Market exposure makes females behave more competitively and closes the gender gap

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Abstract

We investigate how the encounter of two very different farming systems alters the competitive behavior of small-scale farmers. Based on a lab-in-the-field experiment covering 29 Zambian villages, we find that small-scale farmers that are traditionally dependent on low-productive, subsistence agriculture develop more competitive behavior when they are exposed to market-oriented large-scale farms. These results hold for both adults and children. The effect is remarkably strong for females and even closes the gender gap associated with competition. Moreover, we find that competitive behavior is also positively affected by the extent to which small-scale farmers sell their produce in local markets. Taken together, our results provide new insights for understanding how changes in societal arrangements such as increased market integration influence individuals' behavior in small-scale societies.

Keywords: competitiveness; large-scale farms; endogenous preferences; field experiment; small-scale farms; Zambia

JEL codes: O12; O13; P11; P14; Q15

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1 Introduction

Competitiveness is a key component of success in modern market economies. Firms compete for customers, employees compete for positions, politicians compete for voters, and students compete for university placements. The origins of individual competitiveness have been of great interest for economists in recent years. The literature shows that differences in competitiveness already exist among children and depend on parental backgrounds and attitudes (Almas et al., 2015; Deckers et al., 2015; Khadjavi and Nicklisch, 2015). Beyond parental influences, behavioral economic research suggests that societal arrangements influence individuals' preferences for competition, especially gender differences (Andersen et al., 2013; Buser et al., 2014; Croson and Gneezy, 2009; Niederle and Vesterlund, 2007; Gneezy et al., 2003; Gneezy et al., 2009; Leibbrandt et al., 2013; Sutter and Glätzle-Rützler, 2015).

Most changes in societal arrangements, like the extent of gender equality and market integration, happen endogenously and over a long time horizon. This feature makes it hard to identify causal effects of societal arrangements on its members' preferences. For instance, Henrich et al. (2001, 2004, 2010) and Henrich and Ensminger (2014) provide compelling evidence that market exposure correlates with pro-social behavior in small-scale societies. With regard to gender differences, Alesina et al. (2013) show that present day norms and beliefs on gender equality are greatly influenced by the adoption of traditional agricultural practices such as the historical use of ploughs. Likewise, Gneezy et al. (2009) and Andersen et al. (2013) provide evidence on differences in competitiveness in matrilineal and patriarchal societies. Leibbrandt et al. (2013) show how work arrangements based on natural circumstances influence competitiveness while Siddique and Vlassopoulos (2017) find that ethnicity is an important determinant of competitive preferences.

All these findings yield valuable insights into the emergence and endogenous development of competitive preferences through changes in long-term societal arrangements (Bowles, 1998). The aim of this study is to complement previous findings of mostly long-term effects with an example of rather short-term effects, which is more likely to allow for a causal interpretation. One of the few studies that investigate how competitive preferences are shaped by a relatively short-run societal change is by Booth et al. (2016), who analyse how social norms for different birth cohorts in mainland

China and Taiwan have been influenced by the adoption of capitalist market-oriented reforms and Marxist ideology over a period of four decades.

In this paper, we take advantage of an exogenous change over an even shorter time period that has affected small-scale farmers in a number of developing countries: rapid market exposure through the set-up of large-scale farms. Following the triple fuel, food and financial crisis of the years 2008 to 2009, investors from multinational firms have expressed a large interest in agricultural land in developing countries. Currently more than 1000 deals that cover an area of approximately 40 million hectares (an area comparable to the size of Zimbabwe or Paraguay) have been concluded (Nolte et al. 2016). Being market-oriented, highly mechanized, and capital intense, these investments often acquire land next to small-scale farmers that typically have low productivity levels, limited access to markets, and are subsistence oriented. This situation mirrors the encounter of two classic antithetical paradigms of rural farming and development, where the smallholders represent a communal peasant economy and the agricultural firm represents the modern market economy (Timmer, 1997).

To investigate how the competitive behavior of small-scale farmers is altered by the establishment of large-scale farms, we employ the lab-in-the-field experiment first used by Gneezy et al. (2009). More specifically we analyse the decisions to compete made by 442 small-scale farmers in 13 randomly selected villages located within a 15 kilometer radius of two large scale-farms and compare them with the decisions of 484 similar small-scale farmers from 16 randomly selected villages that are located 50-75 kilometers further away from the two large-scale farms. Our central hypothesis is that exogenous market exposure that is introduced through the set-up and operation of large-scale farms leads to more competitive behavior of small-scale farmers.

The results from the lab-in-the-field experiment provide strong evidence in favor of this hypothesis. We find that small-scale farmers that have experienced exogenous rapid exposure to market oriented agriculture are more willing to compete than those that have no such exposure. These results are further corroborated by a comparison of the competitive behavior of children (aged 5 to 15) from the two sets of villages. We find that children living in villages close to large-scale farms are significantly more competitive than their counterparts in villages further away.

Interestingly, the results on competitive behavior are especially pronounced for females (both adults and children) – to the extent that the gender gap in competitive behavior is leveled off in communities near large-scale farms. Lastly, we find evidence suggesting that endogenous market exposure through participation in crop sales also increases the likelihood that small-scale farmers are willing to engage in competition. This result is more pronounced for male small-scale farmers.

The remainder of our paper is structured as follows: Section 2 provides a brief description of the study context. This is followed by an explanation of the experimental design and procedure in Section 3. Section 4 presents the main results and some robustness checks. Possible transmission mechanisms are discussed in section 5 while section 6 concludes.

2 Study Context

The study was conducted in the Mumbwa and Mkushi regions of Zambia's Central Province. These two regions were selected as they both have large-scale farms that were recently set up in the proximity of small-scale farming communities. The farm in Mumbwa was allocated an area of over 30,000 hectares and cultivates nearly one tenth of this land. It began its operations in 2012. The land investment in Mkushi was set up in 2010 and consists of 6 farms that together account for approximately 4000 hectares. These farms can be considered large for a country like Zambia where more than 70 percent of farmers cultivate less than 2 hectares of land and another 23 percent cultivate plots of land that range between 2 and 5 hectares (CSO, n.d). The two large-scale farms both operate in competitive market environments and seek to become major suppliers of wheat and maize for Zambia and her neighboring countries. As a means of achieving its goal of becoming a major player in Sub-Saharan Africa's food production, the large-scale farm in Mumbwa recently expanded its farming division to incorporate livestock and is now the second largest meat company in Zambia (Amatheon Agri, 2015). The two farms are representative of other large-scale farms in Zambia and sub-Saharan Africa in a number of regards: they are similar in size, cultivate similar crops, were set up at almost the same time and target the same markets as other farms of the same magnitude (Harding, 2017; Khadjavi et al., 2017).

This competitive environment driving the two large-scale farms is in contrast to the conditions facing neighboring small-scale farmers who are mostly reliant on low–productive, rain-fed agriculture. Small-scale farmers' competition and full market participation is hindered, for instance, by their limited access to productive assets (Deininger and Olinto, 2000). Chapoto and Jayne (2011) show that in the years 2010/2011 less than 50 percent of the small-scale farming households in Central Province participated in and sold their output on maize markets. The bulk of this output (90 percent) was sold directly on small-scale farms to traders. The authors point out that there is a reasonable degree of competition to purchase maize within these villages. Villages that sell maize in Central province are visited by 7 different traders on average, which makes the environment especially competitive for traders. However, the high supply of traders per village means that the small-scale farmers do not have to compete aggressively to sell their output.

This setting makes it interesting for us to examine how the exposure to competitive, highly productive and market-oriented large-scale farms affects small-scale farmers' preferences for competition. We posit that exposure to market-oriented large-scale farms will increase smallholders' individualism and willingness to participate on the market as has been found in previous research (Kajoba, 1994). Since competitive behavior can be regarded as a key ingredient to participate in market economies we expect that small-scale farmers that have been exposed to large-scale farms will become more competitive.

Moreover, we also expect that those farmers who have already had some degree of market exposure through the sale of their produce to traders will be more accustomed to competition and will hence display a higher willingness to compete. Thus, in the context of our study, we expect that market exposure, be it exogenous (through large-scale farms) or endogenous (through crop sales), increases the competitive behavior of small-scale farmers.

3 Experimental Design and Procedures

29 villages were visited between mid-August and September 2015 and again in July, 2016. The villages where randomly selected using maps and village lists provided by the Zambian Central Statistical Office (CSO) in Lusaka. 13 villages within a radius of

15 kilometers from the two large scale farms (*_near* villages) and 16 villages (*_further* villages) within a 50 to 70 kilometer radius from the large scale farms were selected.

Once the *_near* and *_further* villages were identified, village heads were approached to request permission to conduct the lab-in the-field experiments in their village. Unaware of the true motive of the research questions, the village heads were asked to invite all adults in the village to participate in an incentivized study that sought to analyze socio-economic conditions in the villages. A total of 442 adult participants took part in these experiments in *_near* villages and 484 in *_further* villages.

In order to elicit the impact of exogenous market exposure on participants' competitive behavior, the incentivized competition game of Gneezy et al. (2009) was employed.[1] This experiment was selected due to its simple nature that makes it suitable for a setting such as ours where more than half of the study participants could not read or write well in English or in the main regional languages (Nyanja or Bemba). In addition to being simple, the experiment is well suited for such a setting as the task (throwing ten tennis balls using an undertoss) is unfamiliar.

Before tossing the balls, participants were asked to decide between two options: Option A and Option B. Option A meant that the participant earned 5 Zambian Kwacha (approx. $0.50 at the time of the study) for each successful toss into the bucket. Option B paid 15 Zambian Kwacha (approx. $1.50) for each successful toss (the threefold amount of Option A) to the participant, but only if the participant scored more tennis balls into the bucket than an anonymous randomly matched participant from the same village. Hence, the payment in Option A was a piece rate that was independent of other participants' success while the payment in option B was a combination of a piece rate and a competition. If a participant scored fewer balls into the bucket than the other participant, then she/he received no money in the game under Option B. In case of equal scores, Option B yielded 5 Zambian Kwacha for each successful throw (just like Option A).[2] Ten successful tosses could earn the participants 150 Zambian Kwacha. The payoffs from competing can be considered as high since the average rural per capita

[1] The game was the third and last task, after a sequential prisoner's dilemma to measure social capital and a deception game. Khadjavi et al. (2017) provide further information on the results from the sequential prisoner's dilemma.

[2] Appendix B contains the instructions of our study.

monthly income was estimated at 185.9 Zambian Kwacha during the period in which the study was conducted (CSO, 2016).

After a participant made her decision on the option and tossed the tennis balls, she was directed to a spatially separate waiting area. This measure ensured that neither the two groups nor participants within each group could communicate the task, their decisions or scores. Great caution was undertaken to ensure that all tosses were made in secluded areas with natural barriers to block other participants from learning about the scores of their companions. Figure A.1 in the appendix illustrates such a set-up.

To investigate whether children's competitive behavior is also altered by adults' market exposure, we adjusted the nature of the pay-offs so that they were no longer monetised. The incentive structure for children was the same, except that they earned 1 (Option A) or 3 marbles (Option B, if own_score > other_score) for each scored tennis ball. Marbles themselves are valuable to children as they are commonly used by children in Zambia to play traditional games such as *Nsolo* (a variant of the board game Mancala).[3] After receiving their earnings, the children were informed that they may retain the marbles or exchange them for other toys and school stationary (at exchange rates mirroring market prices). 401 children between the ages of 5 and 15 participated in our competition game. Children were only allowed to participate in the experiment after they had been granted permission by their parents or guardians.

Recognizing that it would be extremely difficult and costly to design such a study within a panel setting that tracks the evolution of competitive behaviour before and after the establishment of a large-scale farm, we undertake several measures to ensure that the *_further* villages are a good counterfactual for the *_near* villages. First, we compare the possible determinants of small-scale farmers' competitive behavior prior to the establishment of the large-scale farms. As shown in Table 1, a large set of pre-treatment village characteristics, such as population density, rainfall and access to infrastructure, do not differ significantly between *_near* villages and *_further* villages.

Second, we compare small-scale farmer and village level characteristics after the establishment of the large-scale farm and only find significant differences in the mean age of small-scale farmers, in the number of small-scale farmers that have worked on

[3] Marbles have also been used as a form of payment for children in other experimental studies that sought to elicit children competitiveness, for instance see Madsen (1971)

large-scale farms as well as the number of small-scale farmers solely engaged in crop sales. However, these differences are not surprising as it can be expected that there is a larger number of farm workers in the vicinity of large-scale farms and a higher number of small-scale farmers engaged in crop sales further away from the large-scale farms since employment opportunities are unavailable.

Table 1. Summary statistics by village type

	_near villages		*_further* villages		
Variable	Mean	SD	Mean	SD	p-values
	Individual and household characteristics				
Household head	0.46	0.09	0.49	0.13	0.32
Number of household members	6.35	0.81	7.11	1.08	0.07
Male	0.55	0.15	0.47	0.12	0.12
Age	35.07	2.46	41.11	5.25	**0.00**
Years in education	6.56	1.08	6.52	0.86	1.00
Large scale farm worker	0.52	0.26	0.24	0.18	**0.00**
Recently migrated to the village	0.20	0.16	0.17	0.13	0.68
Asset index	0.42	0.03	0.41	0.10	0.46
Land title	0.35	0.29	0.31	0.29	0.66
Crops sold	0.68	0.61	0.82	0.10	**0.03**
Crop index	0.21	0.06	0.20	0.06	0.46
	Village characteristics				
Village size (hectares)	413.00	579.19	1112.56	2069.41	0.90
Ethnic groups in village	8.46	3.31	7.84	3.11	0.55
Village is patrilineal	0.15	0.38	0.38	0.50	0.19
	Pre-treatment village characteristics				
Population density (pixel)	5.50	0.52	5.54	0.52	0.85
Population density (5 km buffer)	5.50	0.52	5.54	0.51	0.74
Mean monthly rainfall (pixel)	81.29	3.32	80.05	5.59	0.47
Mean monthly rainfall (5 km buffer)	81.26	3.05	80.18	5.73	0.51
Elevation (pixel)	1213.85	28.82	1250.63	140.12	0.83
Elevation (5 km buffer)	1221.39	28.56	1252.24	132.78	1.00
Mean monthly maximum temperature (pixel)	30.47	0.49	30.08	1.32	0.98
Mean monthly maximum temperature (5 km buffer)	30.42	0.50	30.08	1.25	0.86
Distance to nearest road	0.49	0.61	1.54	2.14	0.20
Distance to nearest water line	1.97	1.13	1.79	1.83	0.33
Distance to nearest rail	71.90	77.57	63.82	65.45	0.20

Note: The p-values are based on two-sided Mann-Whitney tests on the village-level. The asset index includes information on the households' possessions of livestock holdings, radios, agricultural equipment, transportation, as well indicators of the quality of housing.

Importantly, we do not find any significant differences across gender, ethnicity and whether the village has a patrilineal lineage. These variables have been identified in the literature as key determinants of competitive preferences (Croson and Gneezy, 2009; Siddique and Vlassopoulos, 2017; Gneezy et al. 2009).

Third, we collected soil samples from all the villages visited to test whether differences in soil quality could influence the location of large-scale farms and the competitiveness of small-scale farmers. Fourth, we conducted interviews with the large-scale farm managers and the Investment Promotions Officer at the Zambian Development Agency - which is the agency charged with promoting and facilitating investments - to ensure that villagers' preferences did not play a role in the settlement of the investors. Fifth, to make sure that other forms of market integration were not driving the results we kept access to roads constant across both sets of villages. None of these additional cautionary measures revealed that small-scale farmers in *_near* villages are systematically different from their counterparts in *_further* villages.

4 Results

We first report the results of the lab-in-the-field experiment with the adult participants. This is followed by the results of the same experiment with children aged 5 to 15 year in a subset of villages. Finally, we present a robustness check where our main explanatory variable of interest, distance from the investment farms, is continuous rather than dichotomous as in the base specification.

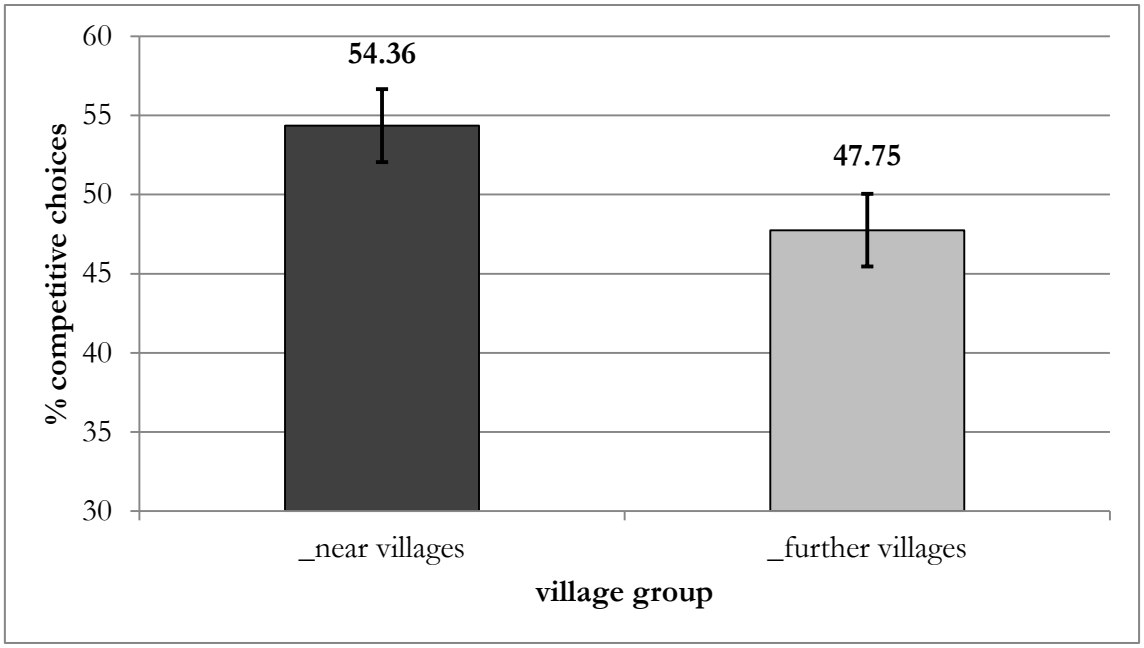
4.1 Adults

In line with our central hypothesis, we indeed find that participants in *_near* villages are more likely to choose the competitive option (54.36 percent) when compared to participants in *_further* villages (47.75 percent).

This difference of about 14 percent is statistically significant based on a (two-sided) chi-squared test ($p < 0.05$). Note also that the share of competitive choices in *_near* villages is greater than chance (binomial test, $p < 0.05$). Figure 1 depicts this result.[4]

[4] See Figure A.2 in Appendix A for histograms of competition game scores in our two village groups. A Kolmogorov-Smirnov test cannot reject the null hypothesis of equal distributions in the two village groups ($p > 0.2$).

Figure 1. Competitive choices of adults by village group.



Given the rich data collected in the survey, we investigate whether the results presented in Figure 1 hold after controlling for individual, household and village level socio-economic observables. We also include a variable that indicates whether a participant sells crops as our proxy for market integration and estimate a logit regression of the following form:

$$y_i = \alpha_i + \beta_1 \tau_v + \beta_2 \mu_i + \beta_3 \chi_{ihv} + \beta_4 \rho_r + \varepsilon_{ihv}$$

where y_i represents the individual's decision to choose the competitive option, τ_v is a dichotomous variable equal to 1 for *_near* villages, μ_i is a variable that indicates whether an individual engages in crop sales, and χ_{ihv} is a vector of individual, household and village-level socio-economic variables. ρ_r is used to control for any region-specific effects while ε_{ihv} is the error term. As a robustness check we replace τ_v with a continuous variable δ_v measuring the distance from the large-scale farm to the villages. Since the outcome variable y_i is dichotomous, we estimate all specifications with logit regressions and report the marginal effects in the tables below.

We find consistent evidence that competitive behavior is stronger in *_near* villages even after estimating different specifications that introduce step-wise controls for individual, household and village-level socioeconomic characteristics (columns I, II and III).

Further, we find that small-scale farmers who sell crops on markets are significantly more competitive than small-scale farmers that do not engage in such crop sales.

Table 2. Regression analysis of adults' competitive behavior

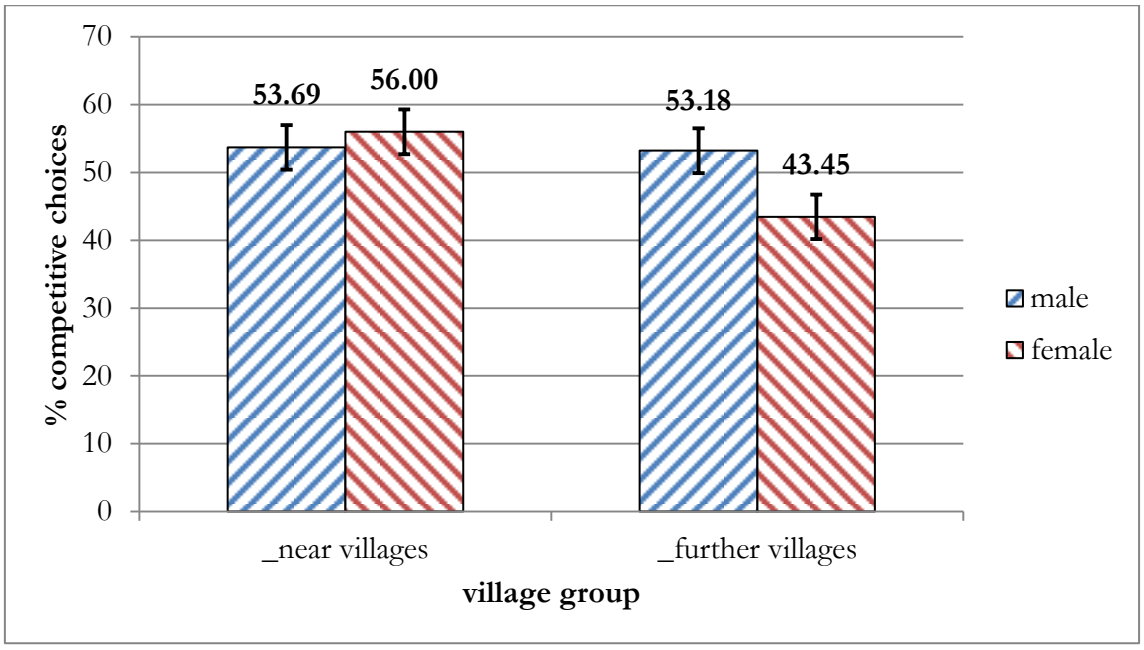
VARIABLES	I Logit	II Logit with household controls	III Logit with household and village controls
_near village = 1	0.093**	0.084*	0.145***
	(0.044)	(0.043)	(0.039)
Household sells crops = 1	0.123**	0.111**	0.110**
	(0.052)	(0.053)	(0.054)
Household head = 1		0.010	0.018
		(0.050)	(0.051)
No. of household members (continuous)		-0.003	-0.002
		(0.007)	(0.007)
Age (continuous)		-0.000	-0.001
		(0.001)	(0.001)
Male = 1		0.025	0.024
		(0.053)	(0.056)
Education in years (continuous)		0.001	0.001
		(0.006)	(0.007)
Large-scale farm worker = 1		0.021	0.015
		(0.041)	(0.041)
Migrated after large-scale farm was set-up = 1		-0.045	-0.042
		(0.050)	(0.051)
Asset index based on pca		-0.023	-0.002
		(0.083)	(0.084)
Crop index based on pca		0.091	0.099
		(0.077)	(0.075)
Land title = 1		0.060	0.063
		(0.051)	(0.051)
Village area (continuous)			0.000
			(0.000)
No. of ethnic groups in village (continuous)			-0.013*
			(0.007)
Village is patrilineal = 1			0.118*
			(0.061)
Region = 1	0.008	0.036	-0.025
	(0.046)	(0.047)	(0.043)
Observations	842	795	795

Note: The table presents marginal effects, except for the constant of the estimation. The observations from the _further control villages are the baseline of the estimations. The standard errors in parentheses are clustered at the village-level (29 villages) in all estimations. Statistical significance: *p < 0.10, **p < 0.05, ***p < 0.01.

Interestingly, the two channels of market exposure, (1) the effect of living close to large-scale agricultural investments and (2) selling crops on markets, affect competitiveness jointly. We therefore find clear evidence that both endogenous market integration (the decision to sell crops on markets) and exogenous market exposure (the settlement of agricultural investments next door) increase competitiveness.

In addition, we obtain evidence that village level characteristics that have been identified as determinants of competitive behavior in the previous literature also affect the decision to compete of participants in our study. First, we observe that an increase in the number of ethnicities in a village significantly reduces participants' willingness to compete. This is in line with Siddique and Vlassopoulos (2017), who show that participants from ethnic minorities in competition games are less likely to enter competition when a pool of potential competitors is multiethnic in Bangladesh. Second, we find that being in a patrilineal village increases participants' willingness to compete. This is in line with Gneezy et al. (2009), who use the same game as we do and show that nurture in matrilineal and patriarchal settings plays a significant role in shaping competitive preferences. Surprisingly, in contrast to previous studies (e.g. Croson and Gneezy, 2009; Booth and Nolan, 2012), we do not find gender influences on competitive behavior.

Figure 2. Competitive choices by village group and gender.



This null result on gender is particularly surprising in the context of rural Zambia where differences in gender equality and ideologies are prolific (Evans, 2017). We further investigate the relationship by comparing the competitive behaviour of female and male participants in the two village groups. In *_further* villages we indeed find that female participants are more likely to shy away from competition as pointed out in the literature on gender and competitiveness (Croson and Gneezy, 2009; Booth and Nolan, 2012): 43.45 percent of females and 53.18 percent of males opt into competition. A chi-squared test rejects the null hypothesis at $p < 0.05$. Conversely, in *_near* villages 56.00 percent of females and 53.69 percent of males opt into competition. This difference is not significant ($p > 0.6$). Figure 2 depicts the results.

To better understand what might be driving these results, we run a logit regression to control for the same socioeconomic variables as in Table 2. Table 3 reports the results for male participants in the first two columns and for female participants in the last two columns.

This time we find that male participants' competitive behavior is determined by endogenous market exposure while female participants' competitive behavior is driven by exogenous market exposure (proximity to the large-scale farms). For either set of participants we no longer find that both forms of market exposure are jointly affecting competitive behavior.

In addition, we find that the effect of being in a patrilineal village persists for males and that the possession of a land title is also a significant determinant of their decision to enter the competition.

Overall, we can conclude that exogenous market exposure in our rural, developing country setting balances competitiveness of females and males. This finding may provide an additional element in the quest for measures to overcome gender differences (e.g. Balafoutas and Sutter, 2012; Niederle et al., 2013).

Table 3. Regression analysis of adults' competitive preferences by gender

VARIABLES	(1) Logit (Males only)	(2) Logit (Males only)	(3) Logit (Females only)	(4) Logit (Females only)
_Near village = 1	0.034	0.062	0.141**	0.203***
	(0.051)	(0.055)	(0.063)	(0.073)
Household sells crops = 1	0.180***	0.140**	0.070	0.087
	(0.056)	(0.060)	(0.066)	(0.067)
Household head = 1		0.085		-0.027
		(0.075)		(0.062)
No. of household members (continuous)		-0.003		-0.001
		(0.009)		(0.009)
Age (continuous)		-0.002		-0.000
		(0.002)		(0.002)
Education in years (continuous)		0.007		-0.005
		(0.009)		(0.009)
Large-scale farm worker = 1		0.032		-0.011
		(0.057)		(0.058)
Migrated after large-scale farm was set-up = 1		-0.049		-0.033
		(0.060)		(0.100)
Asset index based on pca		0.022		-0.097
		(0.130)		(0.147)
Crop index based on pca		0.052		0.178
		(0.086)		(0.142)
Land title = 1		0.145**		0.020
		(0.074)		(0.069)
Village area (continuous)		0.000*		0.000
		(0.000)		(0.000)
No. of ethnic groups in village (continuous)		-0.010		-0.015
		(0.010)		(0.012)
Village is patrilineal = 1		0.111*		0.116
		(0.059)		(0.108)
Region = 1	-0.031	-0.023	0.032	-0.028
	(0.051)	(0.069)	(0.065)	(0.083)
Observations	419	402	423	393

Note: The table presents marginal effects, except for the constant of the estimation. The observations from the _further control villages are the baseline of the estimations. The standard errors in parentheses are clustered at the village-level (29 villages) in all estimations. Statistical significance: *p < 0.10, **p < 0.05, ***p < 0.01.

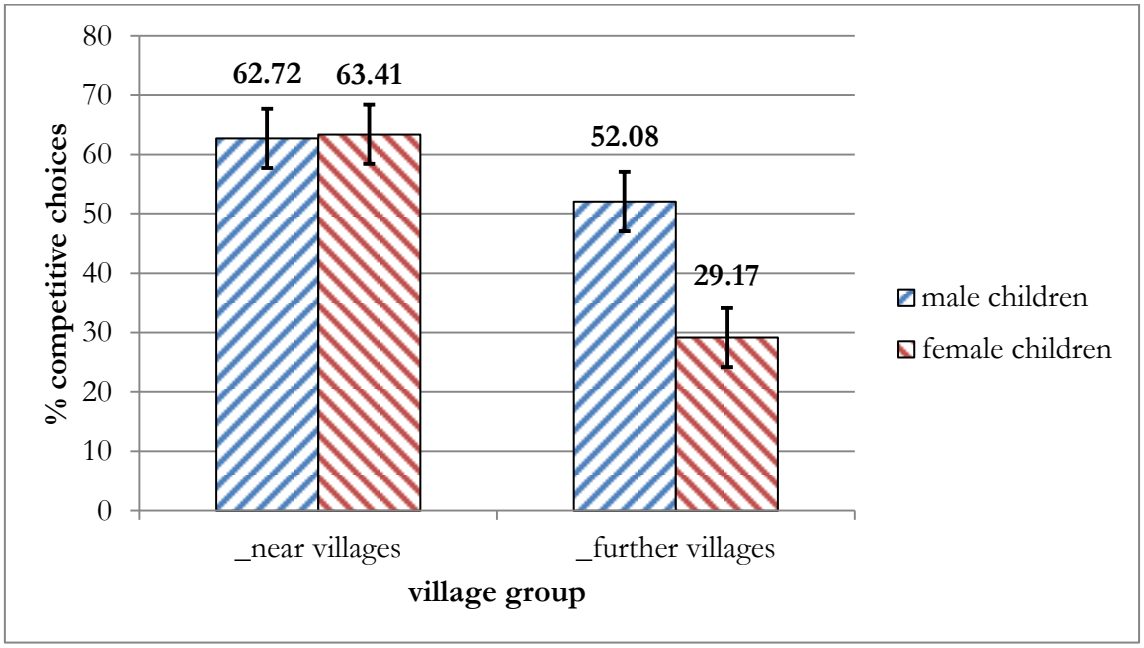
4.2 Children

Next we complement our analysis of adults' behavior with children's behavior. Analyzing children's behavior is interesting, as they may be more receptive to short-

term changes in their environment. While adults have developed their preferences over decades, children are at the prime of their preference formation.

We find a similar effect of market exposure: there is a significantly higher number of participants who decide to make competitive choices in *_near* villages compared to *_further* villages (63.09 percent vs. 42.26 percent respectively, two-sided chi-squared test: $p < 0.000$). Examining the results of females and males separately, we find that both genders are more competitive in *_near* villages compared to *_further* villages (see Figure 3). Analogous to the results that we obtained for adults in Figure 2, we find a large gender gap in competitiveness for *_further* villages (52.08 percent for males vs. 29.17 percent for females, chi-squared test: $p < 0.01$), but not for*_near* villages (62.72 percent for males vs. 63.41 percent for females, (chi-squared test: $p > 0.9$).

Figure 3. Competitive choices of children by gender and village group.



Controlling for all other available variables regarding the children (age, number of scored tennis balls in the competition game and region of data collection) in a logit regression analysis confirms these results (see Table A.1 in Appendix A for details).[5]

[5] Other information on children's socioeconomic variables was not collected due to ethical and time considerations.

4.3 Robustness of results

In order to investigate whether the two main results obtained on exogenous market exposure reported in Tables 2 and 3 are robust, we change the specification of our main variable of interest from a dichotomous variable that is equal to 1 if a village is near a large-scale farm to a continuous variable that indicates the distance away from the large scale farm. All other individual, household and village-level socio-economic controls from the previous specifications are retained. The results are reported in Table A.3. We now see that an increase in the distance away from the large scale farms significantly reduces the likelihood that a participant will engage in competition. This corroborates our result that proximity to a large-scale farm increases competitive behavior.

Next we investigate whether we observe heterogeneity in the determinants of competition across gender as reported in Table 3. These results are reported in Table A.4. Again we find that exogenous market exposure, which is now measured as the distance from the large-scale farm, is only pertinent for female participants. We do not find evidence indicating that these preferences are driven by other factors for female participants. The main determinants of males' competitive preferences remain unchanged.

5 Potential mechanisms

The main result that emerges from the analysis is that market exposure is a main driver of competitive behavior. The impact is so large that it closes the commonly associated gender gap. We now proceed to discuss the possible mechanisms through which proximity to large-scale farms may be affecting small-scale farms on our study sites.

The result on exogenous market exposure indicates that there is a positive externality from being close to the farm particularly for women. Both large-scale farms report having engaged with neighboring small-scale farmers. For instance, the farm in Mumbwa claims to have purchased 2,742 tons of grain from small-scale farmers in its vicinity in 2014 (Amatheon, 2014). However, the descriptive statistics reported in Table 1 show that the number of individuals selling crops across these villages is actually significantly higher in the *_further* villages. Moreover, the regression results show that crop sales and proximity to large-scale farms affect small-scale farmers differently

suggesting that crop purchases from the large-scale farm only partially explain the result.

Literature on the differences in competitive preferences across gender in similar rural settings points out that these differences are not biological but are instead largely driven by contextual conditions. For instance, Bjorvatn et al (2016) find that the gender gap in competitiveness for secondary school students is levelled off in urban regions but still persistent in rural regions of Uganda. The authors suggest that the differences in competitive preferences found for rural and urban Uganda could be driven by cultural factors such as female empowerment. Using ethnographic data from a rural and urban setting in the Luapula and Copperbelt provinces of Zambia, Evans (2017) finds that women's exposure to interconnected, heterogeneous and densely populated urban areas erodes the gender ideologies that persist in rural areas. The author observes that women in rural areas hardly take on socially valued roles and are instead engaged in devalued domestic chores as well as weeding and planting if they are engaged in small-scale agriculture. In urban regions, by contrast, women's confidence and empowerment is enhanced by exposure to diverse forms of flexibility in gender divisions of labor.

It is likely that similar mechanisms are driving the increase in competitive behavior within our setting: the arrival of large-scale farms may introduce female participants to previously unavailable opportunities and alternative livelihoods. Such exposure could increase female participants' empowerment and confidence in their abilities. Females may then pass on these norms and preferences to their children which causes competitive preferences to rise for both their male and female children in *_near* villages. Although these suggested mechanisms are in line with existing literature that equally observes a reduction in gender differences, more data on how exactly these changes come about would be required to establish strong causal relations.

6 Conclusion

Our investigation concentrates on the encounter of two economic and farming systems which are at the extremes along the dimension of market exposure. There is peasant, small-scale farming of smallholders on the one hand and capital-intense market-oriented large-scale farming by the global agricultural industry on the other hand (Timmer, 1997). Our result is that living in the proximity of large-scale agricultural investment

sites makes smallholders more competitive compared to similar smallholders who live at a distance to the investment sites. We regard this finding as highly important for agricultural policy and for the broader understanding of what kind of societal arrangements may influence individuals' preferences (Bowles, 1998).

Depending on the desirability of competitiveness in society, this externality by large-scale farms may be regarded as a benefit or a cost. In the specific case of rural Zambia, we believe that moving small-scale farmers' preferences towards greater competitiveness may increase their market participation and thereby enable them to achieve higher productivity. The externality we identify in our research may therefore be deemed beneficial.

In communities further away from investment sites we find the commonly observed gender gap in competitiveness (Gneezy et al., 2003; Croson and Gneezy, 2009), i.e. that males are more competitive than females. Conversely, the gender gap is completely closed in communities near the sites. This finding suggests that in our case market exposure not only increases competitiveness of smallholders in general, but that females' competitiveness 'catches up' with males'. A large body of literature argues that competitiveness is key to succeed in market environments and that females' lack of competitiveness explains their lower incomes and fewer females in leadership positions (Niederle and Vesterlund, 2007; Buser et al., 2014). Accordingly, balancing competitiveness of females and males through market exposure in the rural setting of developing countries may be regarded as a valuable positive externality.

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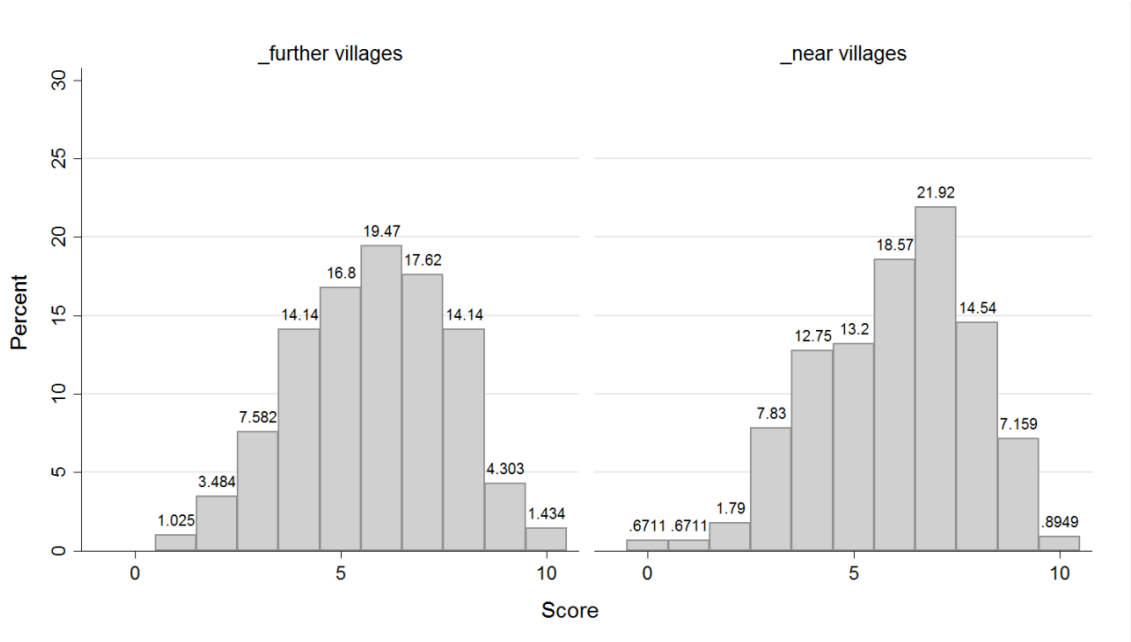
Appendix A – Additional Figures and Tables

Figure A.1. The competition game environment in the field.

Figure A.2. Histograms of competition game scores in *_near* and *_further* villages.



Note: A Kolmogorov-Smirnov test cannot reject the null hypothesis of equal distributions in the two village groups ($p > 0.2$).

Table A.1. Regression Analysis of Competitive Decisions of Children.

VARIABLES	(1) Logit (all children)	(2) Logit (male children)	(3) Logit (female children)
_near village	0.210**	0.112	0.348***
	(0.087)	(0.099)	(0.111)
Age (continuous)	0.018	0.006	0.025*
	(0.011)	(0.014)	(0.013)
Score	-0.021*	-0.017	-0.027
	(0.012)	(0.017)	(0.023)
Region= 1	0.002	-0.029	0.043
	(0.103)	(0.128)	(0.118)
Observations	400	205	195

Note: The table presents marginal effects, except for the constant of the estimation. The observations from the _further control villages are the baseline of the estimations. The standard errors in parentheses are clustered at the village-level (29 villages) in all estimations. Statistical significance: *p < 0.10, **p < 0.05, ***p < 0.01.

Table A.2. Summary Statistics by Gender

Variable	Female (Mean)	Female (SD)	Male (Mean)	Male (SD)	p-value
Household head	0.28	0.45	0.64	0.48	**0.00**
Number of household members	6.74	2.96	6.77	3.37	0.94
Age	37.23	16.30	38.85	16.90	0.16
Years of education	5.57	3.37	7.33	3.19	**0.00**
Large scale farm worker	0.32	0.47	0.46	0.50	**0.00**
Recently migrated to the village	0.15	0.36	0.18	0.39	0.15
Asset index	0.39	0.17	0.44	0.17	**0.00**
Crop index	0.18	0.15	0.24	0.20	**0.00**
Crops sold	0.75	0.43	0.78	0.42	0.32
Land title	0.36	0.48	0.38	0.49	0.52

Note: Statistically significant p-values in bold. The p-values are based on two-sided Mann-Whitney tests for the continuous variables and chi-squared tests for the binary variables.

Table A.3. Regression analysis of adults' competitive behavior with distance from large-scale farm

VARIABLES	(1) Logit	(2) Logit with household controls	(3) Logit with household and village controls
Distance from large-scale farm (continuous)	-0.002**	-0.002**	-0.004***
	(0.001)	(0.001)	(0.001)
Household sells crops = 1	0.124**	0.123**	0.115**
	(0.052)	(0.051)	(0.054)
Household head = 1		-0.006	0.017
		(0.049)	(0.051)
No. of household members (continuous)		-0.004	-0.002
		(0.006)	(0.007)
Age (continuous)		0.001	-0.000
		(0.001)	(0.001)
Male = 1		0.055	0.025
		(0.056)	(0.056)
Education in years (continuous)		0.019**	0.001
		(0.010)	(0.007)
Large-scale farm worker = 1		0.012	0.014
		(0.042)	(0.041)
Migrated after large-scale farm was set-up = 1		-0.051	-0.043
		(0.051)	(0.051)
Asset index based on pca		-0.009	-0.017
		(0.081)	(0.083)
Crop index based on pca		0.094	0.107
		(0.081)	(0.076)
Land title = 1		0.071	0.064
		(0.050)	(0.050)
Village area (continuous)			0.000**
			(0.000)
No. of ethnic groups in village (continuous)			-0.014**
			(0.007)
Village is patrilineal = 1			0.118*
			(0.063)
Region = 1	-0.004	0.023	-0.047
	(0.044)	(0.045)	(0.044)
Literacy (continuous)		-0.060**	
		(0.026)	
Observations	842	785	795
Regional FE	YES		

Note: The table presents marginal effects, except for the constant of the estimation. The observations from the _further control villages are the baseline of the estimations. The standard errors in parentheses are clustered at the village-level (29 villages) in all estimations. Statistical significance: *p < 0.10, **p < 0.05, ***p < 0.01.

Table A.3. Regression analysis of adults' competitive behavior by gender with distance from the large-scale farm

VARIABLES	(1) Logit (Males only)	(2) Logit (Males Only)	(3) Logit (Females only)	(4) Logit (Females Only)
Distance from large-scale farm (continuous)	-0.001	-0.002	-0.003**	-0.005***
	(0.001)	(0.001)	(0.001)	(0.002)
Household sells crops = 1	0.181***	0.144**	0.071	0.090
	(0.056)	(0.060)	(0.066)	(0.067)
Household head = 1		0.084		-0.030
		(0.075)		(0.061)
No. of household members (continuous)		-0.003		-0.001
		(0.009)		(0.009)
Age (continuous)		-0.002		-0.000
		(0.002)		(0.002)
Education in years (continuous)		0.007		-0.006
		(0.009)		(0.009)
Large-scale farm worker = 1		0.030		-0.012
		(0.057)		(0.057)
Migrated after large-scale farm was set-up = 1		-0.049		-0.034
		(0.060)		(0.099)
Asset index based on pca		0.015		-0.121
		(0.129)		(0.145)
Crop index based on pca		0.055		0.188
		(0.084)		(0.147)
Land title = 1		0.143*		0.024
		(0.074)		(0.070)
Village area (continuous)		0.000**		0.000
		(0.000)		(0.000)
No. of ethnic groups in village (continuous)		-0.011		-0.016
		(0.010)		(0.013)
Village is patrilineal = 1		0.115*		0.113
		(0.062)		(0.106)
Region = 1	-0.035	-0.036	0.016	-0.054
	(0.050)	(0.071)	(0.064)	(0.084)
Observations	419	402	423	393

Note: The table presents marginal effects, except for the constant of the estimation. The observations from the _further control villages are the baseline of the estimations. The standard errors in parentheses are clustered at the village-level (29 villages) in all estimations. Statistical significance: *p < 0.10, **p < 0.05, ***p < 0.01.

Appendix B – Instructions

Introduction

Thank you all for taking the time to come today. Today's activities may take three to four hours. Before we begin I want to make some general comments about what we are doing here today and explain the rules that we must follow.

We will ask each of you to make decisions involving money and to answer a few questions. Whatever money you earn during the activities will be yours to keep and take home. Nobody but the researchers and you will know what you decided and earned, and **money will be given in private. No other participant will learn about your decisions and earned money.** We will be supplying the money. This money was given to us by the London School of Economics, a university in Great Britain, to use for research and it is not our own personal money.

Before we proceed any further, **let me stress something that is very important**. Many of you were invited here without knowing very much about what we are planning to do today. If at any time you find that this is something that you do not wish to participate in for any reason, you are of course free to leave whether we have started the activity or not.

We will be asking you to do **three activities** with other individuals in your village today. **Your earnings from all three activities sums to your total earnings**. You will be informed about the outcomes in the three activities and your total earnings in private **at the end of all activities**.

If you have heard anything about these types of activities, you should try to forget about that because each activity can be completely different. It is important that you listen as carefully as possible.

We will run through some examples of how the activities work. **You cannot ask questions or talk while here in the group. This is very important.** Please be sure that you obey this rule, because it is possible for one person to spoil the activities for everyone. If one person talks about the activities while others can hear it, we would not be able to carry out the activities today. Do not worry if you do not completely understand the rules as we go through them here in the group. Each of you will have a chance to ask questions in private to be sure that you understand how the activities work.

Before we explain the activities we divide you into **two groups, the Green Group and the Black Group**, according to the colored cards that you have drawn from the bag a moment ago. The two groups will separate, so that green-card people and black-card people cannot see or hear each other.

After we have explained the activities, you will all wait in a group. We will call you by the number on your ticket, so please listen carefully for your number. While you are waiting you can talk about anything else you want other than the activities here today.

Activity 3 (*instructions for research assistants in parentheses*)

Activity 3 is throwing this ball into this bucket from a line. *(Show them the ball, bucket and line.)* You will have 10 tries.

We now ask you to choose one of two options according to which you will be paid in the experiment.

OPTION 1: If you choose this option, you will get 5 kwacha for each time you get the ball in the bucket in your 10 tries. So if you succeed 1 time, then you will get 5 kwacha. If you succeed 2 times, then you will get 10 kwacha. If you succeed 3 times, you will get 15 kwacha, and so on.

OPTION 2: If you choose this option, you will receive a reward only if you succeed more times than a randomly matched person who is playing in the other group (*green or black*). If you succeed more than this person, you will be paid 15 kwacha for every time you succeed. So if you succeed 1 time, then you will get 15 kwacha. If you succeed 2 times, then you will get 30 kwacha. If you succeed 3 times, you will get 45 kwacha and so on. But you will only receive a reward if you are better than the person in the other group. If you both succeed the same number of times, you will both get 5 kwacha for each success.

A successful throw is one where the tennis ball remains inside the bucket.

We now ask you to choose how you want to be paid: according to Option 1 or Option 2. Now you may play.

(Record both their ID number and their choice,

Allow the participant to toss the balls, while you record the result of each ball in the following manner: S is success, X is failure.)