difficulty of isolating preferences for competition from other characteristics such as appetites for risk, aversion to receiving feedback on performance relative to others, and self-confidence. Their protocol resolves this issue by having participants make two choices: choice 1, choosing to compete against others, and choice 2, choosing to submit one's past performance to a comparative evaluation. Both of these choices are affected by risk preferences, relative feedback aversion, and self-confidence, but only one (choice 1) is affected by a taste for the act of performing competitively. Choice 2, which is affected by risk preferences, feedback preferences, and confidence (but not the latter "taste") is used as a control in analyses of choice 1, the choice to compete.

The task that we use is specifically designed to involve a simple cognitive exercise—

arranging shapes in a row from smallest to largest. Each participant has a set of six blocks. Each side of a given block has one of six shapes. The relative location of the shapes on each of the six blocks is different. The task is to arrange all six blocks such that a given shape (e.g., star) appears facing up, and to align the six versions of that shape (e.g., all six stars) in order from smallest to largest. Upon completing one shape, the participant moves to the next shape. The blocks are designed so that the order of the blocks for one shape does not confer any advantage to arranging the blocks for the next shape. All participants work with identical blocks and face the same order of shapes to complete. Participants are paid based on the number of shapes completed in a 3-minute interval. There are four different rounds. Participants are informed they will be paid for one of the four, selected at random after the game.

- In round 1 (piece-rate), participants are paid X (approx. 0.32 USD) for each set of shapes successfully completed.
- In round 2 (tournament), they receive 4X (approx. 1.28 USD) per success if they complete the most successes in their group of four, but receive nothing otherwise. The group is randomly determined and participants never know who is in their group.
- In round 3 (choice 1), they first choose which of the two payment schemes they want to work under (piece-rate or tournament) and then perform the task.
- In round 4 (choice 2), they do not actually perform the task. Rather, they simply choose to submit their past performance in round 1 either to the noncompetitive piece-rate scheme or the competition-based pay scheme.

Before making the choice for round 3, participants are informed that if they choose competition, their group is the same group that they were placed in for round 2, and the performances they compete against are the round 2 performances. That is, they would compete with individuals who had been forced to compete, rather than individuals who had self-selected into competition. Before making the choice for round 4, participants are again informed that their group is the same group that they were randomly placed in for round 2, and this time the performances they compete against are the round 1 (piece-rate) performances of the group. Thus, if they submit their piece-rate performance to competition, they compete with the (round 1) performance of all individuals in their group, not just those who chose to compete. After all rounds were completed, participants are asked how they believe their performance compares to

the others in their group for rounds 1 and 2, and earn an additional amount Y (approx. 0.13 USD) for correct guesses.

The focus of the exercise is the choice of compensation scheme for round 3 (choice 1), which is whether participants want to perform the task under competition against a group of individuals who were required to compete. Rounds 1 and 2 serve to familiarize participants with each pay scheme. In addition, the number of successes in each of the first two rounds allows us to control for the influence of ability in the task (and any potential boost in ability under competition) on the decision to compete. This allows us to ensure, for example, that it is not simply a difference in ability that drives a lower average willingness to compete among women. The choice made in round 4 (choice 2) is whether participants want to submit a past performance to competition against their group's previous performances. As mentioned previously, both choice 1 and choice 2 are subject to the influence of other factors that affect one's willingness to compete (risk-aversion, feedback-aversion, and self-confidence), but only choice 1 is affected by a preference for performing under competition per se. Therefore, the choice to compete in round 3 conditional on the choice in round 4 captures the preference for competitive environments independent of other factors that can influence this choice.

The experiment took place in an isolated location, often inside a schoolhouse. In each village, we conducted three or four sessions, each session lasting about an hour. Each session had 16 stations, with a set of blocks and a pile of shape-indicator cards. We used facilitators to fill many of the functions of a typical economics lab computer: they gave subjects silent indication when their task was completed and they could move to the next shape arrangement, kept track of the number of successes and the time it took to complete each task, and recorded subjects' choices and beliefs. The facilitator sat facing the subject, handling two subjects at a time (with a barrier between the two subjects). Visual barriers prevented subjects from being able to observe each other's choices or performance. Communication between facilitators and subjects was nonverbal, aided by the use of gestures and pictures (e.g., pointing to a card displaying the shape for the next task). The only speaker during the session was the script-reader, who read the instructions for the experiment translated into the local language.

In addition to the data collected in Malawi, we collected data using exactly the same experimental protocol (in English) and tasks with a sample of adults between the ages of 18 and

85 in the US. We discuss this data in the Appendix 1 and Tables 11 demonstrates that the findings for adults (older than 18) across all villages are qualitatively similar to the findings for our sample in the US. In particular, we find that women over the age of 49 are more competitive than other women in the US sample as well as for the Malawi sample. Furthermore, Table 11 demonstrates that, if we restrict the sample in the US and Malawi to adults between the ages of 18 and 25, our results are strikingly similar to the results shown in Niederle and Vesterlund (2007) with a sample of students from the University of Pittsburg. Thus we feel confident that the novelty of our findings is driven by the special characteristics of our sample and not by any particular artifact of the methodology.

3 Experimental Results

Our dataset contains information about preferences for competitive environments for men and women between the ages of 12 and 90 across two distinct marriage customs, allowing us to examine the roles of biology (gender and fertility) and culture (non-physiological markers within cultures and differences across matrilocal and patrilocal cultures). In terms of understanding the relative roles of biology and culture, it is important to highlight the fact that even though we focus on the results for females, women are always competing against men as well as other women.

The experiments yielded 1,000 observations almost evenly distributed between men and women. Table 1 shows the sample statistics from these experiments. More men (49%) chose to perform under competition than women (43%). (Fisher's exact test rejects equality with a p-value of 0.028). Slightly fewer men (48%) and slightly more women (46%) chose to submit their previous performance to competitive incentives, with the male-female difference not significantly different from zero (p=0.612). Thus, we find evidence that men and women are different in their willingness to experience competition but do not find that they differ significantly in their willingness to submit past performances to competitive evaluation. On average, men were better than women at the task in both rounds, completing 6.76 vs. 6.18 tasks in round 1 (Wilcoxon rank-sum test rejects equality with a p-value <0.001), and 8.10 vs. 7.63 tasks in round 2 (p-value =0.009). Men also believed that they were better (had higher rank). Ability and beliefs are controlled for in all subsequent regressions.

3.1 Cultural institutions and marriage practices

Prior to the experiment, in each of the 12 communities studied we discussed current marriage customs with key individuals in the village. Based on these interviews, we identified six matrilocal communities, four patrilocal communities, and two villages that had undergone a transition from matrilocal to patrilocal marriage custom in the past 50 years. To verify the self-reported practices, we interviewed a random sample of experimental participants and asked them about their own marriage history. Table 2 shows the probability that a married person was born in the village by matrilocal, patrilocal, and transition village status. The coefficient for female shows how much more (or less) likely it is that a married woman was born in the village than a married man (represented by the constant term). As the estimates show, of the six villages that were pre-identified through qualitative interviews as having matrilocal customs, four have statistically significant marriage patterns that conform to the expectation that married women are more likely to live in the village of their birth than married men. Of the four villages that were pre-identified as having patrilocal customs, three have marriage patterns confirming that married women are significantly less likely to live in the village of their birth than men. For both of the transition villages (those that have transitioned away from matrilocal to patrilocal customs), women are less likely than men to reside in their natal village after marriage. However, the pattern is statistically significant only for one of the villages.

Based on these findings, for the remainder of the analysis we exclude the two matrilocal villages that did not have statistically significant matrilocal marriage patterns, the one patrilocal village that did not have statistically significant patrilocal marriage patterns, and the one transition village that did not have statistically significant patrilocal marriage patterns consistent with the transition from matrilocal to patrilocal customs. We redefine the remaining transition village as patrilocal. This leaves us with four matrilocal and four patrilocal villages for the remaining analysis of the impact of marriage institutions on competitive preferences.[3]

3.2 Gender differences by culture

Table 3 examines the descriptive statistics by gender and village type for the eight villages in the restricted sample. Women in matrilocal villages are 10 percentage points (26%)

[3] However, as we show in table 6, virtually all of the findings reported in the paper hold even if we use the original definitions and do not drop any villages.

more likely to choose to perform in a competitive environment than women from patrilocal villages (Fisher's exact test, p=0.064), but otherwise there are no significant differences between matrilocal and patrilocal women. In particular, there is no difference in the willingness to submit a past performance to competitive evaluation. Among men, the only significant difference is that males in patrilocal villages appear more self-confident – they believed they had done better in the piece-rate rounds than men in matrilocal villages (rank belief in round 1 is closer to 1).

Table 4 reports estimated marginal effects from a probit regression that includes the full range of controls from the Niederle and Vesterlund (2007) protocol in order to isolate the effect of gender on preferences to perform in competitive environments.[4] The regression for column 1 (where the omitted category is males) focuses attention on the effect of cultural institutions on women's willingness to compete, while the regression reported in column 2 (where the omitted category is males in matrilocal villages) focuses on the gender gap within each cultural environment. Looking first at column 1, we see that after controlling for other factors that also affect competition choice, women living in patrilocal environments are 11 percentage points less likely to compete than men living in either cultural environment ($p<0.01$), while women living in matrilocal environments do not appear any less competitive than men. Turning to column 2, we see that within patrilocal environments, women are 12.2 percentage points less likely than men to compete ($p<0.001$), whereas in matrilocal environments women are slightly *more* willing to compete than men (0.4 percentage points, not significant). Notably, women in matrilocal cultures also appear no less competitive than men in patrilocal cultures ($p=0.76$). Finally, we see that women in matrilocal cultures are an estimated 10.3 percentage points more likely to compete than women in patrilocal cultures ($p=0.05$). These results show that the standard gender gap in willingness to compete exists in patrilocal villages but is absent in matrilocal villages, and that women from matrilocal environments appear just as competitive as men from patrilocal environments.

3.3 Competitiveness and female fertility markers

[4] In each of the eight villages, the experiment for adults (aged 18 to 90) took place on a single day. On a separate visit to four of the villages, the experiment was also administered to children between the ages of 12 and 17. Standard errors in all regression analyses are clustered at the village-visit level to account for unobservable characteristics correlated with village marriage customs. Due to the small number of clusters, statistical inference should be based on the t-distribution with critical values of 2.201 for significance at the 5% level and 1.796 for significance at the 10% level, as suggested by Cameron and Miller (2015).

Next, we test whether competitiveness changes over a woman's lifetime based on potential fertility and other important markers of lifecycle. In particular, we examine whether female competitiveness is affected by the transition through puberty, getting married, having a child (the first), having a child survive early childhood, and the onset of menopause. We choose the ages of 15 and 50 to represent the markers of puberty and menopause because the Demographic and Health Surveys—the standard-bearer for internationally comparable demographic statistics in developing countries—defines the ages in which women are potentially fertile as between 15 and 49.[5] Thus we refer to youth between the ages of 12 and 14 as early adolescents and everyone between 15 and 49 as adults.[6] Having a child survive early childhood is defined as having a child over the age of six. Health organizations often use the age of five as a significant marker of survival, but this is primarily because data are kept and examined in aggregations of half decades. It is likely the culturally accepted age that marks the end of early childhood is higher – particularly since seven is the point at which most children enter primary school, and this fundamental transition in a child's development may itself serve as a marker and a change in social roles for the mother.[7] All of the results also hold for age cutoff of four and five, though six yields the largest and most significant effect.

Table 5 shows the results of a probit regression on women's decisions to compete, allowing for different coefficients for women in matrilocal and patrilocal villages. Each probit regression includes age markers and Niederle and Vesterlund (2007) controls. The results are shown in three columns: 1) the coefficients for women from matrilocal villages, 2) the coefficients for women from patrilocal villages and 3) the p-value of the test that the coefficients are different from each other. Each regression includes dummy variable for women early adolescent women (under the age of 15) and women over the age of 49—the omitted category is women between ages 15 and 50. A dummy variable for matrilocal cultures is included at the bottom of each regression with the omitted category representing patrilocal cultures.[8] Four sets

[5] Munthali and Zulu (2007) also report that 15 is the median age of menarche in their study in Malawi.

[6] Our results remain similar (including retaining their significance) for markers of menopause that vary between 48 and 52; however, changing the potential age of the first fertility transition (to 14 or 16, for example) does change the significance of that variable.

[7] Furthermore, in a similar setting (rural Tanzania, Malawi's neighbor) Leonard (1997) reports in an interview with a traditional healer who specialized in infertility that fertility treatment is considered to have been fully successful only when the child reached the age of 7.

[8] Note that the dummy variable for matrilocal cultures is difficult to interpret and does not represent the overall difference between the two marriage practices.

of regressions are shown: regression 1 shows the results including the age cutoffs that proxy for adolescence and menopause, a dummy variable for whether a woman is married, and a dummy variable for whether she has a child (of either gender); regression 2 shows the same set of variables with a surviving child (child of age greater than or equal to 7) instead of any child; regression 3 shows the same results as column 2 but without the marriage variable; and regression 4 shows the same set of coefficients as column 2 but with the addition of a linear term for age. Not shown are the results in which having a child or having a surviving child are differentiated by the child's gender; none of these regressions showed any differences by gender in either culture.

The results are broadly similar across all four specifications. Women in patrilocal villages become less competitive when they enter adolescence (the coefficient for early adolescence is positive meaning that early adolescents are more competitive than older women) and more competitive after menopause. Neither being married nor simply having a child impacts competitiveness, but having a child over six increases competitiveness among patrilocal women. On the other hand, in matrilocal villages none of the markers have any impact on competitiveness. Although not all of the coefficients are significantly different across the two cultures, the sign of the coefficients indicating early adolescence, having surviving children, and menopause for matrilocal women is always the opposite of those for patrilocal women. Furthermore, inclusion of continuous age as an additional explanatory variable is not significant and does not change the basic pattern of the markers we see. Thus, the fertility markers of puberty, child survival, and menopause have an important impact on attitudes towards competitiveness – but only under patrilocal institutions.

Recall from Table 3 that, in patrilocal cultures, 49% of men choose to compete compared to only 39% of women. However, 50% of girls under the age of 15 choose to compete, 46% of women between the ages of 15 and 50 with a child over the age of 6 choose to compete and 56% of women over the age of 50 choose to compete. Only women between the ages of 15 and 50 without a child over the age of 6 are less competitive than the average male (36% of this group chooses to compete).

3.3.1 Alternative Definitions of Marriage Customs

In this section, we explore three alternative definitions of marriage customs: 1) the self-

reported practices in the full set of villages with transitional villages classified as patrilocal; 2) three different definitions as classified by self-reported practices (matrilocal, patrilocal and transitional) and the simply classification of whether a woman currently resides in the village in which she was raised (independent of culture).

Table 6 shows the same regressions and models as Table 5 but with the original definitions of matrilocal and patrilocal customs across all 12 of the villages. The results are virtually identical except for the marker for women aged 50 or older in patrilocal villages, which is no longer statistically significant.

Table 7 gives some intuition for why the coefficient for women 50 or older is not significant. The table examines the second specification from Table 5 in which we include only the statistically significant markers, with three types of marriage customs according to the self-reported classifications of long-term matrilocal, long-term patrilocal, and transitional from matrilocal to patrilocal. With the smaller number of individuals in each category, many of the coefficients for markers are no longer significant, but there is some suggestive evidence for an interesting pattern in the two villages that have undergone a transition. In these villages, older women exhibit a pattern that is similar to that of matrilocal villages (as seen in the non-significant and negative sign of the coefficient on the proxy for women 50 or older), and younger women exhibit a pattern that is similar to that of patrilocal villages (as seen in the positive coefficient for early adolescents). Since the transition villages began the transition about 50 years ago, this pattern might be explained by the fact that older women were socialized in a setting of matrilocal customs whereas younger women were socialized in a setting of primarily patrilocal customs.

Finally, Table 8 examines the key fertility markers of adolescence, having a surviving child, and menopause but without reference to village customs. In this table women are divided into those who are living in the village in which they were raised and those who are not. This is to check whether the patterns observed in Table 5 are simply driven by the fact that most women in patrilocal villages have moved and most women who live in matrilocal villages have not—are the patterns we see driven by average life experiences rather than village customs?

In this regression we see no significant coefficients for markers, which is due, at least in part to the difficulty of interpreting the meaning of whether a woman currently resides in the

village in which she was raised. Younger women, even in patrilocal societies, are unlikely to have moved yet, even though they will at marriage. The second regression model focuses only on married women and we can see that the coefficients for being over the age of 50 are as we would expect, although they are not significant. Overall, the results for Table 8 are difficult to interpret except that they are clearly not a reasonable way of explaining the patterns we see at the village level—the patterns are better explained by village customs and not by individual histories.

3.4 Competitiveness and Sibling Order

Recent research (Okudaira et al. 2015) shows that birth order can affect competitiveness and if women in matrilocal societies are more competitive because they are forced to compete with their sisters for scarce resources more so than in patrilocal societies, this might be visible in birth order effects. In the Malawian matrilocal cultures studied here, the oldest daughter is responsible for the matrilineal name and inheritance, much as the eldest boy is favored in most patrilineal cultures. If this cultural institution drives increases in overall competitiveness by making eldest girls more competitive (or if it does the exact opposite and makes their sisters more competitive), we should be able to see such effects within matrilocal villages for women who are older than all their sisters. Table 9 examines the patterns across matrilocal and patrilocal cultures by how many siblings women have and whether the women are older than their male and/or female siblings. Regression results reported in Table 9 show little evidence that attitudes toward competitiveness are driven by family structure in this way: women in matrilocal cultures are no more or less likely to compete if they are the oldest girl. Furthermore, there are no significant differences between matrilocal and patrilocal villages by birth order.

4 Discussion

By choosing to compare women across most of their lifecycle in two deliberately selected types of cultures, we set out to contribute to a better understanding of the relative merit of different models of gender differences in competitiveness. Clearly the basic biological model (women are different than men) is inadequate. However, it is also clear that competitiveness and childrearing are related, suggesting some role for biology. Below we discuss some of the most prevalent explanatory models and assess them in light of our findings: biological, inclusive

fitness, sociological, and socialization. We highlight that the model of inclusive fitness is consistent with our findings.

4.1 The Biological and Inclusive Fitness Models

The fact that the majority of the studies on competitiveness show gender gaps is often explained as coming from a biological taste or distaste for competitive settings. Campbell (2002; 2004) suggests that because women are uniquely able to give birth and have significant advantages in the care of newborns, female competitiveness may be less advantageous to the species as a whole. This is true in a wide variety of species, as Stockley and Campbell point out: "The greater investment usually made by females in producing and rearing young is likely to be an important factor underlying sex differences in competitive strategies" (2013, pp. 2). Similar observations are made by Clutton-Brock (2007) and Stockley and Bro-Jørgensen (2011).

It is possible to augment this model to include competitiveness variations across a woman's lifetime if the taste or distaste for competition is linked to hormones. Female aggression (and therefore potentially competitiveness) in many species of mammals is linked to testosterone or androgen exposure (Stockley and Campbell 2013; Wallen 2005; French et al. 2013; Dloniak, French, and Holekamp 2006).[9] Indeed, changes in competitiveness have been linked to hormone levels in women (Wozniak, Harbaugh, and Mayr 2014; Buser 2012). Since changes in fertility in adolescence and at menopause are driven by changes in hormone levels, it is possible to deepen the biological model to incorporate these effects. Overall, the biological model suggests that women might carry the genetic and physiological products of evolutionary forces, signaled through hormone levels.

However, the animal behavior literature has long recognized that, for animals living in cooperative societies, focusing on maximization of *individual* reproductive success may not be the right way to understand behavior. In particular, this narrow measure of success is not representative of the more general measure of inclusive fitness (Stockley and Campbell 2013), which refers to the degree to which one's genes are present in subsequent generations (Hamilton 1964). For humans, maximizing inclusive fitness means that people may be willing to sacrifice

[9]All of these papers on mammals recognize the additional importance of socialization: "Social context also significantly affects sexually differentiated behavior. Other patterns of behavior, such as threatening behavior, are sexually differentiated in some social conditions but not others and prenatal hormones do not consistently affect the development of this behavior" (Wallen 2005, 23).

on behalf of their own children, but also on behalf of their grandchildren and even the children of their brothers and sisters. Thus, although a fertile woman without children or any genetically related kin can only increase her inclusive fitness through childbearing, a woman who has children, grandchildren, brothers, sisters, nieces, or nephews has other strategies available for improving inclusive fitness.[10]

Consider the implications of maximizing inclusive fitness for a woman in a patrilocal culture. As an early adolescent girl she can neither bear nor rear any children, so the best way to improve inclusive fitness would be to support the childrearing of those children to whom she is genetically related, including younger siblings, cousins, nieces, and nephews. After puberty, the same woman now has the possibility of childbearing but—until she has her first child—not yet childrearing. Importantly, according to the customs of her culture, she now lives far away from anyone to whom she is genetically related and therefore cannot increase inclusive fitness by assisting these relatives. The focus on childbearing means she gains little from winning a competition in the patrilocal culture but might face significant losses from losing, and is therefore likely to avoid competitive settings.

Once she has a surviving child, however, she has an additional strategy available to her for enhancing inclusive fitness—childrearing. In a patrilocal village, her own child is the first person in her community to whom she is genetically related. The childrearing strategy for this woman will be different than the childbearing strategy, and competition during childrearing may offer significant benefits. The cost of losing is lower (children are less reliant on their mothers than embryos or infants), and the benefits of winning can be more easily translated into superior social status for children (there is only so much one can do to help an embryo or infant). According to the inclusive fitness model, the fact that she has a surviving child should therefore increase the likelihood that she will seek competitive situations.

Though after menopause a woman can no longer bear children of her own, she can still invest in the fitness of her surviving children or grandchildren. She no longer has a reason to

[10] In fact, it is possible that for women, having many children is a poor investment. Hrdy (1999) recounts a favorite set of facts for scholars of genetic differences between the sexes: Moulay Ismail the Bloodthirsty of Morocco (1646-1727) fathered 888 children whereas the most fertile female on record, Madalena Carnauba of Brazil, gave birth to 32 children. Clearly the inclusive fitness benefits to "winning" for Moulay significantly outweigh the benefits to Madalena. However, Hrdy points out that no one has ever examined the strategy pursued by Moulay's mother (who had at least 888 grandchildren). It is entirely possible that, by increasing the status of her son, Moulay's mother gained more than if she had increased the number of her own children.

avoid competitiveness and may have a significant reason to seek it.

One of the key predictions of models of inclusive fitness is the existence of kin altruism (costly, unreciprocated assistance to kin).[11] One important manifestation of this form of fitness is the existence of alloparents: adults other than mothers or fathers who are instrumental in the survival of young children (Hrdy 1999).[12] Women in matrilocal villages are likely to benefit significantly more from such altruism and alloparenting because more women are genetically related to each other. Thus, in a matrilocal village, women always have another strategy available for increasing inclusive fitness: investing in the fitness of their sisters. Moreover, they also are surrounded by relatives who have an incentive to help them. Overall, living near their mothers, aunts, and sisters should simultaneously increase the benefits of winning competitions and diminish the costs of losing, and therefore should increase willingness to compete at all phases of life. Rather than simply increasing competitiveness compared to a patrilocal village, living in a matrilocal village should have the effect of reducing the influence of lifecycle changes throughout women's lives.

While the biological model could explain the gender gap in patrilocal villages and some of the effects on competitiveness of fertility markers there as well, only the inclusive fitness model is consistent with different gender gaps in matrilocal and patrilocal villages. Further, the lack of lifecycle effects on competitiveness in matrilocal villages is consistent with the inclusive fitness model.

4.2 The sociological model

Two other approaches that might help to explain the differences and patterns we observe in this study are the sociological model (from evolutionary anthropology) and a more general socialization model. In the sociological model, competitiveness is seen as the product of competition for scarce resources whereas in the socialization model, competitiveness is believed to arise from social pressures to conform to expected models of behavior.

[11] For example, Essock-Vitale and McGuire (1985) find that among white middle-class Los Angeles women, assistance to friends was more likely to involve reciprocation than assistance to kin and that women were more likely to help kin who had greater reproductive potential without expectation of reciprocation.

[12] Euler and Weitzel (1996) show, for example, that grandparents invest more in grandchildren for reasons that can be linked to the certainty that they carry many similar genes. Interestingly, Gaulin et al. (1997) demonstrate that, although uncles and aunts are more likely to invest in cases where similarity of genes is more certain, aunts invest more than uncles.

The sociological model attempts to explain the origins of competitiveness among female kin when resources are scarce. Because gestation and reproduction are costly investments for females, women may have an incentive to "clump" together in groups to protect scarce food resources. According to this model, the scarcer the resources, the more likely we are to observe cooperation among female kin (Clutton-Brock and Harvey 1977; Wrangham 1980; Kappeler 1999). The resulting cooperative outcome, Hrdy (1999) suggests, actually occurs as a result of intense competition among females for status within the group (Wrangham 1980): in essence cooperation is made possible by stable stratification among cooperating females. Thus, it is possible that settings such as matrilocal villages—in which women cooperate to care for their young—could be the product of intense competition for resources within the social structure.

One way to test whether scarcity leads to competitiveness among women is to look for differences in competitiveness according to birth order in matrilocal societies. In Malawian matrilocal villages, the status of lineage is assigned to the oldest girl. The responsibility assigned to the eldest daughter may create a greater willingness to compete. Or perhaps this arrangement forces the younger daughters to increase their competitiveness over the remaining scarce resources. Okudaira et al. (2015) show that birth order affects competitiveness in a sample of high school students in Japan and that women with older sisters are more competitive than women without older sisters. We might expect, therefore, that women in matrilocal communities, in particular, would be affected by birth order. However, Table 9 shows no evidence that competitiveness is driven by birth order in the matrilocal cultures studied. Eldest daughters in these villages are no more likely to compete than other daughters, nor are women with older sisters more competitive than those without older sisters—results that are virtually identical to those of the patrilocal societies.

4.3 The socialization model

The socialization model, on the other hand, suggests that women might learn to compete or to avoid competition from implicit or explicit expectations and that these expectations do not need to be rooted in any current extra-cultural realities. Matrilocal marriage and matrilineal inheritance are well understood to be commonly associated with specific economic structures[13]

[13] In general, matriliny is found in agricultural societies that depend on unsettled agriculture (slash and burn, for example), where wealth is in human capital rather than storable, transferable assets (Kaplan, Hooper, and

which may encourage competitiveness in women. The socialization model suggest that even if the forces that led to the cultural features of matrilocal marriage are no longer present, competitiveness can remain a socially acceptable or desirable trait for women due to continued socialization. For example, Bisin and Verdier (2001) present a model in which parents prepare their children to live in adult settings by making choices for them which are deliberately similar to the choices made by other parents in the same setting, leading to long-term stable patterns of socialization that can have little or no basis in current environmental conditions.

Indeed, many children in rural Malawi take part in explicit initiation ceremonies where they are taught social mores and expectations (Munthali and Zulu 2007). In interviews with key informants in matrilocal and patrilocal villages who participated in the current experiments, we learned that a central element in the initiation of all girls is the importance of women's obedience to their husbands and elders. This is true in *both* types of villages, which suggests little difference in explicit messages about competitiveness. It is possible that socialization could take a less explicit form and thereby help to explain the higher levels of competitiveness in matrilocal communities but socialization fails to explain the changes we observe over a woman's lifetime in patrilocal communities.

It is possible that a more subtle model of socialization would admit that women could be socialized (even at a young age) to change their competitive behavior at various points in their lifecycle.[14] Thus, it is possible that socialization inculcates attitudes towards competitiveness that explicitly vary with status in society. In other words, the variation in competitiveness across the lifecycle for women in patrilocal villages might be explained by changes in status within the family and as a mother at the major lifecycle markers studied here. This is particularly true in terms of the increase in competitiveness that occurs in women with a surviving child. Having children is an important contribution that women make to their families, and there is evidence that succeeding in this sphere conveys status that changes bargaining power within the family (Warner, Al-Hassan, and Kydd 1997; Schuler, Hashemi, and Riley 1997; Doss 1999; Jejeebhoy and Sathar 2001). At the same time, making or participating in decisions about schooling

Gurven 2009). It is not associated with any use of large domesticated animals (Alesina, Giuliano, and Nunn 2013) and is not present in pastoral societies (Mace and Holden 2005) but is common in fishing societies (BenYishay, Grosjean, and Vecci 2015).

[14] In three villages, we asked children whether they had been through an initiation ceremony: 70% of girls 15 and older had been initiated whereas only 33% of girls under 15 had been initiated. Thus, for example, initiation as a type of socialization may help to explain some of the changes seen at the age of 15 in patrilocal communities.

(children usually begin schooling at the age of seven in Malawi) increases women's experience of confidence (Doepke and Tertilt 2009; Jejeebhoy and Sathar 2001).

Support for the idea that there is a status transition with the age of the oldest child can be seen in a separate dataset from Malawi. The Malawi Longitudinal Survey of Family Health (MLSFH) 2010 wave asked women whether they were currently living in their home village or their husband's village (Kohler et al. 2015). This allows us to proxy for matrilocal and patrilocal customs and then examine the fertility of women as a function of the age of their oldest child. The data are discussed in Appendix 2 and Figure 1 shows that women with a surviving child over the age of six are significantly less likely to give birth in that year than women whose eldest child is younger than 7 (after controlling for the age of a woman). Interestingly, this result is only clear for women who are in patrilocal marriages. Thus, in patrilocal communities at least, there appears to be a change in the fertility of women at the same point in which we observe a change in competitiveness. We cannot make any causal statements about the relationship between these two findings, but this provides some evidence that women's roles and therefore status are changing.

This view of transitions within motherhood dovetails nicely with the concept of inclusive fitness. It seems unlikely that individuals are explicitly thinking about the best strategies for increasing inclusive fitness, and thereby deciding to switch behavior at certain fertility markers based on these considerations. It seems more likely that the culture has socialized people to behave in a manner that is consistent with the logic of inclusive fitness.

While the sociological model, based on competition for scarce resources within cooperative societies, could begin to explain overall gender differences in competitiveness across cultures, it does not help us to understand lifecycle effects on women's competitiveness in patrilocal cultures. Also, this model's theory of additional competition over resources among female siblings in matrilocal cultures is not borne out in our data. On the other hand, the socialization model can be seen as consistent with lifecycle effects on women's competitiveness in patrilocal cultures and with differences in gender gaps between matri- and patrilocal cultures. Yet it is less clear why the effects of fertility markers on competitiveness differ by culture. The fact that older women in transition villages behave similarly to women in purely matrilocal cultures while younger women in these villages exhibit patterns that are similar to women in

patrilocal cultures is interesting in this context. It suggests that the current marriage patterns are less important than the socialization that a woman receives when growing up or from women who are her peers in terms of age. Furthermore, the fact that the effects of fertility markers on competitiveness are weaker (not stronger) when examining a woman's current location (natal versus non-natal village) than when looking at her birth culture suggests that although the inclusive fitness model helps to explain a link between women's behavior and the customs in their village, the explanation does not work at an individual level. In other words, it suggests that the current marriage patterns are less important than the socialization that a woman receives when growing up or from women who are her peers in terms of age. We conclude that the best fit for the data is a model in which inclusive fitness constitutes the underlying structure, but in which socialization is the mechanism through which its evolutionary logic is internalized at the individual level.

5 Conclusion

We show that preferences for competition in women can vary both by cultural setting and by stages in the lifecycle. Women who live in villages that practice patrilocal marriage become less competitive as they pass through adolescence, more competitive when they have a child that is at least five to seven years old (with the strongest coefficient at seven), and more competitive again after menopause. On the other hand, there are no patterns of competitiveness variations with age or lifecycle changes for women who live in matrilocal communities. In addition, we find no evidence for changes in competitiveness when women are married or give birth to their first child, either in matrilocal or patrilocal communities. The only group of women who are less competitive than men are women who do not live in matrilocal societies and who do not have a child over the age of 6, a group which represents virtually all samples on which conclusions about female competitiveness have been drawn.

The results in patrilocal villages suggest some support for the biological theory of competitiveness: women are less competitive than men overall, and women's competitiveness changes both at adolescence and menopause, times when hormone levels also change significantly. However, the biological theory cannot predict or explain changes in competitiveness for women who have surviving children, and it cannot explain the fact that women in matrilocal villages are more competitive overall or that competitiveness does not

change at the same fertility markers as in patrilocal villages.

Closer examination shows the data strongly supports a model of inclusive fitness. Transitions in a woman's lifecycle that are linked to whether she can bear children and/or raise her current children are strongly linked to competitiveness in patrilocal communities. The results are consistent with the idea that childrearing becomes an effective inclusive fitness strategy for women when their child passes the age of about six. While unlikely the earliest age at which a child would survive without the assistance of its mother, as the age at which schooling starts, it marks a salient developmental transition in the life of a young child and a likely focal point for cultural significance.

On the other hand, while successful at predicting the data patterns, the inclusive fitness model on its own does not seem fully capable of explaining individual choices. It is unlikely that women explicitly consider the implications of their choices in our experimental setting on the probability that their children, siblings, grandchildren, maternal nieces and nephews will survive to pass on their genes. Socialization, however, offers a mediating mechanism. The socialization model suggests that the optimal choice of strategies to maximize inclusive fitness is not the result of individual maximization, but rather the result of socialization about the social acceptability of different strategies at different ages.

Initial findings of gender differences in competitiveness (e.g. Gneezy, Niederle, Rustichini, 2003; Niederle and Vesterlund, 2007) highlighted the fact that they were consistent with evolutionary processes causing men and women to be inherently different at a biological level. More recently, findings that the standard gender patterns in competitiveness do not hold in matrilocal society have often been taken as evidence that it is instead socialization that determines gendered behaviors (e.g. Andersen et al., 2013). Our findings strongly suggest that either view on its own is too simple to adequately explain the data patterns. The evidence tilts most heavily in favor of the model of inclusive fitness, which integrates both perspectives in an insightful way. This model accepts the logic of evolution as a critical first principle, but also accepts and explains how the dictates of this logic interact with key institutions regulating family interactions that vary by culture, to produce the different patterns of behavior we observe in the literature.

Importantly, this model has implications for behavior in more modern economies such as

the US, where the prevailing culture does not entail adult women living with their sisters, mothers, grandmothers, and maternal nieces and nephews. While the explanation of pure socialization offers the allure of strong potential policy levers, the inclusive fitness model suggests important limitations to how far socialization can go. While socialization plays a role in this framework, it is consistent with imperatives based in the logic of evolution. This suggests it is far from clear that socialization that counters this logic will lead to sustainable positive outcomes. This has important policy implications. If the underlying reason that women do not become less competitive after puberty in matrilocal society is that they live with their close genetic relatives, then it is far less clear that attempts to socialize adolescent girls in other settings will sustainably change their attitudes to make them more competitive.

Furthermore, our findings strongly suggest other important age groups are currently being overlooked. The fact that we find that cultures where women do not live with their close genetic relatives have a more competitive disposition after raising a son or daughter past early childhood, and once again after reaching late maturity around the age of 50, suggests an alternative target group for encouraging women to embark upon competitive paths. While targeting adolescent girls and pre-professional women is understandably attractive due to the potential it offers of influencing early career choices, our findings suggest it may be significantly easier to encourage mothers with children in school and mid-career professionals to enter competitive paths. Although skills and human capital begin to accumulate at early ages in life, the choice of work environment and the competitiveness of this work environment can change.

6 References

Almås, Ingvild, Alexander W. Cappelen, Kjell G. Salvanes, Erik Sorensen, and Bertil Tungodden. 2012. “Willingness to Compete in a Gender Equal Society.” SSRN Scholarly Paper ID 2205795. Rochester, NY: Social Science Research Network. http://papers.ssrn.com/abstract=2205795.

Andersen, S., S. Ertac, U. Gneezy, J. A. List, and S. Maximiano. 2013. “Gender, Competitiveness and Socialization at a Young Age: Evidence from a Matrilineal and a Patriarchal Society.” *The Review of Economics and Statistics* 95 (4): 1438–43.

Balafoutas, L., and M. Sutter. 2012. “Affirmative Action Policies Promote Women and Do Not Harm Efficiency in the Laboratory.” *Science* 335 (February): 579–82.

Bisin, Alberto, and Thierry Verdier. 2001. “The Economics of Cultural Transmission and the Dynamics of Preferences.” *Journal of Economic Theory* 97 (2): 298–319. doi:10.1006/jeth.2000.2678.

Bohnet, Iris. 2015. “Designing Gender Equality.” In *Economic Science Association, North American Meeting*. Dallas, Texas.

Buser, Thomas. 2012. “The Impact of the Menstrual Cycle and Hormonal Contraceptives on Competitiveness.” *Journal of Economic Behavior & Organization*, Gender Differences in Risk Aversion and Competition, 83 (1): 1–10. doi:10.1016/j.jebo.2011.06.006.

Campbell, Anne. 2002. *A Mind of Her Own: The Evolutionary Psychology of Women*. Oxford University Press.

———. 2004. “Female Competition: Causes, Constraints, Content, and Contexts.” *Journal of Sex Research* 41 (1): 16–26.

Clutton-Brock, T. H. 2007. “Sexual Selection in Males and Females.” *Science* 318 (5858): 1882–85. doi:10.1126/science.1133311.

Clutton-Brock, T. H., and Paul H. Harvey. 1977. “Primate Ecology and Social Organization.” *Journal of Zoology* 183 (1): 1–39. doi:10.1111/j.1469-7998.1977.tb04171.x.

Dloniak, S. M., J. A. French, and K. E. Holekamp. 2006. “Rank-Related Maternal Effects of Androgens on Behaviour in Wild Spotted Hyaenas.” *Nature* 440 (7088): 1190–93. doi:10.1038/nature04540.

Doepke, Matthias, and Michèle Tertilt. 2009. “Women’s Liberation: What’s in It for Men?” *The Quarterly Journal of Economics* 124 (4): 1541–91.

Doss, Cheryl R. 1999. “Twenty-Five Years of Research on Women Farmers in Africa: Lessons and Implications for Agricultural Research Institutions; with an Annotated Bibliography.”

Essock-Vitale, Susan M., and Michael T. McGuire. 1985. “Women’s Lives Viewed from an Evolutionary Perspective. II. Patterns of Helping.” *Ethology and Sociobiology* 6 (3): 155–73. doi:10.1016/0162-3095(85)90028-7.

Euler, Harald A., and Barbara Weitzel. 1996. “Discriminative Grandparental Solicitude as Reproductive Strategy.” *Hu Nat* 7 (1): 39–59. doi:10.1007/BF02733489.

Flory, Jeffrey A., Uri Gneezy, Kenneth L Leonard, and John A. List. 2015. *Gender, Age, and Competition: The Disappearing Gap*.

Flory, Jeffrey A., A. Leibbrandt, and J.A. List. 2015. "Do Competitive Workplaces Deter Female Workers? A Large-Scale Natural Field Experiment on Gender Differences in Job-Entry Decisions." *Review of Economic Studies* 82 (1): 122–55.

French, Jeffrey A., Aaryn C. Mustoe, Jon Cavanaugh, and Andrew K. Birnie. 2013. "The Influence of Androgenic Steroid Hormones on Female Aggression in 'Atypical' Mammals." *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 368 (1631): 20130084. doi:10.1098/rstb.2013.0084.

Gaulin, S. J., D. H. McBurney, and S. L. Brakeman-Wartell. 1997. "Matrilateral Biases in the Investment of Aunts and Uncles : A Consequence and Measure of Paternity Uncertainty." *Human Nature (Hawthorne, N.Y.)* 8 (2): 139–51. doi:10.1007/s12110-997-1008-4.

Gneezy, U., K.L. Leonard, and J. List. 2009. "Gender Differences in Competition: Evidence from a Matrilineal and a Patriarchal Society." *Econometrica* 77 (5): 1637–64.

Gneezy, U., M. Niederle, and A. Rustichini. 2003. "Performance in Competitive Environments: Gender Differences." *Quarterly Journal of Economics* 118 (3): 1049–74.

Gneezy, U., and A. Rustichini. 2004. "Gender and Competition at a Young Age." *American Economic Review Papers and Proceedings* 94 (2): 377–81.

Gong, Binglin, and Chun-Lei Yang. 2012. "Gender Differences in Risk Attitudes: Field Experiments on the Matrilineal Mosuo and the Patriarchal Yi." *Journal of Economic Behavior & Organization* 83 (1): 59–65. doi:10.1016/j.jebo.2011.06.010.

Hamilton, W. D. 1964. "The Genetical Evolution of Social Behaviour. I." *Journal of Theoretical Biology* 7 (1): 1–16. doi:10.1016/0022-5193(64)90038-4.

Heale, A., and J. Pate. 2011. "Can Teams Help to Close the Gender Competition Gap?" *Economic Journal* 121 (555): 1192–1204.

Hrdy, S.B. 1999. *Mother Nature: A History of Mothers, Infants and Natural Selection*. New York: Pantheon Books.

Jejeebhoy, Shireen J., and Zeba A. Sathar. 2001. "Women's Autonomy in India and Pakistan: The Influence of Religion and Region." *Population and Development Review* 27 (4): 687–712. doi:10.1111/j.1728-4457.2001.00687.x.

Kappeler, P. 1999. "Convergence and Divergence in Primate Social Systems." In *Primate Communities*, edited by JG Fleagle, C Janson, and KE Reed, 158–70. Cambridge: Cambridge University Press.

Kohler, Hans-Peter, Susan C. Watkins, Jere R. Behrman, Philip Anglewicz, Iliana V. Kohler, Rebecca L. Thornton, James Mkandawire, et al. 2015. "Cohort Profile: The Malawi Longitudinal Study of Families and Health (MLSFH)." *International Journal of Epidemiology* 44 (2): 394–404. doi:10.1093/ije/dyu049.

Leonard, Kenneth L. 1997. "Contractual Structure of Health Care in Rural Cameroun." University of California at Berkeley.

Mayr, U., D. Wozniak, C. Davidson, D. Kuhns, and W.T. Harbaugh. 2012. "Competitiveness

Across the Life Span: The Feisty Fifties, Psychology and Aging." *Psychology and Aging* 27 (2): 278–85.

Munthali, Alister C., and Eliya M. Zulu. 2007. "The Timing and Role of Initiation Rites in Preparing Young People for Adolescence and Responsible Sexual and Reproductive Behaviour in Malawi." *African Journal of Reproductive Health* 11 (3): 150–67.

Niederle, M., C. Segal, and L. Vesterlund. 2013. "Affirmative Action in Light of Gender Differences in Competitiveness." *Management Science* 59 (1): 1–16.

Niederle, M., and L. Vesterlund. 2007. "Do Women Shy Away from Competition? Do Men Compete Too Much?" *Quarterly Journal of Economics* 122 (3): 1067–1101.

Okudaira, Hiroko, Yusuke Kinari, Noriko Mizutani, Fumio Ohtake, and Akira Kawaguchi. 2015. "Older Sisters and Younger Brothers: The Impact of Siblings on Preference for Competition." *Personality and Individual Differences* 82 (August): 81–89. doi:10.1016/j.paid.2015.02.037.

Schuler, Sidney Ruth, Syed Mesbahuddin Hashemi, and Ann P. Riley. 1997. "The Influence of Women's Changing Roles and Status in Bangladesh's Fertility Transition: Evidence from a Study of Credit Programs and Contraceptive Use." *World Development* 25 (4): 563–75. doi:10.1016/S0305-750X(96)00119-2.

Stockley, Paula, and Jakob Bro-Jørgensen. 2011. "Female Competition and Its Evolutionary Consequences in Mammals." *Biological Reviews of the Cambridge Philosophical Society* 86 (2): 341–66. doi:10.1111/j.1469-185X.2010.00149.x.

Stockley, Paula, and Anne Campbell. 2013. "Female Competition and Aggression: Interdisciplinary Perspectives." *Philosophical Transactions of the Royal Society of London B: Biological Sciences* 368 (1631): 20130073. doi:10.1098/rstb.2013.0073.

Wallen, Kim. 2005. "Hormonal Influences on Sexually Differentiated Behavior in Nonhuman Primates." *Frontiers in Neuroendocrinology* 26 (1): 7–26. doi:10.1016/j.yfrne.2005.02.001.

Warner, M. W., R. M. Al-Hassan, and J. G. Kydd. 1997. "Beyond Gender Roles? Conceptualizing the Social and Economic Lives of Rural Peoples in Sub-Saharan Africa." *Development and Change* 28 (1): 143–68. doi:10.1111/1467-7660.00038.

Wozniak, D., W.T. Harbaugh, and U Mayr. 2014. "The Menstrual Cycle and Performance Feedback Alter Gender Differences in Competitive Choices." *Journal of Labor Economics* 32 (1): 161–98.

Wrangham, Richard W. 1980. "An Ecological Model of Female-Bonded Primate Groups." *Behaviour* 75 (3/4): 262–300.

Tables

Table 1 Descriptive Statistics for Full Sample

	Male	Female	p-value
Choice 1	0.49	0.43	0.031
Choice 2	0.48	0.46	0.612
Round 1 successes	6.76	6.18	0.002
Round 2 successes	8.1	7.63	0.040
Belief of rank in round 1	1.85	2.11	<0.001
Belief of rank in round 2	2.05	2.36	<0.001
Observations	495	505	

Notes: Sample includes both adults and children from all villages. Fisher's exact test is used for discrete variables and Wilcoxon rank-sum test is used for continuous variables.

Table 2 Ex Ante Labels and Ex Post Village Types

	Ex-Ante Matrilocal customs						
	All	Village 1	Village 2	Village 3	Village 4	Village 5	Village 6
female	0.279***	0.0952	0.675***	0.438***	0.381**	0.522***	-0.0556
	(4.512)	(0.869)	(3.538)	(3.050)	(2.351)	(4.043)	(-0.377)
Constant	0.505***	0.810***	0.143	0.500***	0.333**	0.238**	0.722***
	(10.85)	(10.44)	(0.957)	(4.930)	(2.459)	(2.502)	(6.480)
Observations	220	42	18	32	40	46	42
R-squared	0.085	0.019	0.439	0.237	0.127	0.271	0.004

	Ex-Ante Patrilocal customs				
	All	Village 1	Village 2	Village 3	Village 4
female	-0.525***	-0.582***	-0.215	-0.438**	-0.778***
	(-7.160)	(-4.312)	(-1.335)	(-2.133)	(-7.714)
Constant	0.873***	0.895***	0.778***	0.750***	1***
	(16.66)	(9.800)	(7.031)	(4.478)	(14.03)
Observations	129	35	34	24	36
R-squared	0.288	0.360	0.053	0.171	0.636

	Transition from Matrilocal to Patrilocal		
	All	Village 1	Village 2
female	-0.152*	-0.0581	-0.278**
	(-1.715)	(-0.409)	(-2.640)
Constant	0.811***	0.690***	0.958***
	(13.57)	(7.727)	(12.72)
Observations	97	48	49
R-squared	0.030	0.004	0.129

The coefficients are drawn for 15 different regressions of the variable indicating that a married respondent was raised in the current village on the dummy variable female. Observations are drawn from an exit survey that included some participants in the laboratory experiments as well as other members of the village who did not participate in the experiments.

Table 3 Descriptive Statistics for Restricted Sample

	Patri	Matri	P-value
Females			
Choice 1	0.39	0.49	0.064
Choice 2	0.44	0.46	0.609
Round 1 successes	6.21	6.44	0.306
Round 2 successes	7.66	7.91	0.554
Belief of rank in round 1	2.18	2.13	0.822
Belief of rank in round 2	2.38	2.42	0.726
Observations	190	195	
Males			
Choice 1	0.49	0.48	0.758
Choice 2	0.45	0.46	1.000
Round 1 successes	6.93	6.7	0.569
Round 2 successes	8.32	8.07	0.622
Belief of rank in round 1	1.84	2.08	0.019
Belief of rank in round 2	2.06	2.18	0.337
Observations	192	184	

Sample includes all participants from eight villages verified with either matrilocal or patrilocal customs. Fisher's exact test is used for discrete variables and Wilcoxon rank-sum test is used for continuous variables.

Table 4 Overall Pattern by Culture and Age in Restricted Sample

	(1)	(2)
Patri*female	-0.110***	-0.0987*
	(-4.505)	(-1.883)
Matri*female	-0.00784	0.00392
	(-0.158)	(0.0764)
Patri*Male		0.0231
		(0.365)
Round 2 performance	-0.00577	-0.00588
	(-0.628)	(-0.640)
Round 1 to Round 2 improvement	0.0351**	0.0352**
	(2.342)	(2.326)
Choice to submit to comp.	0.438***	0.438***
	(8.307)	(8.310)
Rank belief in round 2	0.00364	0.00395
	(0.118)	(0.128)
Observations	760	760
Clusters	12	12

Probit regression with marginal effects reported. Dependent variable is the choice to enter and perform under competition incentives in round 3. The omitted category for the regression in column 1 is males, and for the regression in column 2 is males in matrilocal villages. Sample includes all participants from eight villages verified with either matrilocal or patrilocal customs. T-statistics in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Test that the coefficients for patri*female and patri*male are equal (in column 2) is rejected with a p-value < 0.001. Test that the coefficients for patri*female and matri*female are equal (in column 2) is rejected with a p-value of 0.05.

Table 5 Female Competitiveness and Fertility Markers across Cultures

	(1)			(2)			(3)			(4)		
	matri	patri		matri	patri		matri	patri		matri	patri	
early adolescent	-0.0493	0.179**	{0.11}	-0.0438	0.205**	{0.08}	-0.00581	0.179*	{0.21}	-0.0630	0.187*	{0.13}
(age < 15)	(-0.438)	(2.050)		(-0.412)	(2.154)		(-0.0502)	(1.898)		(-0.486)	(1.867)	
married	-0.0722	0.0947	{0.35}	-0.0956	0.0674	{0.27}				-0.0855	0.0705	{0.26}
	(-0.448)	(1.253)		(-0.818)	(0.751)					(-0.818)	(0.784)	
50 or older	-0.110	0.352***	{0.11}	-0.110	0.322***	{0.14}	-0.0817	0.292***	{0.20}	-0.0318	0.377*	{0.25}
	(-0.380)	(4.856)		(-0.379)	(3.799)		(-0.287)	(3.766)		(-0.107)	(1.666)	
has a child	-0.0643	-0.00556	{0.72}									
	(-0.455)	(-0.0639)										
has child > 6				-0.0598	0.109***	{0.17}	-0.0890	0.126***	{0.07}	-0.0322	0.126**	{0.30}
				(-0.510)	(3.605)		(-0.786)	(4.521)		(-0.225)	(2.511)	
age										-0.0025	-0.0023	{0.98}
										(-0.439)	(-0.354)	
Round 2 perf.	-0.0412**	0.0102	{0.02}	-0.0415**	0.0134	{0.02}	-0.0404**	0.0109	{0.03}	-0.0428*	0.0110	{0.04}
	(-1.983)	(1.065)		(-2.012)	(1.245)		(-2.052)	(0.894)		(-1.923)	(0.834)	
Round 1 to	0.0321	0.0639**	{0.51}	0.0309	0.0645**	{0.49}	0.0303	0.0566*	{0.58}	0.0309	0.0643*	{0.50}
Round 2 impr.	(0.906)	(1.973)		(0.847)	(1.966)		(0.900)	(1.690)		(0.847)	(1.956)	
Choice to submit	0.467***	0.370***	{0.25}	0.468***	0.362***	{0.23}	0.468***	0.364***	{0.20}	0.470***	0.363***	{0.24}
to comp.	(9.310)	(4.495)		(9.050)	(4.193)		(10.36)	(4.499)		(8.168)	(4.121)	
Rank belief	-0.0652**	0.0873*	{0.00}	-0.0652**	0.0858*	{0.00}	-0.0706***	0.0875*	{0.00}	-0.0655**	0.0863**	{0.00}
in round 2	(-2.190)	(1.939)		(-2.289)	(1.948)		(-2.828)	(1.947)		(-2.284)	(1.973)	
type of marriage	0.802***			0.821***			0.780***			0.818**		
customs	(2.884)			(3.043)			(2.786)			(2.269)		
Observations	320			320			324			320		
Clusters	12			12			12			12		

The coefficients are marginal effects from a probit regression. The dependent variable is the choice to enter and perform under competition in round 3. Sample includes all female participants with non-missing demographic variables from eight villages verified with either matrilocal or patrilocal customs. T-statistics in parentheses: *** p<0.01, ** p<0.05, * p<0.1. P-values of the test that matri and patri coefficients are not different are shown in brackets.

Table 6 Female Competitiveness and Fertility Markers across Cultures in the Full Sample

	(1)			(2)			(3)			(4)		
	matri	patri		matri	patri		matri	patri		matri	patri	
early adolescent	-0.0115	0.203***	{0.12}	-0.0242	0.229***	{0.06}	0.0122	0.204***	{0.14}	-0.0926	0.188**	{0.06}
(age < 15)	(-0.103)	(2.593)		(-0.238)	(2.663)		(0.114)	(2.699)		(-0.792)	(2.136)	
married	-0.0964	0.0276	{0.35}	-0.0912	0.0294	{0.25}				-0.0928	0.0284	{0.23}
	(-0.848)	(0.404)		(-1.109)	(0.449)					(-1.136)	(0.468)	
50 or older	-0.132	0.146	{0.23}	-0.126	0.126	{0.01}	-0.100	0.117	{0.33}	0.0587	0.267	{0.55}
	(-0.698)	(1.131)		(-0.663)	(1.072)		(-0.521)	(1.058)		(0.204)	(1.326)	
has a child	-0.0436	0.102	{0.33}									
	(-0.390)	(1.042)										
has child > 6				-0.110	0.227***	{0.26}	-0.141	0.232***	{0.00}	-0.0423	0.264***	{0.06}
				(-1.050)	(3.546)		(-1.289)	(3.625)		(-0.330)	(2.747)	
age										-0.0071	-0.0048	{0.79}
										(-1.191)	(-0.777)	
Round 2 perf.	-0.0225	-0.00130	{0.38}	-0.0248	0.00522	{0.18}	-0.0226	0.00669	{0.19}	-0.0333*	0.000261	{0.15}
	(-1.038)	(-0.128)		(-1.221)	(0.523)		(-1.136)	(0.630)		(-1.702)	(0.0207)	
Round 1 to	0.0166	0.0247	{0.85}	0.0151	0.0341	{0.62}	0.0127	0.0366	{0.50}	0.0168	0.0336	{0.66}
Round 2 impr.	(0.575)	(0.816)		(0.533)	(1.295)		(0.475)	(1.574)		(0.604)	(1.264)	
Choice to submit	0.447***	0.333***	{0.17}	0.452***	0.335***	{0.15}	0.455***	0.333***	{0.15}	0.451***	0.336***	{0.18}
to comp.	(7.407)	(4.740)		(7.974)	(4.640)		(7.725)	(4.425)		(7.203)	(4.584)	
Rank belief	-0.0582**	0.0559	{0.01}	-0.0592***	0.0654*	{0.00}	-0.0640***	0.0631*	{0.00}	-0.0597**	0.0643*	{0.01}
in round 2	(-2.478)	(1.526)		(-2.717)	(1.828)		(-3.097)	(1.688)		(-2.366)	(1.767)	
type of marriage	0.554**			0.662***			0.627**			0.710**		
customs	(1.973)			(2.759)			(2.486)			(2.103)		
Observations	420			420			428			418		
Clusters	16			16			16			16		

The coefficients are marginal effects from a probit regression. The dependent variable is the choice to enter and perform under competition in round 3. Sample includes all female participants with non-missing demographic variables from all villages according to ex-ante customs, with transition villages as patrilocal villages. T-statistics in parentheses: *** p<0.01, ** p<0.05, * p<0.1. P-values of the test that matri and patri coefficients are not different are shown in brackets.

Table 7 Female Competitiveness and Fertility Markers by Three Types of Villages

	(1)		
	long matri	long patri	transition
early adolescent	0.0122	0.229***	0.235*
(age < 15)	(0.114)	(3.137)	(1.807)
50 or older	-0.100	0.182	-0.177
	(-0.521)	(1.369)	(-0.895)
has child > 6	-0.141	0.268***	0.120**
	(-1.289)	(2.685)	(2.024)
Round 2 perf.	-0.0226	0.00915	-0.00981
	(-1.136)	(0.502)	(-0.412)
Round 1 to	0.0127	0.0566*	-0.00476
Round 2 impr.	(0.475)	(1.841)	(-0.131)
Choice to submit	0.455***	0.280***	0.393***
to comp.	(7.725)	(3.419)	(2.975)
Rank belief	-0.0640***	0.0732	0.0321
in round 2	(-3.097)	(1.599)	(0.387)
type of marriage	0.657**		0.242
customs	(2.333)		(0.695)
Observations		428	
Clusters		16	

The coefficients are marginal effects from a probit regression. The dependent variable is the choice to enter and perform under competition in round 3. Sample includes all female participants with non-missing demographic variables from all villages by ex-ante type: matrilocal, patrilocal, and transition from matrilocal to patrilocal. T-statistics in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 8 Competitiveness and Fertility Markers By whether a woman Lives In the Village Where She Was Raised

	(1)		(2)	
	raised here	not raised here	raised here	not raised here
early adolescent	0.0800	-0.0949		
(age < 15)	(0.901)	(-0.591)		
married	-0.114**	0.0661		
	(-2.072)	(0.590)		
50 or older	-0.0441	0.0684	0.0211	0.355
	(-0.278)	(0.738)	(0.0430)	(0.838)
has child > 6	0.100	-0.0196	0.191	-0.117
	(1.181)	(-0.202)	(0.669)	(-0.398)
Round 2 perf.	-0.00407	-0.0230	-0.0106	-0.0873*
	(-0.309)	(-1.188)	(-0.180)	(-1.807)
Round 1 to	0.00583	0.0867*	-0.0284	0.304***
Round 2 impr.	(0.286)	(1.704)	(-0.346)	(2.772)
Choice to submit	0.394***	0.289**	0.872***	0.839**
to comp.	(8.335)	(2.124)	(3.415)	(2.026)
Rank belief	-0.0364	0.107**	-0.0524	0.329**
in round 2	(-1.183)	(2.221)	(-0.427)	(2.261)
Raised in current	0.283		0.472	
location	(0.931)		(0.474)	
Observations	417		182	
clusters	16		16	

The coefficients are marginal effects from a probit regression. The dependent variable is the choice to enter and perform under competition in round 3. Sample includes all female participants with non-missing demographic variables from all villages differentiated by whether or not the woman is living in the village in which she was raised. Column 1 includes all women and Column 2 includes only married women. T-statistics in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 9 Competitiveness and Sibling Composition

	(1) matri	(2) patri
Older than all brothers	0.00858	0.0345
	(0.0881)	(0.754)
Older than all sisters	0.168	0.00826
	(1.560)	(0.101)
Number of siblings	-0.0344*	0.00969
	(-1.920)	(0.684)
Round 2 performance	-0.0408**	-0.00600
	(-2.237)	(-0.503)
Round 1 to Round 2 impr.	0.0393	0.0466
	(1.272)	(1.283)
Choice to submit to comp.	0.484***	0.329***
	(12.27)	(4.327)
Rank belief in round 2	-0.0716***	0.0718*
	(-3.496)	(1.652)
Observations	173	150
clusters	6	6

The dependent variable is the choice to enter and perform under competition in round 3. Sample includes all female participants with non-missing demographic variables from eight villages verified with either matrilocal or patrilocal customs. t-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Appendix

1 Data from the US using the same methodology

Flory et al. (2015) describe patterns seen in data collected in the US for subjects between the ages of 18 and 85 using exactly the same methodology as that used in Malawi. In particular, we used the same task: arranging blocks. Two important results from that paper help to support the validity of the data used in this paper. Table 10 shows the result of a probit regression for all adults in both samples, showing both the standard gender gap and the finding that women over the age of 49 are more competitive than women between the ages of 18 and 50. Note that the coefficient for women in Malawi is about half the size of the coefficient in the US, but that the sample includes women from both matrilocal and patrilocal communities.

Table 11 restricts the samples in the US and Malawi to women and men between the ages of 18 and 25 to better compare the sample to the sample of students at the University of Pittsburg examined in Niederle and Vesterlund (2007). All three studies used the same basic methodology, but the broader US sample and the sample in Malawi used a different task. By restricting ages, we end up with a very small sample in the US (28 subjects) but the coefficients across all three samples are remarkably similar. Note that, to match the results reported in Niederle and Vesterlund (2007), the table reports p-values, not standard errors.

Both Tables 10 and 11 validate the methodology used in Malawi: the age pattern (visible at menopause) exists both in Malawi and in the US and the gender gaps in the sample of younger adults is virtually the same using the same methodology in the US and in Malawi and also virtually identical to the study collected by Niederle and Vesterlund (2007).

Table 10 Comparing results for the US and Malawi for the adult sample

	US Sample		Malawi Sample	
	(1)	(2)	(3)	(4)
Female	-0.14	-0.246**	-0.078**	-0.105**
	(0.114)	(0.120)	(0.039)	(0.042)
Female Over 49		0.339***		0.141**
		(0.114)		(0.071)
Round 1 perf.	-0.02	-0.005	0.003	0.007
	(0.024)	(0.026)	(0.008)	(0.008)
Round 1 to	-0.019	-0.01	0.009	0.013
Round 2 impr.	(0.040)	(0.041)	(0.014)	(0.015)
Choice to submit to	0.365***	0.373***	0.386***	0.391***
to comp.	(0.111)	(0.114)	(0.035)	(0.035)
Rank Belief	-0.097	-0.121	-0.007	-0.005
in Round 2	(0.085)	(0.090)	(0.020)	(0.020)
Observations	84	84	728	728

Estimated marginal effects from a Probit regression of the choice to select tournament for round 3. Omitted category is men. Columns 1-2 are drawn from the US sample and columns 3-4 are drawn from the Malawi sample. Standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11 Comparing subjects between the ages of 18 and 25 across three samples

	Univ. of Pittsburgh Students	US Adults 18-25	MW Adults 18-25
Female	-0.162	-0.242	-0.144
	[0.05]	[0.43]	[0.03]
Round 2 perf.	-0.009	0.0313	-0.0134
	[0.42]	[0.75]	[0.35]
Round 1 to	0.011	-0.17	0.0402
Round 2 impr.	[0.44]	[0.24]	[0.12]
Choice to submit to	0.258	0.829	0.389
to comp.	[0.012]	[0.037]	[0.00]
Rank Belief	-0.12	-0.809	-0.0485
in Round 2	[0.01]	[0.047]	[0.14]
Observations	77	28	291

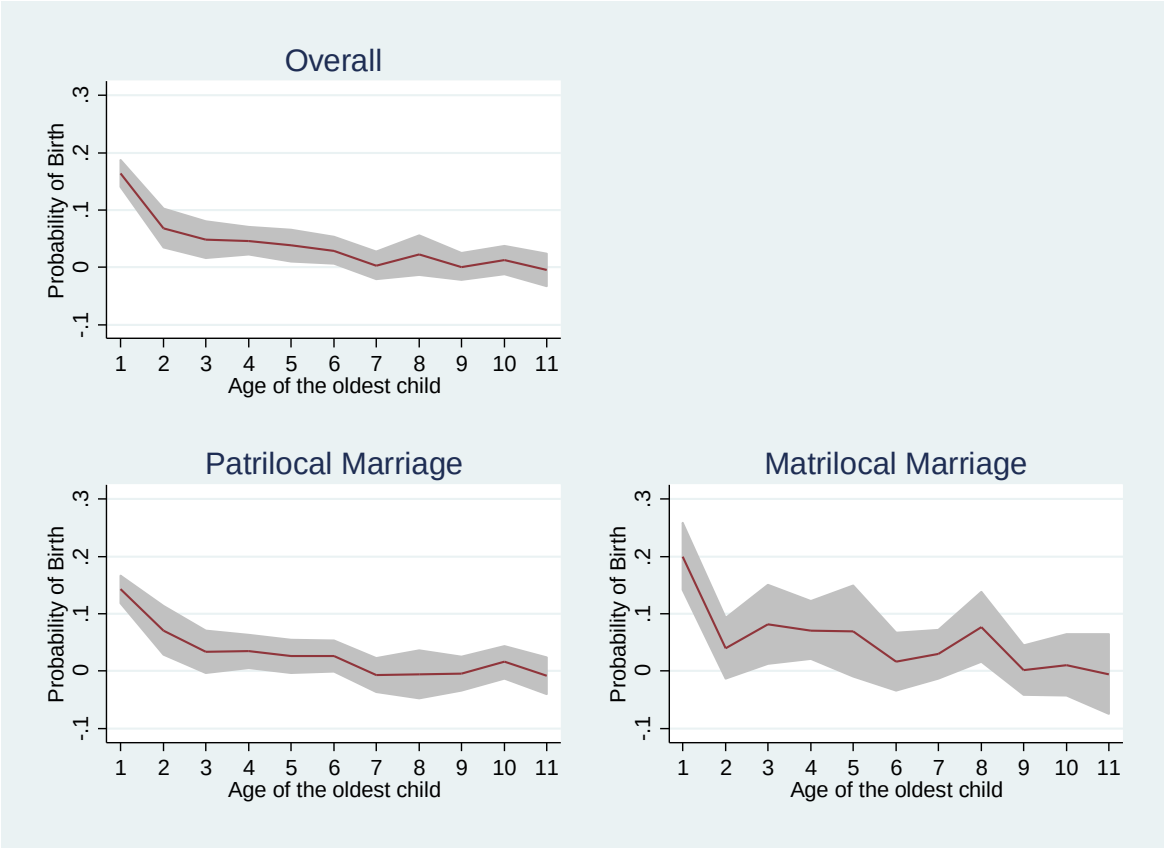
Estimated marginal effects from Probit regressions in 3 different samples of participants which experienced the same basic experimental protocol. Column 1 contains results reported in NV, for which students from the University of Pittsburgh are used. Column 2 shows the results from the 28 individuals (14 men and 14 women) between the ages of 18 and 25 from a sample in the urban US. Column 3 shows results from the 291 individuals (140 men and 151 women) between the ages of 18 and 25 from our rural Malawi sample. Brackets contain p-values, to facilitate comparison with the results reported in NV.

2 The Malawi Longitudinal Survey of Families and Health (MLSFH)

The MLSFH survey households in 2010 (Kohler et al. 2015) asked the following question of each household "after getting married, where did you live?" A total of 2,247 households live in the man's village and 1,133 in the woman's village. Using this response as a proxy for matrilocal and patrilocal marriage, we examine the fertility history of women who live in these two types of communities. By taking a woman's current age and the age of all her living children (the survey does not record the year of birth of deceased children) we create a panel of years for each woman from the age of 15 up to a maximum age of 50. The age of her living children allows us to proxy for whether or not she got pregnant in the year that child was zero. We have no data on miscarriages or deceased children, so the measure is imperfect.

Focusing on women who have at least one child (1,298 women in patrilocal marriages and 534 women in matrilocal marriages and 83 women who live outside of either village) we run a probit regression on the probability of giving birth in any year from the age of 15 up to the current age (or 50) as a function of cubic specification of age and the age of the oldest child. All standard errors are clustered at the household level. We use dummy variables for eldest child age from 1 to 11 with the omitted category being women whose oldest child is older than 11.

Figure 1 shows the coefficients on the 11 dummy variables for the full sample (matri, patri and other), the sample of women in patrilocal marriages and the sample of women in matrilocal marriages. The results show that for the full sample and for the sample of women in patrilocal marriages, women are more likely to give birth (conditional on their age) when their eldest child is less than 7. The sample of women who live in matrilocal villages is smaller so the standard errors are larger but there is no strong evidence of the same pattern in these coefficients.



Shown are the marginal effects for the age of the oldest child (between 1 and 11) in a regression that includes a cubic specification for age. The coefficient is shown as a solid line. Standard errors are clustered at the household level and the 95% confidence interval is shown shaded. The sample is restricted to women who have at least one child: 1,298 women in patrilocal marriages, 534 women in matrilocal marriages and 83 women who live in neither their village nor their husband's village.

Figure 1 Additional Probability of giving birth as a function of the age of the oldest child

3 Experimental Instructions

These instructions were translated into Chichewa for use in Malawi where X was 50 kwacha and used in English in the US. Amounts for the US: X = $1, Y = $0.50. Amounts for Malawi: X = 50 kwacha (approximately $.33), Y = 20 kwacha (approximately $.13). The show-up fee was divided into two payments of $5 and two payments of 80 kwacha (approximately $0.52)

Welcome

In the study today, we will ask you to complete a simple task in four different rounds. None of these rounds will take more than 5 minutes. Because we are not simply asking you questions, but asking you to perform a task, we will pay your for your work. You will receive {*amount*} at the beginning and at the end you will receive {*amount*} for having completed the four rounds. In addition, you can earn more money based on your performance in one of the four rounds.

In order to participate in this study you must be at least 18 years old and you must agree to participate in the study or you must have the permission of your parent or guardian.

We will now give you some information about the study today. In each round, we will ask you to do something that can earn you money. When you are done here, you go to the cashier, he will put four cards into a bag, and you will pick one of these cards from the bag without seeing the cards. These are the four cards, this one is for the first round, this one is for the second round, this one is for the third round and this one is for the fourth round [*speaker places cards in bag*]. You will be allowed to pick one just as this man is going to show you right now. He cannot see which card he will pick, but we are not choosing the card. You will receive money according to how well you have done for the round that you pick from the bag without seeing. We will explain to you exactly how you can earn money in each round. Some people will

only earn the show up fee today. Others will earn more. But everyone who begins will earn {*amount*}and everyone who finishes will earn {*amount*} again.

This is the payment desk [*speaker points*]. When you are finished with the tasks, please go here to answer some questions that we will ask and after that please come here to receive your payment.

Explanation and practice round

Welcome to this study. Now your helper will give you the {*amount*} that we promised to give to you at the beginning of the study. Today we will ask you to perform tasks and make decisions. If you listen carefully, you can earn a large amount of money. So pay close attention to the instructions, and ask questions if you do not understand, because it may affect how much money you earn.

Please do not talk with one another at any time during this study. I am happy to answer any questions you have at any time. But please direct your questions only to me. The person sitting in front of you is here to help show you the task, and to record the decisions that you make. They are not allowed to help you make decisions; please do not ask them for help with the decisions we ask you to make.

You see the blocks that are in front of you. Please look at them and see the shapes and colors on each of the blocks. Take one of the blocks and show your helper each of the shapes on the block as he points to it on the paper in front of you. Every shape shown on the paper is shown on each of the blocks. The task we will ask you to perform today is to arrange the shapes in order from smallest to largest. The person helping you will now demonstrate for you how to complete the task. First, your helper will show you how to find all of the circles. When all of the circles are facing up, he or she will put them in order from the smallest circle to the largest circle. The

circles are now finished and they are finished correctly. The task is complete.

We will now ask *you* to practice doing the task one time. Your helper will now turn your card to the next shape, which is a square. We want you to perform the task for the squares. When you think you are finished, look at your helper for confirmation. If you have completed the task correctly, your helper will nod his head. If you are incorrect, he will shake his head, and you must continue until the squares are arranged from smallest to largest.

The way you are paid for this task will change each round. So pay close attention to these rules each round and be sure you understand them, because they will affect how much money you can earn in that round. For each round, we will explain the rules, before we ask you to begin. Please do not begin until we tell you to.

We will ask you to perform this task as many times as you can within 3 minutes. As soon as you finish arranging the blocks for one shape, look to your helper and he or she will indicate to you whether you may move to the next shape. If he nods his head, then turn the paper in front of you to show the next shape and then begin the next shape. If your facilitator shakes his head this means you have not correctly completed the task and you need to keep trying. You have 3 minutes to complete as many shapes as possible. The number of tasks that you complete is recorded on the paper but we will never tell anyone else how you have done.

Does anyone have any questions about how to perform the task?

Round One: Individual Performance.

We will now begin round one. Before we begin, we will explain how you will be paid for the tasks this round: If Round 1 is the task that you draw from the bag at the end, then you get $\{X\}$ for each shape you successfully complete. For example, if you complete one set of shapes

you receive {X}, if you complete two sets of shapes you receive {$2X$}, if you complete three sets of shapes you receive {$3X$}, if you complete four sets of shapes you receive {$4X$}, and so on for as many shapes as you complete. We call this **individual performance**. This is represented by the single person standing alone in the picture in front of you.

Please do not talk during the task or after you have finished. This is very important. If you have any questions, please raise your hand and ask me now. Once we begin, you cannot ask any questions. Do you have any questions before we begin?

Are the facilitators ready? *[When ready:]* Okay, go. *[When time is up:]* Okay, everyone please stop now.

Round Two: Compared Performance.

Now we will move to the second round. For this round, the task is exactly the same. However, the way you are paid is now different. In this round, your payment depends on your performance compared to a group of other participants. Each group consists of four people. The three other members of your group come from other participants. Your group members may be in this room right now, but they may not be. You will never know the names of the other people in your group and they will never know your name. The person sitting next to you is <u>not</u> in your group. Do you have any questions about who is in your group? If you have a question, please raise your hand and ask me now.

We will now explain how your payment is determined in this round. If round 2 is the task that you draw from the bag at the end, then your earnings depend on your number of successes compared to the three other people in your group. If you complete the most shapes in 3 minutes out of anyone in your group, you receive {$4X$} for each set you complete. But if someone else in

your group completes the most shapes, you receive nothing.

One times {*4X*} is {*4X*}. Two times {*4X*} is {*8X*}. Three times {*4X*} is {*12X*}. Four times {*4X*} is {*16X*}. And so on. We call this **compared performance.** This is represented by the group of 4 people standing together in the picture in front of you. You will not know how you did in the compared performance until the end of today's activity, when you receive your earnings.

Please do not talk during the task or after you have finished. This is very important. If you have any questions, please raise your hand, and ask me now. Once we begin, you cannot ask any questions. Do you have any questions before we begin?

Are the facilitators ready? *[When ready:]* Okay, go. *[When time is up:]* Okay, everyone please stop now.

Round Three: Choice of Payment Scheme, Before Doing Task.

Now we will move to the third round. The task in this round is exactly the same, but now you can choose which way you want to be paid. If round 3 is the one that you draw from the bag, then your earnings for this task are determined as follows. If you choose **individual performance**, you receive {*X*} per success and you will not be compared to anyone else.

If you choose **compared performance** your payment for this round is similar to the payment in round two. The only difference is that your performance in this round is compared to the performance of the other three members of your group <u>for round 2</u>, the one we just finished, instead of being compared to their performance this round. If you complete the task more times than the other people in your group did for round 2 then you will receive four times the payment from the individual performance, which is {*4X*} per success. You will receive no earnings for

this round if you choose compared performance and you do not complete more sets of shapes than the other people in your group did for round 2.

Notice that this round is a little different than last round because nothing you do in this round can affect the earnings of other people in your group, and nothing that other people in your group do this round can affect your earnings from this round.

You will not know how you did in the compared performance until the end of today's activity, when you receive your earnings. Do you have any questions? If you have any questions, please ask me now.

Please do not talk as you are making your decision. If you would like to choose individual performance, please point to the picture of one person. If you would like to choose compared performance please point to the picture of the group.

Please do not talk during the task or after you have finished. Are the facilitators ready? *[When ready:]* Okay, go. *[When time is up:]* Okay, everyone please stop now.

Round Four: Choose Scheme for Past Performance

For this new round, you do not have to do any tasks. Instead, you may be paid one more time for how you did in the first round of the experiment. Now we are going to ask you how you would like to be paid for the tasks that you completed in the first round. You can choose to be paid for your individual performance or compared performance.

If the fourth round is the one selected for payment, then your earnings for this round are determined like this. If you choose *individual performance*, you receive {X} per success you had in round 1. If you choose *compared performance*, your performance will be compared to the performance of the other three members of your group in the first round. If you completed the

task more times in round 1 than they did in round 1, then you receive four times the earnings of the individual performance choice, which is {*4X*} per success. If you choose compared performance and you did not complete the task more times than others did in round 1 you will receive no earnings for this round. Do you have any questions? If you have any questions, please ask me now.

Please do not talk as you are making your decision. Now your helper will show you how many times you successfully completed the sets of shapes in the first round. Now your helper will show you a picture. If you would like to choose individual performance, please point to the picture of the one person. If you would like to choose compared performance please point to the picture of the group.

Belief-Assessment Questions:

We will now ask you how you think you performed in the tasks, compared to the 3 other people in the group we assigned you to, for the first two rounds. You will earn *{Y}* for each correct guess. Please look at the picture of the four people. The highest person completed the most sets of shapes in your group; he is first in the group. The next person completed the second-most sets of shapes in your group; he is second. The next person completed the third-most sets of shapes; he is third. The final person completed the least sets of shapes in your group; he is fourth.

We will first ask you how you think you performed in Round 1, the ***individual performance***. If you are correct, you will be paid an additional *{Y}* when we pay you your earnings. Before we ask you, do you have any questions? If you have any questions, please ask me now.

Please do not talk as you are making your decision. Now please silently show your helper how you think you performed in Round 1, the ***individual performance,*** compared to the other people in your group, by pointing to the position in the picture. Do you think you were the best? Do you think you were the second-best? Do you think you were third-best? Or, do you think you were last?

We will now ask you how you think you performed in Round 2, the ***compared performance***. If you are correct, you will be paid an additional *{Y}* when we pay you your earnings.

Please do not talk as you are making your decision. Now please silently show your helper how you think you performed in Round 2, the ***compared performance,*** compared to the other people in your group, by pointing to the position in the picture. Do you think you were the best? Do you think you were the second-best? Do you think you were third-best? Or, do you think you were last?

Thank you very much for your participation today. You can go now. Please go to there to answer some questions for our study.