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Fishermen's competitiveness and labour market performance: Evidence from shrimpers in Bangladesh

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Abstract

We conduct an experiment to determine competitiveness among shrimpers who engage in collecting shrimp seeds in the southwestern coastal region of Bangladesh. We then examine how competitiveness affects the labour supply decisions and labour market performance of these shrimpers. Our results show that shrimpers who prefer competition are more productive than shrimpers who do not prefer competition. Competitive shrimpers secure better prices and earn higher incomes selling their catches. We estimate that their wage elasticity of participation ranges from 0.4 to 0.5, which is consistent with preferences under neoclassical assumptions. Competitive shrimpers have a slightly greater wage elasticity than non-competitive shrimpers, suggesting that they might be more responsive to expected earnings. Our results have important policy implications for the efficient management of common pool resources.

KEYWORDS

competitiveness, labour supply, performance, shrimpers, wage elasticity

JEL CLASSIFICATION

O13, J22, J30, H40

1 | INTRODUCTION

Competition is ubiquitous. There are many different contexts in which individuals must compete to attain superior positions, from daily social situations to organisational settings and market transactions (Garcia et al., 2013). Willingness to compete and strong performance in competitive situations are critical in shaping one's position in society. An aversion to competition can be costly for individuals given the extensive use of competition-based allocations in recent times (Flory et al., 2018). However, behavioural experiments reveal a wide variation in individual preferences for competition. Competitiveness may vary across different groups of people based on factors such as gender, ethnicity or even stage of life (Gneezy et al., 2009; Mayr et al., 2012; Niederle & Vesterlund, 2011). These differences in competitiveness can be explained by exposures to different environments and pressures, in addition to individuals' genetic endowments, abilities and attitudes towards risk (Leibbrandt et al., 2013).

This paper examines the relationship between competitiveness and the labour market performance and participation decisions of shrimpers who collect shrimp seeds from the open sea. A common pool resource, such as the open sea, creates specific concerns for competition because the return on the effort of one participant can have an impact on that of another participant, requiring dynamic management of the resource, and of the interactions between participants. We conduct an experiment among 429 shrimpers to measure their preferences regarding the competition. We then examine how shrimpers' performance in the labour market and daily labour supply decisions are associated with their competitive preferences.

The shrimpers in our study are from the southwestern coastal area of Bangladesh. As the second-largest export commodity, shrimp plays an important role in Bangladesh's economy. These shrimpers are involved in wild seed collection, which is the first tier of the shrimp industry. They go out every day to deep river or sea areas to collect shrimp seeds, which they later sell in the local markets. We collected their daily labour market participation information, including total daily earnings, selling prices and total working hours, for about 10 months.

There are several potential channels through which competitiveness may help an individual achieve better labour market performance. Competitiveness is conceptualised to capture two important elements: (1) competing to demonstrate one's superiority and the inferiority of others; and (2) interpersonal success (beyond the domination over others) (Newby & Klein, 2014). Due to these social comparisons, especially in a competitive environment, competitive individuals may set higher goals in their economic performance (Schrock et al., 2016). Brown and Peterson (1994) and Brown et al. (1998) find that salespeople who are highly competitive set higher performance goals and earn more in sales revenue. In the context of our study, competitiveness of shrimpers may translate into differences in the goals or targets they set for earnings, prices of catches sold, quantities of catches sold and hours of work. Given that one's competitive preference may be correlated with their perceived likelihood to outperform others, competitive preference is likely to be correlated with one's skills, confidence level, tendency to cooperate and risk preference (Niederle & Vesterlund, 2011). For example, competitive individuals may also be more confident in their skills and ability, and take risks. Then, the better performance of a competitive individual may be the result of the risk they take, rather their desire to outperform others. Thus, in addition to using an experiment to measure shrimpers' competitive preference, we also conducted a number of other behavioural experiments to measure their levels of patience, attitudes towards risk and cooperative tendencies. These variables are then included as additional explanatory variables to assess whether the effect of competitiveness on economic performance can be partially attributed to these other attitudes and traits.

Our results show that shrimpers who prefer competition perform better in the labour market than those who do not prefer competition. Competitive shrimpers are more productive in terms of earnings per hour. Contrary to our expectations, we find that competitive shrimpers collect less seed than non-competitive shrimpers. However, they receive better market prices for their catches and thus achieve higher earnings. These estimated effects are not sensitive to controlling for risk attitudes, cooperative tendency and patience. Although we do not have the data to pinpoint the exact reasons for the higher market prices, better quality of catches of competitive shrimpers is likely to be an important explanation. The results suggest that competitive shrimpers compete on the basis of quality rather than quantity.

We also estimate the wage elasticity of participation for both groups of shrimpers. Our results confirm that shrimpers' levels of participation are positively correlated with their expected earnings for both groups, which is consistent with preferences under neoclassical assumptions. We find that, on average, shrimpers' wage elasticity of participation is 1.11. Our wage elasticity estimates are similar to those of Stafford (2015) and Giné et al. (2017). We find a larger elasticity of participation among non-competitive shrimpers (1.16 vs. 0.96), which suggests that non-competitive shrimpers are more responsive to expected earnings (in terms of participation) than competitive shrimpers. However, the difference is not statistically significant.

We contribute to the existing literature on competition by linking it to the labour market performance and labour supply decisions of individuals with the help of behavioural experiments in the context of a developing country. Being competitive is particularly important in this context because it is more challenging to access limited natural resources. Although there has been ample research examining the determinants of individual competitiveness, the issue of how competitiveness influences individuals' economic behaviours and performance has remained underexplored.

A number of recent studies have examined the effects of competitiveness on individual performance, with mixed results. The focus of most of these studies is gender differences. For example, Kamas and Preston (2012) carry out a lab experiment among college students in which the subjects are required to complete mathematics tasks. Their results show that men who choose to compete have higher scores than those who do not. However, no significant association between competitiveness and performance is observed for women. In a field experiment, Gneezy and Rustichini (2004) find that competition triggers improved performance in men but not in women. In the labour market context, the difference in competitiveness between men and women can explain the gender gap in terms of wages and promotions (see Flory et al., 2018 for a review). Leibbrandt et al. (2013) find a strong correlation between a participant's willingness to compete for financial rewards and their incomes. This study contributes to the literature on competitiveness by examining how individuals with different degrees of competitiveness perform and make labour supply decisions when harvesting common pool resources. Thus, any insights gained from this study will be useful for the development of policies that enhance the efficient management of common pool resources.

2 | BACKGROUND

Shrimp is the second-largest export commodity in Bangladesh. In 2015–2016, national export earnings from prawn/shrimp were US500 million (DOF, 2017). The market chain from fishers to either exporters or traders who sell prawns or shrimp in the local markets consists of various tiers.[1] The first tier of the shrimp industry is the collection of wild seeds by local shrimpers, and we focus on them in this study.

Shrimp farming in Bangladesh depends largely on the supply of wild seeds from deep rivers and seas and is concentrated in the southwestern areas of Bangladesh. Seed collection is the main occupation for many people in these areas, with most of these shrimpers being landless people who have limited options for alternative income-generating activities (Ahmed & Troell, 2010).

Various species of shrimp seeds are available in these areas. However, two specific species of seeds are the most desired: *P. monodon* (the seed of the tiger shrimp known locally as

[1]In December 2015, the US Dollar to Bangladesh Taka exchange rate was 1 USD = 78.5 BDT (source: Bangladesh Bank; retrieved from https://www.bb.org.bd/econdata/exchangerate.php).

Bagda) and *M. rosenbergii* (the seed of the giant freshwater shrimp known locally as *Golda*).[2] *P. monodon* seeds can be collected throughout the year, although the peak season is from February to May. In contrast, *M. rosenbergii* is mostly available from April to July. The demand for *M. rosenbergii* peaks in July, when the harvesting of *P. monodon* is over, and farmers become ready to stock *M. rosenbergii* in low salinity or fresh water (Rahman & Hossain, 2013).[3] In addition to the seasons, there are a number of other factors that affect the availability of seeds. For example, the lunar cycle significantly influences the supply of wild seeds. Shrimpers exhibit greater efforts during full moons, when the seed concentration in the surface layers reaches its maximum level (Ahmed & Troell, 2010). Various meteorological factors, such as rainfall and wind direction, also affect the availability of seeds in nature.

Following collection, the shrimpers transfer their collected seeds, along with any debris such as leaves and floating mangrove twigs, to earthen bowls. They then spread the seeds out on flat white plates and cover them with water, in order to sort out their desired species with the help of plastic spoons or freshwater mussel shells. After sorting, the rest of the seeds are discarded.

The shrimpers usually sell their collected seeds to seed traders. The prices of the seeds vary according to season and the availability of seeds as well as the types of seeds and their quality. For example, in 2014, the price of *M. rosenbergii* seed varies from BDT 400 to BDT 5000 per 1000 seeds, whereas the price of *P. monodon* usually ranges from BDT 200 to BDT 1000 (1 AUD = 72 BDT = 0.68 USD as of April, 2023). Negotiation skills of shrimpers may potentially influence the prices shrimpers receive in the market. Seeds are often forward sold to the traders (wholesalers) at a predetermined lower price. As there are typically few wholesalers and many shrimpers in an area, shrimpers have less room to negotiate a good price. Specifically, seeds are forward sold via the practice of '*dadon*', where shrimpers receive informal credit built upon a verbal contract between them and the trader. The *dadon* is then paid back using the harvested shrimp seeds at the predetermined lower price. In our data, about 40% of shrimpers received *dadon* the week prior to the survey. There are a few tiers of middlemen between the seed collectors and farms, such as transporters, suppliers, fry traders and local agents. Every time the seeds pass through an intermediary, the price goes up. Various types of transportation are used for seeds, such as head-loading, motorised boats, country boats, vans, bicycles and buses.

3 | SURVEY AND EXPERIMENT

3.1 | Sampling

The study was carried out in the southwestern coastal area of Bangladesh in 2012 and 2013. We chose this location as most of the inhabitants of these two subdistricts (Koyra and Shamnagar) of the Khulna and Satkhira districts (Appendix A) mainly depend on shrimp collection or other types of fishing activities for their livelihood. There are similar farmers in some other areas (subdistricts) of the two districts. With the help of village leaders and fishermen, we first made a list of the shrimpers who were actively involved in seed collection during that time. From the list, we excluded some shrimpers who were new or only occasionally go to catch fish. We came up with a

[2]Seed species other than *P. monodon* and *M. rosenbergii* that are available in the southwestern coastal areas of Bangladesh include *Penaeus indicus*, *Metapenaeus monoceros*, *M. brevicornis*, *Palaemon styliferus*, *M. villosimanus*, *M. dyanus*, *M. dolichodactylus* and *M. rude* (Hoq et al., 2001).

[3]The spawning and development of *M. rosenbergii* larvae take place in brackish water regions where the salinity level is 10–15 parts per thousand (ppt). However, their further development occurs in fresh water or water of low salinity (Rahman & Hossain, 2013).

list of 450 fishermen who primarily depended on seed collection for their livelihood and had more than 2 years experience, and were willing to participate in the surveys. However, some of them (about 5%) dropped out from the study over time for various reasons including migration, sickness and moving to a different occupation. Thus, we ended up with 429 regular shrimpers (all male) whose livelihoods depended mainly on open-access shrimp seed collection.

3.2 | Survey

The research was conducted between July 2012 and April 2013. During the study period, each shrimper was interviewed weekly to obtain daily information about total hours worked, total catches, sale prices and expenditures, and weather conditions. Because the data set includes information on consecutive days for almost a year, we are able to capture the seasonality of their incomes and any other daily price and quantity-related variability resulting from market forces. Note that although these data are self-reported, the possibility of intentional and systematic misreporting is likely to be small for two main reasons: first, because shrimpers were not paid for study participation, there was no monetary reward for intentional misreporting, and second, because the shrimpers knew that the numbers reported would be kept confidential for research purpose (through informed consent), misreporting would not affect their social reputation. In addition to this individual-level data set, a baseline survey was conducted to gather information about the shrimpers' household members, sociodemographic background, wealth and involvement in other income-earning activities, along with detailed information about their engagement in fishing-related activities.

3.3 | Experiments

We conducted economic experiments to measure several traits of shrimpers. We briefly describe these experiments here and include details in Appendix B. First, we adopted the individual competition experiment that Leibbrandt et al. (2013) used to measure the degree of competitiveness among the shrimpers. In this experiment, the shrimpers were required to throw tennis balls into a bucket. Each of them was given five attempts, with two possible payoff options in which they can participate. In Option 1, a shrimper received one point for each successful landing of a ball in the bucket. In Option 2, each shrimper was required to compete against another shrimper, with each ball scored earning three points; however, the payoff was provided only to the shrimper with the higher score. In the case of equal points, each shrimper received one point for each ball that landed in the bucket.

When deciding which option to choose, the shrimpers did not know who they would be competing against, meaning that choosing Option 2 indicates a higher willingness to compete for a financial reward. We define a shrimper who chose Option 2 as a 'competitive' shrimper, while a shrimper who chose Option 1 as a 'non-competitive' shrimper. In this game, all the shrimpers were paid according to the options they chose.

Second, following Binswanger (1980), we measure shrimpers' attitudes towards risk in terms of their responses to a lottery game designed to reveal their financial risk preferences. Each participant was provided with six different options with different possibilities of payoffs in BDT and was asked to choose a payoff based on a heads or tails coin-toss outcome (see Appendix B for the options and amounts). Extremely risk-averse participants will choose the first option because it guarantees a payment of BDT 100. Options 2–6 require a coin toss with a 50 chance of high payoff and a 50 chance of low payoff. The degree of riskiness of the options increases in ascending order, with Option 6 being the riskiest. Option 6 will be chosen only by extremely risk-loving individuals because it provides BDT 400 for heads but no payoff for tails. Shrimpers who chose an option greater than the mean (i.e., Option 5 or Option 6) are categorised as risk-takers.

Third, following Fehr and Leibbrandt (2011), we conducted a public good experiment to measure the level of cooperation among the shrimpers. The game was played in groups of three. The shrimpers were not aware of who the other members in their group were. At the beginning of the experiment, each participant was given an empty envelope and BDT 20 in cash and was asked to contribute to the empty envelope some amount from the BDT 20 that they had been given. They could contribute any amount of that money, from zero to BDT 20. The total contribution of a group was doubled by the facilitator and then distributed equally among the group members. For instance, if each member of a group contributes the full amount of money, the total of BDT 60 will become BDT 120 after the facilitator's contribution, and each member will receive BDT 40. However, if the three members contribute BDT 10, BDT 5 and BDT 0, respectively, they will each end up receiving BDT 10. Participants who choose to contribute more than the average amount of money (BDT 11.5) are classified as highly cooperative.

Lastly, we used a time preference game to measure shrimpers' levels of patience. This game involved three rounds. In each round, the participants were asked to choose an alternative answer to a hypothetical question: whether to receive a smaller payoff (BDT 300) sooner under option, or a greater payoff (BDT 350) in the future under Option 2 (see details in Appendix B). Option 1 is associated with a lower level of patience, whereas Option 2 is associated with a high degree of patience given that the payoff will arrive much later in the future. Because this game was based on hypothetical questions, no payments were made to the participants. To classify whether a participant is highly patient or not, we first gave participants who chose Option 2 in a round a score of 1, whereas those who chose Option 1 in a round a score of 0. The average total score in the three rounds is 1.5, and shrimpers who have patience levels higher than the average are classified as highly patient.

As we collected these measures only once, we assume that these traits and preferences are stable during the relatively short study period (<1 year). Our assumption is consistent with a number of studies in the literature on risk preferences, time preferences, social preferences and personality traits. For example, in a review article, Chuang and Schechter (2015) found that risk, time and a range of social preferences are stable in the short-to-medium term. Carlsson et al. (2014) found that contributions in public good game are also stable over many years. Cobb-Clark and Schurer (2012) also found that big-five personality traits are stable for working-age adults over a 4-year period, whereas Fletcher and Nusbaum (2008) found that facets of the big-five were related to trait competitiveness.

4 | SUMMARY STATISTICS

Table 1 presents summary statistics by competitive and non-competitive shrimpers (i.e., whether a participant chose to compete or not). Twenty-six per cent of shrimpers are competitive, that is showing a willingness to compete in the ball-throwing experiment (Option 2). The personal and household characteristics of the shrimpers are presented in Panel A of Table 1. On average, shrimpers are 37 years old and have a low level (1.7 years) of schooling. They have 18 years of experience in fishing, and most of them (about 98%) are Muslim. The average per capita household income for the shrimpers is BDT 1918 per month. There are significant differences between competitive and non-competitive shrimpers in terms of age, years of schooling, years of experience, religion and per capita income. We find that an average of 46% of non-competitive shrimpers have taken out a loan for fishing purposes, compared to only 34% for competitive shrimpers.

TABLE 1 Summary statistics.

	All		Competitive		Non-competitive		Difference	SE
	Mean	SD	Mean	SD	Mean	SD	(3–5)	(diff)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Demographic and household characteristics								
Age (in years)	37.287	10.516	36.306	9.926	37.629	10.708	−1.323	(1.116)
Education (years com)	1.69	2.725	1.739	2.662	1.673	2.75	0.066	(0.296)
Experience (in years)	18.2	8.342	17.414	7.256	18.475	8.683	−1.061	(0.842)
Muslim	0.981	0.135	0.964	0.187	0.987	0.112	−0.023	(0.019)
Per capita HH income	1918.43	826.63	1956.74	775.13	1905.06	844.64	51.678	(87.385)
Loan taken	0.427	0.495	0.342	0.477	0.456	0.499	−0.114**	(0.053)
Panel B: Traits								
Willingness to compete	0.259	0.438						
Risk-taker	0.427	0.495	0.613	0.489	0.475	0.5	0.138***	(0.054)
Highly cooperative	0.510	0.500	0.495	0.502	0.519	0.5	−0.024	(0.055)
Highly patient	0.513	0.500	0.555	0.499	0.450	0.498	0.105*	(0.055)
Panel C: Performance								
Participate	0.807	0.395	0.790	0.410	0.810	0.390	−0.020***	(0.010)
Hours spent	6.215	2.211	6.040	2.410	6.280	2.130	−0.240***	(0.075)
Revenue (in BDT)	203.71	92.77	206.55	94.41	202.74	92.18	3.810**	(1.522)
Price of seeds (per 1000)	385.06	204.21	394.38	215.64	381.87	200.05	12.510***	(3.412)
Observations	429		111		318			

Note: Standard errors, clustered at the individual level, are given in parentheses. A shrimper is considered competitive (whether each participant chose to compete or not) if he chose to compete in the ball-throwing experiment (Option 2).
$^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$.

Panel B of Table 1 shows that 50% of the shrimpers are risk-takers, 46% are highly co-operative and 48% are highly patient. We do not find any differences between competitive and non-competitive shrimpers in terms of their levels of cooperation; however, we find that competitive shrimpers are more likely to be risk-takers (about 61%) than non-competitive shrimpers (about 47%), and they are also more likely to be patient (55%) than non-competitive shrimpers (45%).

Panel C of Table 1 presents summary statistics for the major outcome variables. We find that the average participation rate among shrimpers is 81%, and they spend an average of 6.21 h in seed collection per day. Both the participation rate and the number of hours spent are lower for competitive shrimpers (79% and 6.04 h, respectively) than for non-competitive shrimpers (81% and 6.27 h, respectively). The average daily earnings of shrimpers from selling shrimp seeds are BDT 204, and the average price per 1000 seeds is BDT 385. However, competitive shrimpers earn more (BDT 207 vs. BDT 203) per day and receive higher prices (BDT 394 vs. BDT 382) than non-competitive shrimpers. The differences between competitive and non-competitive shrimpers in terms of these performance variables are all statistically significant.

5 | COMPETITIVENESS AND LABOUR PRODUCTIVITY

5.1 | Empirical strategy

To understand the competitiveness among the shrimpers and relate it to their economic performance, we first focus on their daily transactions, including the total amounts of shrimp seeds collected and sold, the prices at which their catches are sold and the total revenue earned. We also examine whether productivity differs between competitive and non-competitive shrimpers.

We estimate the following wage equation for shrimpers:

$$log\,Y_{it} = \delta_0 + \delta_1 Comp_i + \delta_2 X_i + \delta_3 Z_t + U_i + \varepsilon_{it}, \tag{1}$$

where Y_{it} denotes the economic performance of shrimper i on day t. We consider four measures of economic performance: quantity collected, price sold, earnings and productivity. Quantity collected is the amount of shrimp seeds collected. Price sold is the average price per 1000 shrimp seeds that the shrimpers offer for sale on a day. Earnings are the revenue from selling these shrimp seeds in the market. Productivity is measured in terms of total earnings per hour spent in seed collection. All the dependent variables included in the regression model are on a daily basis and in log form. These outcome variables are available for all the days the shrimpers participated in seed collection.

In Equation (1), $Comp_i$ is equal to 1 if shrimper i is competitive (i.e., chose to compete in the competition experiment), and 0 otherwise. X_i represents the vector of time-invariant controls on shrimpers (e.g., age, experience, and education), including the shrimpers' other attributes, such as their attitudes towards risk, cooperativeness and patience. We include these additional regressors because they may be correlated with competitiveness and other unobserved influences, such as fishing skills, knowledge and confidence. For example, Horn and Kiss (2020) find that time preferences are associated with educational attainment, income and wealth, and financial decisions. Similarly, Liu (2013) shows that risk preferences of farmers are correlated with their technology adoption decisions, whereas Yao and Rabbani (2021) find that confidence level of an individual is correlated with their investment risk tolerance. Cooperation is also found to be a correlate of patience (Curry et al., 2008; Fehr & Leibbrandt, 2011). Z_t includes several time-variant weather-related exogenous variables, such as the moon cycle, type of tide, amount of rain and month of the year. We control for the month to capture seasonality. If competitiveness is associated with higher performance among shrimpers, we expect $\delta_1 > 0$ because past studies have found competitive men to be better performers (Gneezy & Rustichini, 2004; Kamas & Preston, 2012). All our regressions have standard errors clustered at the individual level.

Our main explanatory variable of interest is competitiveness, which is time invariant. Because the main explanatory variable of interest is time invariant, we adopt Hausman and Taylor's (1981) panel data model, which combines the consistency of a fixed-effects model with the applicability and efficiency of a random-effects model. This estimator uses the method of instrumental variables, assuming that some of the explanatory variables are correlated with the individual-level random effects U_i. It also assumes that none of the explanatory variables are correlated with the idiosyncratic errorε_{it}. In this model, we treat competitiveness as an endogenous variable. In our data, competitiveness is highly correlated with risk preferences (significant at the 5% level) and weakly correlated with time preferences (significant at the 10% level). Furthermore, 61.3% of competitive shrimpers are also risk-takers, 55.4% are patient and 49.5% are highly cooperative. If the estimated effect of competitiveness is robust to the inclusion of shrimpers' attitude towards risk and their levels of patience and cooperation, which may be correlated with fishing skills and confidence level, then the omission of skills and ability as regressors is unlikely to confound the estimate.

5.2 | Results

Our first panel of results examines the overall performance of shrimpers (Table 2). We begin by estimating whether competitive shrimpers are likely to earn more than non-competitive shrimpers. Consistent with our expectation, the results confirm that the earnings from selling shrimp seeds differ significantly between competitive and non-competitive shrimpers.

TABLE 2 Competitiveness and performance of shrimpers.

	Panel A			
	(1)	(2)	(3)	(4)
	Revenue	Revenue	Productivity	Productivity
Competitive	0.123**	0.117**	0.124**	0.119**
	(0.061)	(0.056)	(0.061)	(0.056)
Age	0.002	0.001	0.002	0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Age squared	−0.000	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Risk-taker		−0.009		−0.009
		(0.010)		(0.010)
Highly cooperative		0.001		0.001
		(0.008)		(0.008)
Highly patient		0.010		0.011
		(0.009)		(0.009)
	Panel B			
	(1)	(2)	(3)	(4)
	Quantity	Quantity	Price	Price
Competitive	−0.234***	−0.201***	0.360***	0.327***
	(0.066)	(0.053)	(0.109)	(0.093)
Age	0.002	0.003	0.000	−0.002
	(0.004)	(0.003)	(0.005)	(0.005)
Age squared	−0.000	−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Risk-taker		0.015		−0.025
		(0.011)		(0.017)
Highly cooperative		0.016*		−0.015
		(0.009)		(0.015)
Highly patient		0.025**		−0.016
		(0.010)		(0.016)
Observations	85,406	85,172	85,396	85,162
# of unique shrimpers	429	428	429	428

Note: Standard errors, clustered at the individual level, are given in parentheses. Regressions 2 and 4 in Panels A and B also include other time-invariant controls (e.g., education and experience) as well as time-variant controls (e.g., full moon, type of tide, and amount of rain). All specifications include month dummies and fixed effects. Because the Hausman–Taylor specification requires the inclusion of at least one time-invariant regressor, we include age and age squared in all specifications because competitive and non-competitive shrimpers do not significantly differ in terms of age.

*$p<0.10$, **$p<0.05$, ***$p<0.01$.

Our results show that being competitive increases a shrimper's earnings by 11.7% to 12.3% (Columns 1–2 in Panel A of Table 2). The results remain similar when we include other attributes of shrimpers—such as their attitudes towards risk, cooperativeness and patience—as additional controls. The robustness of the estimated effect of competitiveness to the inclusion of these additional variables that are potentially correlated with unobserved influences, such as confidence and skills, implies that the estimate is unlikely to be biased by these unobserved influences. Second, Columns 3–4 estimate whether competitive shrimpers are likely to be more productive than non-competitive shrimpers when productivity is measured by earnings per hour. We consider productivity an outcome of interest to understand whether higher earnings are due to a greater effort being exerted by the shrimpers (i.e., spending longer hours in seed collection) or simply to higher levels of efficiency. We find that competitive shrimpers are 11.9%–12.4% more productive than non-competitive shrimpers. Our results are similar and remain statistically significant when we control for other variables. These results indicate that competitive shrimpers tend to perform better than non-competitive shrimpers in terms of both earnings and productivity.

Next, we examine whether the higher earnings of competitive shrimpers are likely to be due to larger amounts of shrimp seeds being collected, to higher selling prices being obtained in the market or both. Columns 1–2 of Panel B of Table 2 show that non-competitive shrimpers collect 20%–23% more seeds than competitive shrimpers. Seed collection may be higher for the non-competitive group in part because they spend more time in seed collection.[4] Shrimpers who collect better quality seeds could also earn more despite collecting a smaller amount. We examine any association between competitiveness and the price received in the market (Columns 3–4 in Panel B of Table 2). Our results confirm that competitive shrimpers are more likely to obtain higher prices in the market, measured in terms of the daily selling price per 1000 shrimp seeds. The results show that they sell seeds for prices 33%–36% higher than those of non-competitive shrimpers.

The results reported in Table 2 indicate that competitive shrimpers earn more than non-competitive shrimpers by selling at a higher price and at a lower quantity. There are two possible explanations for the higher prices that competitive shrimpers obtained on average: the first is that their competitive trait drives them to set a higher goal in terms of the quality of shrimp seeds, and the second is that their competitive trait helps them negotiate higher prices. We argue that the second explanation is less likely for the following reasons. First, past experimental research shows that competitive individuals tend to achieve lower payoffs in bargaining (Keser et al., 2018). Second, because a lot of shrimpers forward sold their shrimp seeds to a small number of buyers (wholesalers) at a lower predetermined price via the practice of *dadon*, there is little room for price differences to arise through negotiation. Lastly, since past research has shown that individuals who are highly competitive set higher goals (Brown et al., 1998), it is plausible for the goals to differ in terms of quality of catch between the two types of shrimpers.

6 | COMPETITIVENESS AND WAGE ELASTICITY

6.1 | Empirical strategy

The collection of shrimp seeds is a daily activity. Whether a shrimper will go out to collect shrimp seeds on a particular day is likely to depend on his expected earnings from selling the

[4]Note that shrimpers' actual time spent collecting seeds largely depends on many factors, as mentioned in Section 2 (background). The total time spent collecting seeds in a day remains almost the same as they go to deep river/sea areas and come back during high tide and low tide.

seeds and other bycatches, along with various other factors, such as the weather, tide and factors that affect earnings.[5] We determine how competitiveness affects the labour supply elasticities of shrimpers following Stafford (2015) and Giné et al. (2017). We first estimate a reduced form labour force participation equation of the following form:

$$P\left(participation_{it} = 1\right) = \Phi\left(F_i + \delta lnW_{it} + \gamma Z_{it}\right). \quad (2)$$

We can use the estimates from the participation equation to calculate the wage elasticity of participation for each group.

$$E(wage\ elasticity\ of\ participation) = \frac{\hat{\delta}\phi(\left(\hat{F}_i + \hat{\delta}\ lnW_{it} + \hat{\gamma}Z_{it}\right)}{\Phi\left(\hat{F}_i + \hat{\delta}\ lnW_{it} + \hat{\gamma}Z_{it}\right)}. \quad (3)$$

A shrimper would decide to participate if the utility derived from participation, $U(P=1)$, is larger than that from non-participation, $U(P=0)$, on that particular day. Therefore, the probability of participation is estimated as $P\left(participation_{it} = 1\right) = P[U(P=1) - U(P=0) \geq 0]_{it} = \Phi\left(\epsilon_{it}\right)$, where $\Phi(.)$ is the standard normal cumulative distribution function, and ϵ_{it} is the combined random component of $[U(P=1) - U(P=0)]$. Equation (2) specifies shrimper i's probability of participation on day t as function of hourly earnings, W_{it}, and a vector of observables that affect the labour supply decisions of the shrimper, Z_{it}, including the weather, religious festivals and weekends. Equation (3) estimates the wage elasticity of participation, where ϕ denotes the standard normal probability distribution function. In both equations, F is a shrimper-specific fixed effect.

However, income is observed only for shrimpers who participate in seed collection on a given day. Thus, there are likely to be correlations between the idiosyncratic errors and the explanatory variables in Equation (2) due to self-selected participation. Therefore, we estimate the equation using reduced form residuals that lead to a control function method (see Vella, 1993) of accounting for the possible selection bias that may arise from self-selection.

Thus, we estimate the wage elasticity using the following steps. First, we estimate a reduced form probit model of participation (Equation 2). This model includes all of the variables that affect the participation decision, whether directly or indirectly (through income/earnings). Second, we then obtain generalised residuals (inverse Mills ratio) using the probit model for the reduced form participation equation. We use the estimated residuals as an additional regressor in the wage equation (the hourly earnings) below.

$$\ln W_{it} = F_i + \alpha X_{it} + \epsilon_{it}\ , \quad (4)$$

where X_{it} is the vector of observables determining earnings, including the residuals estimated from Step 1, and F_i is a shrimper-specific fixed effect. The earnings equation excludes a set of variables that are assumed to affect the participation decision only. We assume that variables such as religious festivals,[6] weekly holidays, interaction between being Muslim and Fridays, interaction between age and rain, and storm warnings, affect shrimpers' participation decisions but not their earnings. Muslims are required to participate in a special prayer on Friday, and we therefore use the interaction of these variables to see whether Muslims are less likely to participate in shrimping activities on a Friday.

[5]Here, in addition to shrimp seeds, we considered earnings from shrimpers' other bycatches because obtaining total earnings is crucial to understanding shrimpers' participation decisions.

[6]The festivals mainly include religious festivals that are celebrated by Muslims worldwide.

Because these variables do not affect earnings, we exclude them from our earnings equation, and they are arguably valid instruments of the wage of shrimpers. Thus, we apply a two-step Heckman procedure to estimate the selectivity-corrected wage equation. We then calculate predicted log earnings from Equation (4).[7]

Third, we estimate a (structural) probit model of participation (such as Equation 2) using the predicted earnings (calculated from Equation 4) as a regressor. The model excludes a set of variables that affect earnings but not participation, such as wind direction and the presence of a full moon, under the assumption that they do not affect participation, except potentially through earnings. Finally, the elasticity of participation is calculated from the structural probit equation. We use a mixed effect probit model to estimate the participation equations to take into account the fixed effect in the model. These steps allow us to consistently estimate the wage–labour supply elasticities.[8]

6.2 | Results

6.2.1 | Reduced form equation of participation

We begin by presenting our estimates of the reduced form probit model of participation in Table 3 for both competitive and non-competitive shrimpers. Column 1 of Table 3 presents the estimates for the full model, whereas Columns 2 and 3 present the estimates for competitive and non-competitive shrimpers, respectively.

Weather and meteorological variables are found to be important determinants of shrimpers' participation decisions. Storm warnings are likely to decrease participation for both groups. Overall, rain increases the probability of participation, especially for the non-competitive group. However, older non-competitive shrimpers are less likely to participate if it is raining heavily. The cycle of the moon is also found to be associated closely with participation. Shrimpers are more likely to participate during full moon days, with the coefficient being larger for non-competitive shrimpers. As Ahmed and Troell (2010) state, the shrimp seed concentration on the surface layer is at a maximum during the full moon, meaning that shrimpers' participation rates are likely to be higher on these days.

Holidays are also likely to affect participation decisions. Both types of shrimpers are less likely to participate in yearly religious festival days, although the coefficient is higher for competitive shrimpers. On the contrary, shrimpers are more likely to participate during weekends, especially the non-competitive group. However, as expected, both competitive and non-competitive Muslim shrimpers are less likely to participate on Fridays.

6.2.2 | Selectivity-corrected log earning equation

Our estimates of the selectivity-corrected log earning equation are presented in Table 4 for both groups. We find that wind from a southerly direction is correlated with higher earnings for both groups of shrimpers and that earnings are also likely to be higher on full moon days for both groups. This gives us a justification for excluding these variables from the structural

[7]This enables us to obtain predicted earnings of all days for shrimpers including the uncensored sample of shrimpers as those were not observed in the data since we can observe the earnings of those shrimpers who went to collect the seed on a particular day.

[8]Multilevel mixed effects probit regression fits mixed effects models for binary or binomial responses. It contains both fixed effects and random effects in panel data. The conditional distribution of the response given the random effects is assumed to be Bernoulli, with success probability determined by the standard normal cumulative distribution function.

TABLE 3 Reduced form probit model of participation.

	(1)	(2)	(3)
	All	**Competitive**	**Non-competitive**
Storm warning	−2.345***	−2.173***	−2.412***
	(0.045)	(0.090)	(0.050)
Rain	0.463***	0.285	0.525***
	(0.111)	(0.222)	(0.129)
Age*rain	−0.005*	−0.002	−0.005*
	(0.003)	(0.005)	(0.003)
Wind, southerly direction	0.921***	0.890***	0.932***
	(0.033)	(0.065)	(0.038)
Full moon	0.436***	0.378***	0.463***
	(0.029)	(0.051)	(0.035)
Festival	−2.328***	−2.473***	−2.273***
	(0.054)	(0.108)	(0.062)
Weekend	0.037***	0.031	0.038***
	(0.013)	(0.027)	(0.014)
Friday*Muslim	−0.090***	−0.082***	−0.090***
	(0.014)	(0.028)	(0.016)
Observations	105,968	27,676	78,292
# of unique shrimpers	429	111	318

Note: Standard errors, clustered at the individual level, are given in parentheses. The variables storm warning, rain, wind in the southerly direction, full moon, festival, weekend and Friday*Muslim are all dummy variables. We also include dummies for months and individual-level fixed effects for shrimpers.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

probit equation, as they are likely to affect the opportunity costs of participation only though earnings. However, we do not observe any significant association between rain and earnings.

The variables that are excluded from the earnings equations are holidays (both religious festivals and weekends), an interaction dummy for age and rain, and an interaction dummy for Fridays and being Muslim. As with the participation equation, we also used month fixed effects to capture any seasonality in earnings.

6.2.3 | The structural probit equation of participation and elasticities

Finally, we estimate the structural probit model in Equation (2) using the predicted log earnings from Equation (4) and present the results in Panel A of Table 5. Our results show that the coefficients on the predicted log earnings are positive and significant for both groups of shrimpers.[9] The signs of the coefficients for the other variables in the models are also consistent. The lower panel of Table 5 presents the wage elasticities of participation for both groups—approximately 0.96 for the competitive group and 1.14 for the non-competitive group—suggesting that non-competitive shrimpers have slightly larger elasticities of participation (in terms of

[9]Standard errors on predicted log wage coefficients are likely to be understated if they are not corrected for the fact that the variables are predicted. Therefore, we bootstrap the standard errors to correct the possible bias.

TABLE 4 Selectivity-corrected wage equation.

	(1)	(2)	(3)
	All	**Competitive**	**Non-competitive**
Rain	0.006	−0.007	0.010
	(0.006)	(0.011)	(0.007)
Wind, southerly direction	0.246***	0.271***	0.238***
	(0.009)	(0.019)	(0.011)
Full moon	0.032***	0.031**	0.032***
	(0.007)	(0.014)	(0.008)
Inverse mills	0.198***	0.202***	0.195***
	(0.012)	(0.024)	(0.014)
Observations	85,396	21,767	63,629
# of unique shrimpers	429	111	318

Note: Standard errors, clustered at the individual level, are given in parentheses. The variables rain, wind in the southerly direction and full moon are all dummy variables. We also include dummies for months and individual-level fixed effects for shrimpers.
*$p<0.10$, **$p<0.05$, ***$p<0.01$.

expected earnings) than competitive shrimpers. However, this difference is not statistically significant.

We find that the labour supply is close to unit elastic to changes in expected earnings. Our findings are similar to those of Giné et al.'s (2017) and Stafford's (2015) findings. Using daily labour supply data for South Indian boat owners, Giné et al. (2017) found that the participation elasticity with respect to expected earnings ranges from 0.8 to 1.3. However, this is slightly smaller than Stafford's (2015) estimate; Stafford found wage elasticity of labour supply (participation) between 1.05 and 1.26 for lobster fishermen in Florida. In another paper, using the same data set as Stafford (2015), French and Stafford (2017) found that the participation elasticity is quite high (2.7) for highly experienced retiring fishermen, but it is approximately zero for entry-level fishermen who are participating in the lobster season for the first time. Our calculated participation elasticities range from 0.96 to 1.14, suggesting that the labour supply is close to unit elastic to the change in expected earnings in our case. Non-competitive shrimpers have slightly larger elasticities than competitive shrimpers, although the difference is not statistically significant. Some recent research in labour economics provides evidence of reference-dependent preferences for labour supply in different contexts (Camerer et al., 1997; Fehr & Goette, 2007). Consistent with the findings of Stafford (2015), Giné et al. (2017) and French and Stafford (2017), our results refute the notion of reference-dependent preferences for labour supply in the context of marginal shrimpers in Bangladesh. Even such an important trait as competitiveness does not affect our results, which provides strong support for the neoclassical model of labour supply.

7 | CONCLUSION

Using data of shrimpers collected through survey and experiments in the southwestern coastal area of Bangladesh, this study finds that shrimpers who prefer competition are more productive than shrimpers who do not prefer competition. Specifically, competitive shrimpers perform better than non-competitive shrimpers in terms of earnings and productivity. The difference is due to competitive shrimpers obtaining better prices in the market, rather than harvesting more shrimp seeds. We argue the higher prices that competitive shrimpers obtain are more likely due to them catching better quality shrimp seeds than them being better at

TABLE 5 Structural probit equation and elasticities.

	(1) All	(2) Competitive	(3) Non-competitive
Panel A			
Predicted log wage	5.030***	4.289***	5.322***
	(0.197)	(0.293)	(0.246)
Storm warning	−3.682***	−3.261***	−3.839***
	(0.090)	(0.134)	(0.108)
Rain	0.577***	0.381**	0.646***
	(0.074)	(0.164)	(0.099)
Age*rain	−0.006**	−0.003	−0.007***
	(0.0002)	(0.004)	(0.003)
Festival	−3.810***	−3.819***	−3.787***
	(0.133)	(0.232)	(0.167)
Weekend	0.025	0.020	0.025
	(0.023)	(0.043)	(0.027)
Friday*Muslim	−0.102***	−0.089	−0.105***
	(0.029)	(0.057)	(0.038)
Panel B			
Elasticity	1.114***	0.962***	1.146***
	(0.051)	(0.082)	(0.061)
Observations	105,968	27,676	78,292
# of unique shrimpers	429	111	318

Notes: Standard errors reported are bootstrapped (200 replications). The variables storm warning, rain, festival, weekend and Friday*Muslim are all dummy variables. We also include dummies for months and individual-level fixed effects for shrimpers. Elasticity is calculated as the mean of covariates.

*$p<0.10$, **$p<0.05$, ***$p<0.01$.

bargaining because: (i) shrimpers tend to forward sell their catches to traders at a lower pre-determined price when they have little room for price negotiation; (ii) past research shows that competitive individuals tend to end up with worse payoffs in bargaining; and (iii) better quality shrimp seeds are consistent with the tendency for competitive individuals to set higher goals. Our results also provide support for the neoclassical model, refuting the possibility of reference-dependent preferences for labour supply, irrespective of an individual's degree of competitiveness. In addition, our results suggest that competitive shrimpers are slightly less responsive to changes in expected earnings than non-competitive shrimpers, although the difference is not statistically significant.

There are a few potential limitations of this study to note. First, the various attitudes and traits measured in the experiments are assumed to be relatively stable during the 10-month period of this study. Although this assumption is consistent with a number of studies that show that these attitudes and traits are relatively stable over time, we cannot rule out the possibility that they might not be stable in the context of this study. Second, because we cannot easily measure the quality of shrimp seeds, it is not possible for us to pinpoint that the exact reason for competitive shrimpers obtaining better prices is due to them catching better quality shrimp seeds. Third, we rely on self-reported price and quantity data, which can suffer from misreporting. However, we argue that there was no incentive for shrimpers to intentionally misreport these data in our study. Because these data were collected over

10 months, it is also unlikely for any unintentional over-reporting in prices to dominate in the repeated responses over the survey period. More importantly, if competitive shrimpers over-report, they would likely do so for both number of catches and selling price, but we found that self-reported catch volume is lower for competitive shrimpers than non-competitive shrimpers.

Note that the study was conducted in a particular setting in Southwestern Bangladesh among fishermen who rely on shrimp collection for the most of the year for their daily living. These are neither commercial nor recreational fishermen. At the time of conducting the study, these shrimpers had little or no access to technologies that provide better information on prices, access to credit and weather conditions, and they were engaged in seed collection using traditional method. Therefore, we should caution against generalising these findings to other settings such as where the shrimpers have more access to technology, are well-connected to the markets and have different sources of income.

Our study contributes to an understanding of the ways in which competitiveness affects the labour market performance and decisions of individuals in the context of a developing country where individuals make a living harvesting from a common pool of resources. Our findings that competitive shrimpers obtain lower quantities at higher prices imply that competitiveness may not necessarily lead to excessive resource extraction in a common pool of resources. If the quantity of resources available is an important consideration for the management of common pool resources, our findings indicate that having competitive individuals harvesting common pool resources will not necessarily imply over extraction of resources. On the contrary, individuals may compete on the quality dimension, rather than the quantity dimension to achieve better outcomes for themselves. If the quality of resources available is also an important consideration, then managing common pool resources through monitoring quantities and putting caps on quantities will not be sufficient.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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SUPPORTING INFORMATION

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