GRIPS Discussion Paper 12-09

Does working with spouses make teams more productive? A field experiment in India using NREGA

By

Alistair Munro
Arjan Verschoor
Amaresh Dubey

September 2012

National Graduate Institute for Policy Studies
7-22-1 Roppongi, Minato-ku,
Tokyo, Japan 106-8677

Does working with spouses make teams more productive? A field experiment in India using NREGA

by

Alistair Munro, Arjan Verschoor,* and Amaresh Dubey*****

* School of International Development, University of East Anglia, Norwich, NR4 7TJ, UK

** National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, Tokyo 106-8677, Japan.

*** Centre for the Study of Regional Development, Jawaharlal Nehru University, New Mehrauli Road, New Delhi 110067, India.

Abstract.

An important question in labour economics is whether the presence in a work environment of friends or relations lowers or raises productivity. We examine the question using evidence from a simple field experiment in Uttar Pradesh, India with married wives and husbands. Teams of four are engaged to dig soil under the NREGA programme. In one treatment husbands and wives work together; in the other treatment they work in separate teams. We find that working with spouses is associated with significantly higher productivity.

Keywords: household experiment; India; NREGA; labour productivity.

JEL codes: C9, D1, D7, M5, O1

1. Introduction

Does working alongside friends or relations lower or raise productivity? We supplement evidence on the issue through a field experiment in Uttar Pradesh, India conducted with married couples. Teams of four are engaged to dig soil. In one treatment husbands and wives work together; in the other treatment they work in separate teams. We find that working with spouses is associated with significantly higher team productivity.

2. Background.

There are two main motives for the experiment. Some recent work in personnel economics examines the impact of non-work relationships on workplace productivity (e.g. Mas and Moretti, 2009, Bandiera et al, 2005). This literature focuses largely on non-related acquaintances, but particularly in developing countries, family members often work alongside one another on farms and enterprises (Haddad et al., 1997). Since family members often pool some or all of their resources within the household, the response to working with relatives might be quite different to the effect of working with non-relatives with whom income is not shared. Some evidence is called for. The other motive concerns experiments on household decision-making. Recent experiments have found significant impacts on spousal behaviour from playing games together (Peters et al. 2004), making decisions together (Bateman and Munro, 2005) or altering the information shared between partners (Ashraf, 2009, Iversen et al, 2011) in laboratory-like settings. For the sake of external validity, it is useful to see whether spousal behaviour is sensitive to context in more natural settings[1] and in particular, when rewards are earned through actual labour.

[1] With features such as onsite assignment to treatment and the presence of non-local supervisors, we do not claim this was a natural field experiment.

The experiment was conducted by financing work within the rules of the National Rural Employment Guarantee Act (NREGA). Launched in February 2006, NREGA is a workfare programme designed to alleviate rural poverty amongst working age adults. This act creates provision for 100 days of unskilled, manual employment per year for adult members of rural households. Each NREGA worker must pre-register to receive a job card with a specific code number which can be shared between spouses. A Block Development Officer (BDO) is in charge of the NREGA affairs at every block in the various districts of UP. The BDO in turn hands over the affairs to local officials who run and supervise the programme at the village and panchayat level. Although NREGA is supposed to be available for all who need it, there is evidence from some states (e.g. Datta and Singh, 2012, for West Bengal) that women often face significant impediments in their attempts to benefit from the scheme. Nevertheless, there are many examples where women are allowed to work and do work alongside men, albeit there is often a gendered division of labour for specific jobs (Khera and Nayak, 2009).

3. Methodology

The work in the experiment was the complementary tasks of digging of soil by men and the transporting and dumping of soil by women to improve existing ponds. Because we wished to compare the effects of working with a spouse to the effect of working alone, we needed treatments in which men worked with women to whom they were not married. Mixed sex teams of two would have produced strong cultural resistance, so we created teams of four with two males and two females. All individuals were paid on the basis of the *team* performance, as measured by the volume of soil successfully removed. In treatment one (the

control) each team of four consisted of 2 men and 2 women, none of whom were married to one another. However, for one man and one woman their spouses were working in another site nearby under the same conditions. In treatment two, teams also contained 2 men and 2 women but in this case two members of each team were spouses. The other two individuals were not married to one another or to anyone else taking part in the experiment. The team members were paid at the rate of Rs 2 per cubic foot of soil successfully removed from the site and dumped, subject to local NREGA rules that dictate a minimum wage of Rs100 per working day.[2]

The fieldwork was carried out in three culturally homogeneous blocks of rural Uttar Pradesh (UP) namely, Chunar and Sikhar (in district Mirzapur) and Sewapuri (in district Varanasi). Within this area five sites were selected as suitable: Samaspur (Chunar), Madiya and Mowiya (Sikhar), Katwarupur and Manghipur (Sewapuri). Prior to the experiment the names of the participants along with their account number and job card number were randomly selected from the NREGA muster roll/ NREGA register that were in the custody of either the *Pradhan* (village head) or Block Development Office for each site. A total sample of 540 workers, stratified by sex (equal numbers) and status (registered couples and non-registered) were short listed at the five sites and invited to take part. On the days of the experiment, the total number of participants that took part was 516.[3] A total of 258 participants were in the form of married couples

[2] Only 7 out of 86 teams fell below this 50 cubic feet threshold and results reported below are not significantly affected by the inclusion of this group.
[3] Here we discuss results from 344 of the participants. The remaining 1/3 were randomly assigned to another treatment in which wages were not linked to output and are not discussed in this paper.

while 129 male and 129 female were unaccompanied individuals.[4] The experiments were carried out over 4 days: digging at sites number 2 (Madiya) and 3 (Mowiya) were carried out on the same day (day 2) to prevent contamination of data between the neighbouring villages and achieve the target of playing a total of 30 groups per day.

On a game day the participants from the prepared list were ticked for presence and randomly assigned to treatment. Afterwards, each team was taken to their designated spots with a team number and an area of 12 x 10 ft or 10 x 8 ft area to dig as a team. Each experimenter gave the information for each treatment to each team separately. Each team was given 3.5 hours to work. The time of start of each team was recorded by the experimenter for each treatment and the time of stop was pre-calculated. The teams were asked to dump the mud at roughly the similar distance (measured as 15-20 walking steps) from each pit, depending on the area. The workers were asked to dig for 3.30 hours (which was timed) and than take a lunch break and come back to their pits. Post lunch the experimenter publicly measured the length, breadth and height of the pit dug by each team. The earnings of the team were then calculated and then team members were paid-off individually.

In this context, when the spouses are separated as in treatment 1, they cannot coordinate their efforts. When they play in the same game, they can coordinate. Typically, therefore we would expect that, for players from a cooperative household average output will be higher when spouses play together than when apart. However, male and female effort is complementary in this game, meaning

[4] Many of these individuals have spouses who were not themselves registered for the NREGA scheme.

that there may be multiple Nash equilibria. Treatment may move play from one equilibrium to another.

To see this, it may be useful to introduce a basic model of the design in order to aid the interpretation of the results. Individual reward in this experiment is proportional to team output, y, which in turn is given by the expression $y = \min(x_1 + x_3, x_2 + x_4)$ where x_is i=1,3 are the digging efforts of the males and x_is i=2,4, are the transporting efforts of the females. Odd numbers represent males and even numbers are females. The representative couple in the experiment are identified by i=1 and i=2. If effort costs are proportional to the square of effort, then individual payoffs are: $\min(x_1 + x_3, x_2 + x_4) - \alpha_i x_i^2$ where α_i is a positive parameter that may vary across individuals.[5]

Consider a household that maximizes a weighted average of its net payoffs. When the spouses are separated as in treatment 1, each spouse takes part in his or her own game. The household payoffs are,

$$\lambda \min(x_1 + x_3, x_4 + x_6) + (1-\lambda)\min(x_5 + x_7, x_2 + x_8) - \lambda\alpha_1 x_1^2 - (1-\lambda)\alpha_2 x_2^2$$

For an individual, i, let –i be the other person with the same gender, let I be the set of the same gender members of the team and let –I be the set of opposite gender players in the team. At any Nash equilibrium,

$$1 - 2\alpha_i x_i \geq 0$$
$$\sum_{i \in I} x_i = \sum_{j \in -I} x_j$$

[5] Though the production function is a reasonable approximation to the reality of the task, the quadratic form for effort costs is introduced for expositional simplicity.

Because of the functional form for the output function, in general there are multiple Nash equilibria. At what we call the *largest* (in terms of team output) such equilibrium[6],

$$\frac{1}{2}\min\left\{\frac{1}{\alpha_i}, \sum_{j\in -I}\frac{1}{\alpha_j} - \frac{1}{\alpha_{-i}}\right\} = x_i \quad i = 1,...,8$$

Meanwhile, when the spouses work in the same team as in treatment 2, the household payoff is,

$$\min(x_1 + x_3, x_2 + x_4) - \lambda\alpha_1 x_1^2 - (1-\lambda)\alpha_2 x_2^2 .$$

If the household chooses x_1 and x_2 together and other players each maximize their own payoffs then at any Nash equilibrium,

$$\min\left\{1 - 2\lambda\alpha_1 x_1, 1 - 2(1-\lambda)\alpha_2 x_2\right\} = 0$$
$$1 - 2\alpha_i x_i \geq 0 \quad i = 3,4$$
$$\sum_{i\in I} x_i = \sum_{j\in -I} x_j$$

At the largest Nash equilibrium,

$$\frac{1}{2}\min\left\{\frac{1}{\lambda\alpha_1}, \frac{1}{(1-\lambda)\alpha_2} + \frac{1}{\alpha_4} - \frac{1}{\alpha_3}\right\} = x_1$$
$$\frac{1}{2}\min\left\{\frac{1}{(1-\lambda)\alpha_1}, \frac{1}{\lambda\alpha_1} + \frac{1}{\alpha_3} - \frac{1}{\alpha_4}\right\} = x_2$$
$$\frac{1}{2}\min\left\{\frac{1}{\alpha_3}, \frac{1}{(1-\lambda)\alpha_2} + \frac{1}{\alpha_4} - \frac{1}{\lambda\alpha_1}\right\} = x_3$$
$$\frac{1}{2}\min\left\{\frac{1}{\alpha_4}, \frac{1}{\lambda\alpha_1} + \frac{1}{\alpha_3} - \frac{1}{(1-\lambda)\alpha_2}\right\} = x_4$$

It follows that as long as $\lambda \in (0,1)$ then at the largest Nash equilibrium, average output is higher when spouses play together than when apart. In particular if the household places equal weight on the partners and all players have the same effort costs, then expected output is 50% higher in treatment 2 compared to treatment 1. However, two other effects might also cause a difference between

[6] Generically, the strategies that support the largest equilibrium are non-unique, though there is a unique output level consistent with Nash equilibrium.

treatments. First, it is possible that the largest Nash equilibrium is not the equilibrium actually played in the game and moreover that the treatment moves teams from one equilibrium to another. Secondly, the appropriate household model may not be a cooperative one. In particular, individual effort may be harder to observe when couples are apart and this may lead to different behaviour between treatments (Ashraf, 2009). In both these cases, it is theoretically possible for output to be lower when spouses play in the same team.[7]

4. Results.

Altogether, in each of the two treatments there were 172 participants making 86 teams of four. Table 1 sets out some basic information obtained in an ex-post survey. In addition to obvious questions such as age, land-owned, education and social group, we asked individuals about the time they typically spend working with their spouses in a standard week. We also asked them to specify how many members of their team were known to them prior to the experiment. Mean responses do not differ significantly between treatments.

[7] That may seem unlikely, but for instance suppose that spouses are engaged in a repeated game and condition their post-game behaviour on in-game effort. Low effort is punished and high effort is rewarded by subsequent behaviour. When effort is observable this is straightforward, but when spouses work in different teams only output is observable. In this situation, subjects working separately might work harder so as to decrease the probability of the bad signal provided by low output.

Table 1. Summary of Means.		
	Treatment 1	Treatment 2
Age (years)	38.2	40.0
Land owned (acres)	0.22	0.14
Household size	6.3	6.5
Of which aged 15-60	3.2	3.6
Cast and Tribe (%)		
Scheduled caste	50.9	68.4
Scheduled tribe	2.92	1.17
Other backward caste	37.4	24.6
Upper caste	0.0	0.0
Other	8.77	5.85
Number in team known to you	2.37	2.2
Education level, female	1.18	1.13
Education level, male	1.79	1.63
Hours spent working with spouse per week	37.7	33.3
N	172	172

Education: 1 = not literate, 2 = only primary school; 3 = secondary level or above.
All variables are self-reported.

The key result is summarized in figure 1 which shows the distribution of output for the two treatments. The frequency scale reports the number of individuals in each output class. Mean group output was 169 for treatment 2 and 111.9 for treatment 0, a difference of approximately 50% and we reject the hypothesis of no treatment effect at the 1% level (Mann-Whitney test on teams, $z=4.024$, $p<0.001$).

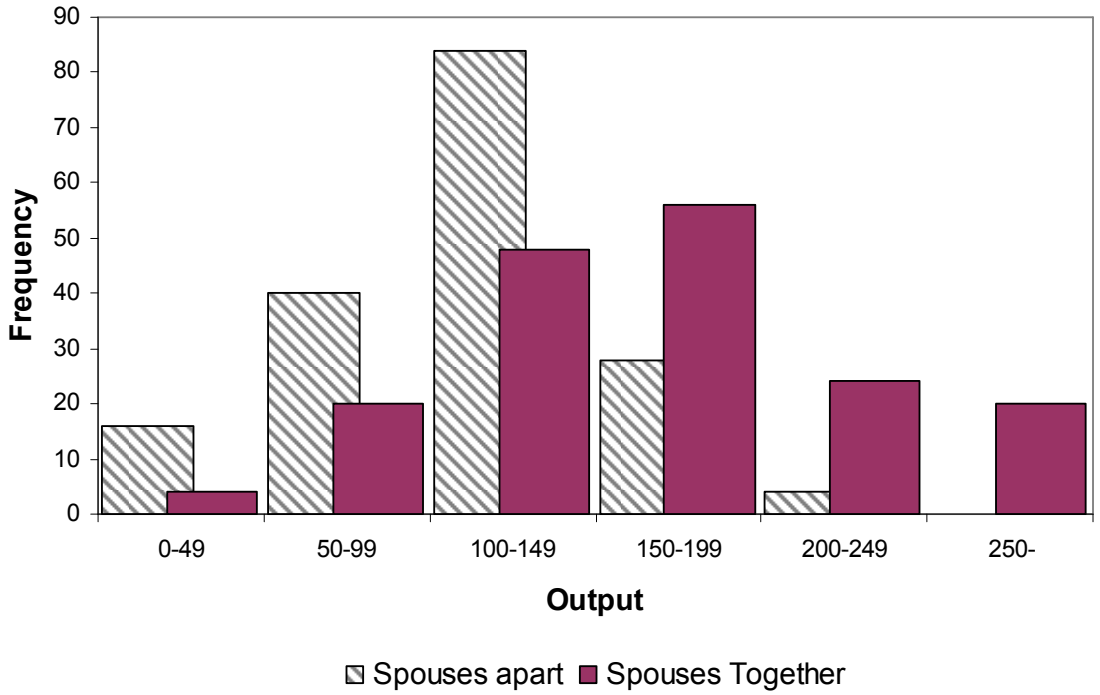

Figure 1. Distribution of output by treatment.

Table 2 summarizes regression results using only the data for couples where both spouses took part in the field experiment. The first equation has dummies for treatment 2 and the locations. The second equation has a fuller set of control variables. It contains an interactive term with hours in the week spent working together and there are also two variables for the age of the oldest male and female member of the team and a dummy variable which equals 1 only if the couple have a joint account for NREGA payments. The key result is the same as that shown in figure 1: mean output is higher in the treatment when couples work together.

Most controls are not significant, but four sites show significantly lower output than Samaspur. Local research teams noted higher temperatures at these sites and harder soil conditions, suggesting that heat played a role in productivity. We have estimated equations with interaction terms between treatment and site, and there is no evidence that the impact of the sites varies with treatment. The coefficients on time working and the interactive term have opposite signs and the absolute values are not significantly different from one another. In other words generally, couples who work more often together in daily life have higher productivity. However, for these couples, the impact of treatment is weaker. The number of known players in the game is also positively associated with productivity, while a higher value for the age of the oldest female in the group is associated with lower output. Finally, separate NREGA bank accounts are associated with higher productivity.[8]

[8] It is worth noting that there is a strong negative correlation between working together and having a separate bank account.

Table 2. Regression results (dependent variable = soil volume).		
	Site dummies only	Full set of controls
Constant	145.950***	102.140***
	(10.432)	(2.878)
Treatment	58.000***	111.333***
	(4.636)	(3.567)
Hours working together (per week)		1.206***
		(3.272)
Treatment x Hours working together		-1.383*
		(-1.780)
Madiya	-17.250	-52.297***
	(-1.065)	(-2.777)
Mowiya	-63.117***	-79.518***
	(-3.047)	(-4.112)
Katwarupur	-49.677***	-69.455***
	(-3.136)	(-3.844)
Manghipur	-40.859*	-59.898***
	(-1.925)	(-3.094)
Scheduled Tribe		21.687
		(0.527)
OBC ("Other backward caste")		4.204
		(0.330)
Other		-16.651
		(-0.919)
Known members of group		11.176***
		(2.835)
Age		0.531
		(0.958)
Landholding		-6.244
		(-0.650)
Education		2.652
		(0.516)
Age of oldest female in group		-0.967**
		(-2.202)
Age of oldest male in group		-0.020
		(-0.034)
Separate bank accounts		32.673***
		(2.760)
N	172	172
R^2	0.215	0.403
* p<0.10, ** p<0.05, *** p<0.01. Omitted category: Scheduled Caste. Standard errors clustered on teams.		

5. Conclusions and discussion.

In this simple field experiment, mixed sex teams of four dig holes and move dirt to another site nearby. Couples are randomly assigned to one of two treatments.

In the first, couples work separately and in the second couples work together. In all cases the team is paid according to the volume of soil removed successfully in a working day. We find that teams with paired couples consistently outperform teams where spouses are separated from their partners. The output gap between the two systems is large, by approximately 50%. This result is consistent with a household model in which equal weight is placed on both partners and effort costs are proportional to the square of the output. However, it is also consistent with a change of Nash equilibrium between treatments and with some forms of non-cooperative model of the household in which team working enables spouses to monitor more closely the efforts of the partner (Alchian and Demsetz, 1972). In contrast to some of the recent work on social connections and the workplace, we also find a positive relationship between output and other kinds of social contact.

A feature of our results is that couples who work together more frequently outside the experiment have higher productivity within the control group. However, within treatment 2 the effect is not significant. It is possible that spouses who do not work regularly together are more strategic within their marital relationship compared to spouses who work together. That is, spouses who do not work together, shirk when not being observed by their partners.

Acknowledgements. This study is funded jointly by the UK's ESRC and DFID (RES-167-25-0251). We are especially thankful to the hard-working efforts of our fieldwork manager, Dr Biswarupa Gosh, and the advice and support received from Dr Pradip K. Sen, Dr Anup K. Mishra and Mr Umesh Pandey.

References.

1. Alchian, Armen A and Harold Demsetz, 1972, Production, Information Costs, and Economic Organization, *American Economic Review* , 62, 5, 777-795
2. Ashraf, N., 2009, Spousal Control and Intra-Household Decision Making: An Experimental Study in the Philippines, *American Economic Review*, 99, 4 1245-1277
3. Bandiera, O., I Barankay, I Rasul, 2005, Social Preferences and the Response to Incentives: Evidence from Personnel Data, *The Quarterly Journal of Economics*, 120:3, 917-962
4. Bateman, I. and A. Munro, 2005, An experiment on risky choice amongst households, *Economic Journal*, 115, 176-189.
5. Datta, Soumyendra Kishore and Krishna Singh, 2012, Women's Job Participation in and Efficiency of NREGA Program—Case Study of a Poor District in India, *International Journal of Public Administration*, 35, 7
6. Goto, J., T. Aida, K. Aoyagi and Y. Sawada, 2011, Incentives and Social Preferences in a Traditional Labour Contract: Evidence from Rice Planting Experiments in the Philippines, University of Tokyo
7. Haddad, L., J. Hoddinott and H. Alderman, 1997, *Intrahousehold resource allocation in developing countries: Methods, models and policy*, John Hopkins University Press, Baltimore.
8. Ichino, A. and G. Maggi, 2000, Work Environment and Individual Background: Explaining Regional Shirking Differentials in a Large Italian Firm, *Quarterly Journal of Economics,* 115 (3), 1057 - 1090.
9. Iversen, V., C. Jackson, B. Kebede, A. Munro, and A. Verschoor, 2011, Do spouses realise cooperative gains? Experimental evidence from rural Uganda, *World Development*, 39, 4, 569–578.
10. Khera, Reetika and Nandini Nayak, 2009, Women workers and perceptions of the National Rural Employment Guarantee Act in India, Paper presented at the FAO-IFAD-ILO Workshop on Gaps, trends and current research in gender dimensions of agricultural and rural employment: differentiated pathways out of poverty Rome, 31 March - 2 April
11. Mas, Alexandre, Enrico Moretti, 2009, Peers at Work, *American Economic Review*, 99, 112-145
12. Peters, E. H., A. N. Unur, J. Clark and William D. Schulze 2004, Free-Riding

and the Provision of Public Goods in the Family: A Laboratory Experiment, *International Economic Review*, 45 (1): 283-299.