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Characterising conformity bias in production decisions: The case of smallholder Indian farmers.

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Abstract: We analyze farmer behaviour in a setting in which on-farm production decisions are not influenced by profit alone. We first conduct field work, which helps us understand the presence of behavioural biases. In addition, it also helps us identify conformity to be the most likely of all biases influencing behaviour. Based on this, we develop a theoretical model of conformity, which helps us understand the relevant strategic complementarities in this setting. We then add a sophistication to this model, the potential that the "copying" behaviour may not be only due to psychic costs but also due to physical cost complementarities, e.g., similar soil quality. Finally, we discuss the model implications for designing experiments and policy.

Keywords: Conformity bias, cost complementarities, smallholder farmers.

JEL classification: D91, D21, Q18.

1 Introduction

In this paper, we consider the case of small holder farmers in India. Farmers are faced with a series of production decisions. Broadly, these decisions are split into two categories: crop and input choices. Traditional economic thought would suggest that a farmer makes these decisions by optimizing a profit function. It is typically argued that the results from such an analysis, though not perfect, are reasonably accurate (Romer, 2006). Some economic studies take into account that consumers do not strictly optimize based on economic factors, but are influenced by their individual behavioural characteristics as well (Deaton and Muellbauer, 1980; Howley, 2015). A vast literature in economics accounts for behaviour in consumption analysis. Some of these characteristics include conformity, inequity aversion, altruism, reciprocity, and overconfidence (Kőszegi, 2014; Velez et al., 2009; Alpizar et al. 2008).

While behavioural aspects of consumer decisions have been researched extensively, these aspects remain largely under-studied in production decisions. We believe such biases are pertinent in the production choices of smallholder farmers in India (and broadly in the developing country context) who often choose traditional farming methods over adoption of newer technologies. This is not to say that there is no literature on farmer behaviour in production decisions. It has been theorized that farmers often make decisions based on factors, including value orientations and maintenance of traditions (Gasson, 1973). Further, farmers frequently engage in loss making strategies (Howley and O'Donoghue, 2012). To put it simply, production decisions of small holder farmers often do not aim to maximize profits, but to maximize utility. In economics literature, behaviour is a trait of an individual or a consumer. Producers or firms are not considered to be influenced by behavioural factors. In this regard, small holder farmers are in a unique position, in that they are producers but because of their small farms, lack of resources, and dedication to values and tradition are not strict profit maximizers when it comes to production decisions.

This poses a number of unique questions. For one, just the study of farmer behaviour and the motivation behind their decisions itself poses an interesting problem. However, the problem has scope beyond academic study. Specifically in the context of a developing country, policy is designed to target farmer welfare and agricultural production. This includes protection against market fluctuations (minimum support prices), making modern inputs more affordable (subsidies on fertilizers and seeds) and making credit more accessible. Though these address some key issues, they are designed assuming that the farmer is a profit maximizing agent. For example, the Ministry of Agriculture and Farmer Welfare, Government of India provides soil health cards (SHCs) that contain information to help the farmer choose the ideal combinations of inputs and outputs conditional on land quality. However, the SHC is only accounts for costs and returns from cropping. We conjecture that the information contained in SHCs could be enhanced if it were to also account for farmer behaviour.

Based on the above, we argue that it is utility, and not profits that drive these decisions. The expected utility theory would suggest that risk is one factor that plays a role in this decision. However, behavioural economics has explored several other individual characteristics that motivate these decisions. Policy must thus account for farmer utility in order to be effective. Specifically, we consider the SHCs discussed above. We first derive broad-based policy implications of behavioural bias, which were largely ignored in the design of the SHC, and then on "nudges" in this policy to guide biased decisions toward a socially desirable outcome (Coffman et al. 2017). Here, the effectiveness of the SHC can be enhanced to "nudge" farmers away from applying excessive fertilizer by including visuals of nearby polluted lakes as an ill effect of fertilizer over-application apart from the quantity specification. For example, Sudarshan (2017) utilized field experiments to show that nudges can prevent overconsumption of electricity in the Indian cities.

In this paper we start with individual farmer interviews conducted by us in three villages in Madhya Pradesh, India. The villages were Nazirabad, Papda and Rampura Kalan. The aim of this task was to identify if at all non-economic factors affected decision making. In addition, we attempted to uncover which behavioural traits stood out. We describe this in detail in the next section. After this, we set up a model of strategic complementarities, to explain how a potential conformity bias among farmers (observed in the survey) affects their decisions. In our theoretical model, we identify that some component of strategic complementarities could be arising from cost complementarities. We also model conformity and show it's effect. We then discuss how nudges can help a policy maker in this setting. Finally, we present our goal to set up an experiment to test if our theory model is consistent with farmer behaviour.

2 Field Interviews

In order to investigate the presence and nature of behavioural biases in our setting, we conducted interviews in three villages in the semi-arid region of Madhya Pradesh, a province in India. Our surveys suggested a presence of a tendency for farmers to emulate the production behaviour of their neighbours, as well as their ancestors. This corroborated our suspicion that there was a strong conformity bias in the decision making process.

The strongest evidence of conformity in our surveys is that farmers would usually ignore expert advice from government agency such as the Kisan Helpline, and rather put a greater weightage on emulating their peers in decision-making. The information from experts that they do incorporate is generally accepted by most farmers, e.g., weather forecasts from a national broadcaster. Another evidence of conformity in our surveys was the farmers' persistence in growing Soybean in the dry growing-season (December-March each year), despite multiple crop failures in recent years.

Broadly, conformity seemed to be of two types: in input choices (including choices for technology), and crop choice. There also were two distinct sources of conformity: neighbour choices and family traditions. Policy often tries to address the two types of conformity, but seldom addresses the behavioural motivation driving these effects. While this has been discussed in the literature, the problem seems to be accentuated for small holder farmers in developing countries like India.

It is important to note that just because large groups of farmers make the same or similar production decisions, this does not confirm a conformity bias. Even if the decisions are not necessarily profit maximizing at an individual level, there is potential for "cost complementarities" in these choices (Bleakley and Lin, 2012). However, given the inefficient nature of some of these decisions, we conjecture a social motivation as well for these actions.

In order to further investigate our idea, we form a theoretical model of farmer's utility maximization. We then aim to take the idea forward to experimentally verify and estimate these traits, in order to address potential policy concerns.

3 Model

We first identify the theoretical foundation for the impact of conformity in farmer decisions. Consider farmer i, in a networked population of N farmers with $i \in N$, whose profit, $\pi(X_i)$, is specified as a function of J input choices, i.e., $X = x_1, \ldots . x_J$. Typical policy designs for subsidies, credit schemes etc. assume that farmers maximize $\pi(X_i)$. We argue that farmers not only optimize profits, but utility (which is a function of profit) based on our survey finding that farmers conform to cultural and familial traditions while making production decisions. Velez et al. (2009) draw from the concept of normative conformity (Henrich and Boyd 2001; Henrich 2004) and specify it as a tendency to imitate the most frequently occurring behaviour. They further specify a theoretical model of conformity and provide an experimental design for verification. We draw from these works to characterize conformity in cropping decisions.

For simplicity, consider a 2 player setting with one choice variable and that each player derives positive utility from conforming to the other player. Hence, player 1's objective function can be written as

$$\max_{x_1} u(x_1) = \pi_1(x_1) - \beta_1(x_1 - x_2)^2$$

In the above function, the first expression is farmer 1's utility from profit, the second is utility from conformity and $\beta_1 \in (0, 1)$. We assume that players' utility is additively separable, with the first expression being economic profit and the second expression being utility from the player's conformity bias. The negative sign in front of the second expression signifies loss in utility (a penalty) when each farmer deviates from player 2's action. Here, β_1 is called the parameter of conformity, and lies between 0 and 1 . The optimality condition for player 1 is specified by the following FOC

$$\frac{\partial u_1(x_1)}{\partial x_1} = \pi_1'(x_1) - 2\beta_1(x_1 - x_2) = 0$$

Additionally, we can see that

$$\frac{\partial u_1(x_1)}{\partial x_1 \partial x_2} = 2\beta_1 > 0$$

That is, conformity reduces to strategically complementary decision-making in the analytical setting, which support at least two Nash equilibria and one of these will be Pareto inferior (Vives (1990), Echenique 2004). Specifically, it is clear that the farmer chooses x_1 based on the choice of his neighbour, x_2, and this choice is not entirely driven by profits. A policymaker concentrates on achieving higher producer surplus, however in a scenario when farmers value conformity sufficiently, the game's Nash equilibrium can support inferior profit margin. This leads to socially sub-optimal production levels.

It is important to note that in this section, we have only used a model to define how conformity will present a problem. We have not modelled the fact that part of the complementarities in decisions can be motivated by costs, and not behaviour. We look at this in detail in the following section.

3.1 Modelling Conformity amidst Cost Complementarities

The dependence of one player's choice on another is often down to cost complementarities. This is especially pertinent in an agricultural setting. For example, it maybe easier to have a large market selling the same agricultural product, as the infrastructural facilities needed for this are similar. Policy often keeps this in mind (in terms of roads to a market place, providing specific types of irrigation etc.). This could also justify to some degree why there is copying of agricultural production decision making. We now present a model that allows for both conformity bias and cost complementarities, to give a broader picture of what motivates these decisions.

Consider an extension of the two player case. We assume that firms choose output (this can be functionally linked to input in case of a single input model). q_i is quantity produced by firm i where $i \in \{1, 2\}$. We express conformity in the same way as before, and add cost complementarities to the model as well. γ is the parameter of cost complemantirity. Prices are normalized to 1, and costs are convex. Out objective function is .

$$\max_{q_i} u_i(q_i, q_j, \beta_i, \gamma) = q_i - [c_i q_i^2 + \gamma(q_i - q_j)^2] - \beta_i(q_i - q_j)^2$$

where the term in the box brackets represent total costs, divided into production costs and cost complemantirities (Bénabou 2015; Tirole 2002). Like β_i where $i \in \{1, 2\}$, $\gamma \in (0, 1)$. Our model thus accounts for the fact that deviating from other player's decision could be down to both behavioral elements and profit maximizing factors. As per our field work, the presence of conformity is high, and hence we model it. But we do not ignore the possibility that there are other factors driving these copying decisions as well. In the above case, the best response function becomes

$$q_i(q_j) = \frac{1}{2(\beta_i + c_i + \gamma)} + \frac{\beta_i + \gamma}{\beta_i + c_i + \gamma} q_j$$

As is evident from the positive slope, an increase in q_j would result in a corresponding increase in q_i for any given level of q_i and q_j. This is driven by the complemantirities. In the event that β_i and γ were 0, we would then get no complementarities in production. The strategic effect vanishes as we assume farmers are price takers. This is a reasonable assumption, at least in the context of small holder farmers in India. We then solve the best response functions for firm i and j simultaneously to get

$$q_i^* = \frac{(\beta_i + \beta_j + 2\gamma) + c_j}{2[\beta_i c_j + \beta_j c_i + c_i c_j + (c_i + c_j)\gamma]}$$

It is interesting to note that $\frac{\partial q_i^*}{\partial \beta_i} > 0$ if $c_i > c_j$, or if the firm i has the cost disadvantage. When the cost disadvantage is higher, one would typically be incentived to produce less. However, due to complemantarities, there is an incentive to get closer to the other firm as β increases. On the other hand, when one has a cost advantage, one reduces production to get closer to their rivals as the weightage on conformity increases. The effect with γ is a little bit more ambiguous, and depends on the relative values of both costs and the conformity parameters. The effect is positive is $\beta_1 + \beta_2 > c_2 > c_1$. This is because unlike β_i, γ is shared by both firms. However, the effect of complementarities in general holds, that there is an incentive to get closer to ones rival as the importance of being close to ones rival increases.

3.1.1 Optimal Output: Behaviour vs Non-Behaviour

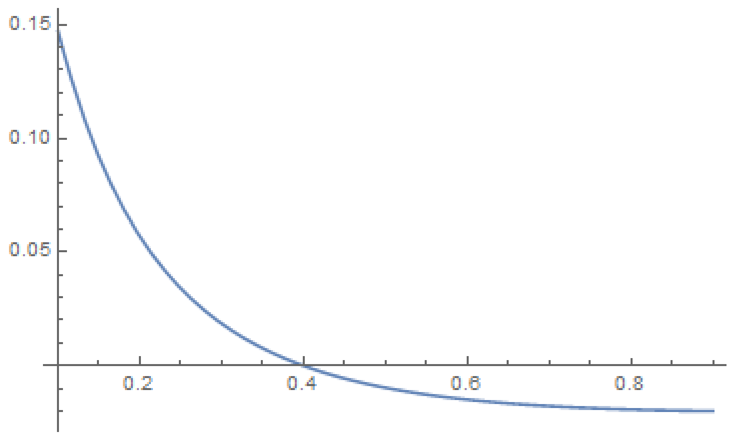
The objective at the beginning of the paper was to identify that in the presence of behaviour, current policy tools are not entirely effective. For that, we compare the optimal output of an agent in a setting of behaviour vs non behaviour. Hence, we compare the cases of $\beta_i, \beta_j = 0$ vs $\beta_i, \beta_j > 0$.

$$q_i^*(\beta_i, \beta_j = 0) - q_i^*(\beta_i, \beta_j > 0) = \overline{q}$$

Since $\overline{q}$ is a large expression and difficult to analyse for the purpose of comparative statics, we use simulations. In the first simulation, we have q_i^* o n the y-axis, and c_2 on the x axis. We get $\beta_1 = 0.2, \beta_2 = 0.2, \gamma = 0.4, c_2 = 0.4$

Figure 1

which shows that as farmer i becomes less efficient relative to firm j, it produces an amount that is closer to the optimal level. However, as it becomes



very costly to produce, a rational farmer would reduce his production a lot more than a behaviourally biased one. This is because a behaviorally biased farmer still tries to match (or come close to) his rival, as he is motivated by β_i. We also simulate comparative statics for β_i and γ. We find this gap to be increasing in β_i and decreasing in γ. This is understandable as the more pronounced behaviour is, the more the gap between a rational and behaviourally biased agent. However, this effect is ameliorated by γ. Figure 2 represents the case for β_i. The parameter values remain the same as in Figure 1 with the additional assumption that $c_1 = 0.6$.

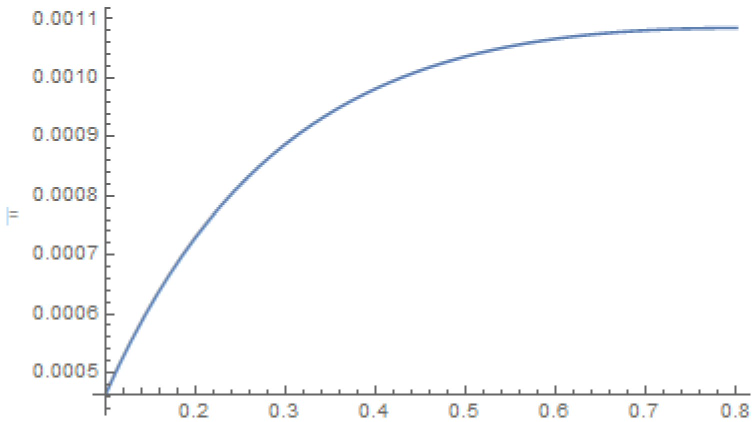


Figure 2

Figure 3 does the same for γ. As stated, the effect is of the opposite nature here.

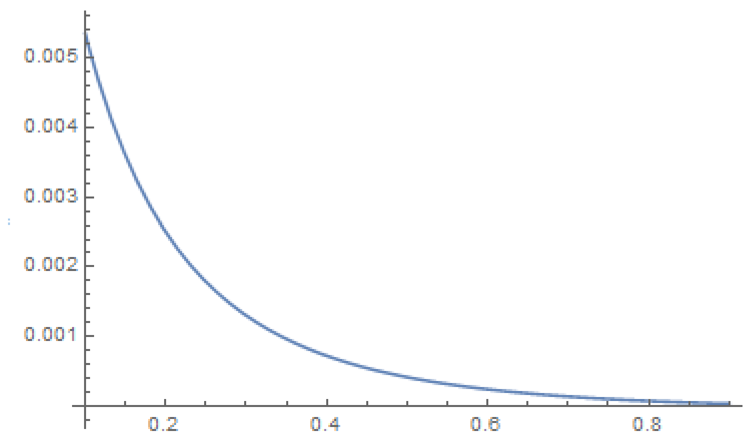


Figure 3

4 Discussion

Our results show that there is a substantial divide between what is optimal for a behaviourally biased farmer and for a rational profit maximizing farmer. This raises a number of important questions. The first is the extent to which this bias effects decision. Theoretically, our model helps us understand this. Our simulations corroborate the theory. However, the identification and characterization of this is only the first step in addressing the problem.

As mentioned above, the ultimate aim of the paper is to inform how policy can be more effective when accounting for behavioural biases. In order to do this, we must first identify as well as estimate these components. This is the motivation and theoretical foundation of the next step, which will involve field experiments. Experiments will help us confirm (or reject) our theoretical conclusions, while also providing additional insight into factors affecting these cropping decisions.

5 References

1. Alpizar, F., Carlsson, F., & Johansson-Stenman, O. (2008). Anonymity, reciprocity, and conformity: Evidence from voluntary contributions to a national park in Costa Rica. *Journal of Public Economics*, 92(5-6), 1047-1060.

2. Bénabou, R. (2015). The economics of motivated beliefs. Revue d'économie politique, 125(5), 665-685.

3. Bleakley, H., & Lin, J. (2012). Portage and path dependence. *The*

quarterly journal of economics, 127(2), 587-644.

4. Coffman, L., Featherstone, C. R., & Kessler, J. B. (2015). A Model of Information Nudges. *Stanford institute of Theoretical Economics Working paper.*

5. Deaton, A., & Muellbauer, J. (1980). Economics and consumer behavior. Cambridge university press.

6. Gasson, R. (1973). Goals and values of farmers. *Journal of agricultural economics*, 24(3), 521-542.

7. Henrich, J. (2004). Cultural group selection, coevolutionary processes and large-scale cooperation. *Journal of Economic Behavior & Organization*, 53(1), 3-35.

8. Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., & McElreath, R. (2001). In search of homo economicus: behavioral experiments in 15 small-scale societies. *American Economic Review*, 91(2), 73-78.

9. Howley, P. (2015). The happy farmer: the effect of nonpecuniary benefits on behavior. *American Journal of Agricultural Economics*, 97(4), 1072-1086.

10. Howley, P., Donoghue, C. O., & Hynes, S. (2012). Exploring public preferences for traditional farming landscapes. *Landscape and urban*

planning, 104(1), 66-74.

11. Koszegi, B. (2014). Behavioral contract theory. Journal of Economic Literature, 52(4), 1075-1118.

12. Romer, D. (2006). Do firms maximize? Evidence from professional football. *Journal of Political Economy*, 114(2), 340-365.

13. Sudarshan, A. (2017). Nudges in the marketplace: The response of household electricity consumption to information and monetary incentives. *Journal of Economic Behavior & Organization*, 134, 320-335.

14. Tirole, J., 2002. Rational irrationality: Some economics of self-management. *European Economic Review*, 46(4-5), pp.633-655.

15. Velez, M. A., Stranlund, J. K., & Murphy, J. J. (2009). What motivates common pool resource users? Experimental evidence from the field. *Journal of Economic Behavior & Organization*, 70(3), 485-497.

16. Vives, X. (1990). Nash equilibrium with strategic complementarities. *Journal of Mathematical Economics*, 19(3), 305-321.