"Who gets the job referral? Evidence from a social networks experiment"
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Online Appendix

A1. Description of the Puzzles

Appendix Figure 1 gives some additional detail on the cognitive task which is the central measurement in this paper. Each subject in our treatment completed one of two similar sets of four puzzles; one of those sets is presented in Appendix Figure 1, with initial conditions in the first column and suggested solutions in the second. Puzzle A gave the subject four swatches of each of four colors and asked the respondent to arrange them so that exactly one of each color was in each row and each column. Puzzle B repeated this request, but began with the diagonal set as presented in the figure. That is, the subject had to again make sure that one of each color was in each row and each column, but had to do so in a way which did not disturb the diagonal. Puzzle C changed the rules slightly: respondents were again given four swatches each of four different colors, but this time were asked to make sure that each row and column contained either two or zero of each color in each row and each column. Moreover, the puzzle began with four corners set as the same color, and the respondents were told they must keep those four corners untouched in their solution. Finally, Puzzle D had the most complex rules. Subjects were given 9 swatches: four each of two colors and one of the third. The rules in this puzzle were different for each color: For the first color (with four swatches), the rule was that swatches of that color could not border any other swatches of the same color, and it was explained that bordering could mean touching on a horizontal edge, a vertical edge, or across a corner. For the second color (also with four swatches), the rule was that the swatches of that color must border exactly two swatches of the same color. For the final color, with only a single swatch, they were told it was free and could be placed anywhere. The solution to this puzzle is unique, and presented here.

A2. OP and Referral test scores

Cognitive test scores represent both the primary dependent variable in our paper and the primary dimension of stratification. In this section, we provide descriptive evidence on the distributions of test scores which go beyond the mean comparisons presented in the main paper.

Just as in the primary analysis, a first question is how the distribution of OP ability compares to that of Referral ability in each treatment. Appendix Figure 2 provides additional detail on the densities of OP and Referral test scores, by treatment type. Each panel presents a kernel density estimate of the distribution of test scores for a different treatment group. In most treatment groups, OP ability dominated referral ability, consistent with the discussion in the text that the OPs did not in practice bring in higher

ability referrals. The exception to this trend is the high stakes, performance pay treatment, where referral ability dominates OP ability.

Much of the analysis in the paper was devoted to understanding the correlation between OP ability and referral ability, by treatment type. Appendix Figure 3 presents this correlation graphically, showing kernel-weighted local polynomial regressions of Referral test scores on OP test scores separately for OPs in fixed fee and performance payment treatments. Of course, as the sample consists only of the OPs who chose to return with a referral without any selection correction, some caution must be taken in interpreting this figure. With that caveat, the figure suggests that higher ability OPs tend to bring in higher ability referrals in fixed treatments, though the slope is not very steep. In performance treatments, not only is the slope stronger but lower ability OPs actually bring in referrals who are worse when they are exposed to performance incentives, while higher ability OPs bring in referrals who perform stronger under these incentives. We read these results as consistent with our interpretations throughout the paper: while both high and low ability OPs change their referral choice in response to performance incentives, only high ability OPs do so in a way which yields superior outcomes.

The paper also emphasized the decision to bring in a coworker rather than a relative as a tradeoff between social incentives and employer incentives. A natural question is whether coworkers are actually better at the puzzle task than relatives, on average. The ideal data to show whether coworkers dominate referrals would have information on each OPs' entire network, including his coworkers and referrals. We only observe the ability of their preferred referral, which we argue is the result of an optimization problem. As a result, a relative who is referred by an OP in the performance treatments in particular may be systematically different from a 'representative' relative in the OP's network. He may be a particularly high ability relative (an anomaly) or he may give such a high social return that it is worth referring him despite the loss in performance pay. These two scenarios have different predictions for the referral's performance. Therefore we focus on OPs in the fixed treatments. This is still not the perfect sample, since according to the model these individuals were selected based on their social transfer, but it is the most appropriate data we have available to answer the question of whether coworkers' performance dominate that of relatives. Appendix Figure 4 shows the distribution of performance by referrals in the fixed treatments, by the OP's ability estimated through a kernel-weighted local polynomial regression.

For high ability OPs (roughly those with a test score greater than 0), coworkers outperform relatives. Interestingly, low ability OPs recruit coworkers who perform worse than relatives. This pattern is consistent with the results in Tables 4 and 5 and Appendix figure 3: though both high and low ability OPs in performance pay treatments respond to treatment by bringing in more coworkers, only high ability OPs in performance pay treatments bring in referrals who actually perform better.

We should also note that given that relatives and coworkers are both a relatively small fraction of the total sample, the shift from relatives to coworkers only serves as an example of the tradeoff between transfers and performance, and an example of how OPs are changing their recruitment strategies in response to incentives. OPs are surely using additional strategies in order to recruit better performing referrals. For example, 61% of OPs bring in 'friends'. Estimates from a regression similar to that in Table 5 restricted only to OPs who brought in friends also show that high ability OPs in performance pay treatments bring in friends who perform better. This regression is of course imperfect, since it is conditional on an endogenous variable, but it is still suggestive that OPs are selecting better referrals along other dimensions. Thus, the coworker / relative result is just one example of the types of tradeoffs OPs face but is not the only change driving the performance results.

A3. Additional Results

Specification

Appendix Table 1 repeats the full sample OLS estimation, where the outcome variable is an indicator for having brought in either a coworker (columns 1 and 2) or a relative (columns 3 and 4). The interpretation is somewhat different in this case than in the similar analysis on puzzle performance (i.e. columns (4)-(6) of Table 5): the outcome variable is coded as a zero whenever an OP fails to make a referral. Thus, an OP who does not make a referral will be coded as having brought in neither a coworker nor a relative. We note that the specification is less intuitive than in the case of puzzle performance. Consider performance pay: if people are choosing not to participate rationally, we may anticipate people who return to expect their referrals to perform more strongly than people who do not. It is less clear what we should anticipate in terms of their social tradeoffs and optimal relationship choice. Nonetheless, an advantage of this specification is that the variation used is truly random. The coworker result maintains statistical significance. That is, if an individual is given performance pay, they are more likely to return with a coworker than to return with someone else or not return. The relative result remains similar in magnitude, but is no longer quite statistically significant at conventional thresholds.

Appendix Table 2 addresses the potential concern that rainfall on a laboratory day is likely correlated with temperature in the lab, which may pose a distraction and affect puzzle performance. To address this, we repeat the estimation of Table 5, but include as an additional covariate the mean temperature on the referral day. Results including this control variable are extremely similar in magnitude and precision to the main results of Table 5.

Identifying Good Referrals

Appendix Table 3 presents simple correlations between various covariates and performance on the puzzle task, restricting the sample to OPs (who are not endogenously selected). OPs who score well on Ravens tests and Digit Span tests tend to perform more strongly on the puzzle task, as do younger OPs, better educated OPs, and poorer OPs. We note that these groups do overlap to a large degree.
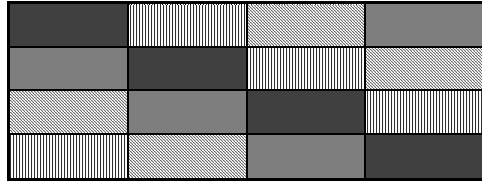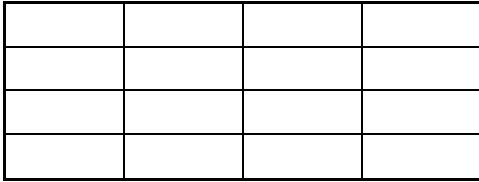
Given that a number of covariates can predict performance on the puzzle task, Appendix Table 4 asks how strongly they predict the performance premium documented in Table 5 for high ability workers in the high stakes performance pay treatment. Column (1) of Appendix Table 4 repeats the main analysis of Table 5, restricting the sample to those for whom we have responses to all of the referral characteristic variables. Results are extremely similar to the main specification. Column (2) then adds in a number of potential explanatory variables, including those which could be easily observed on a resume (indicators for 5 year age group, occupation, and education level) and those which are not typically included in resumes but could be assessed in a screening questionnaire (Ravens tests, Digit Span tests, and referral income). Controlling for these characteristics do not explain the performance premium – results maintain precision and the coefficient of interest actually rises slightly. We note that we considered alternate specifications, including a broad variety of variables in our data set and alternate inclusion/exclusion restrictions of variables, and we could not identify variables which substantially changed the performance premium.
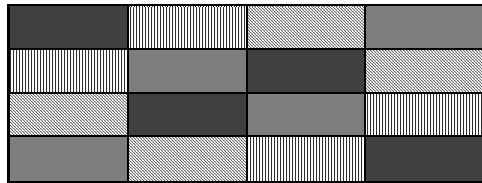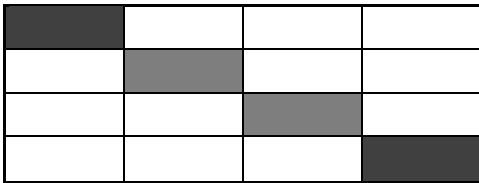
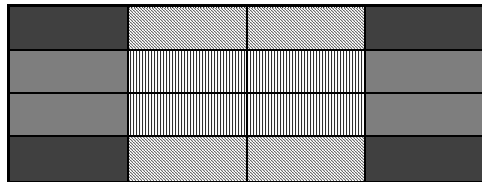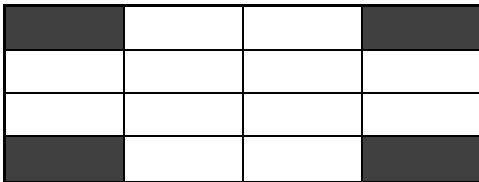ONLINE APPENDIX FIGURE 1: PUZZLES

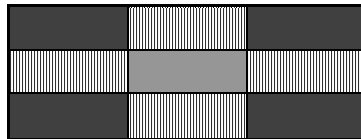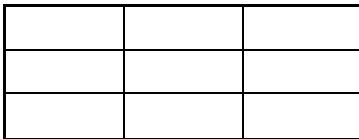| Initial Setup | Proposed Solution |

Puzzle A

Puzzle B

Puzzle C

Puzzle D

ONLINE APPENDIX FIGURE 2: DENSITIES OF TEST SCORES

High Fixed Payment

Low Fixed Payment

Very Low Fixed Payment

High Performance Payment

Low Performance Payment
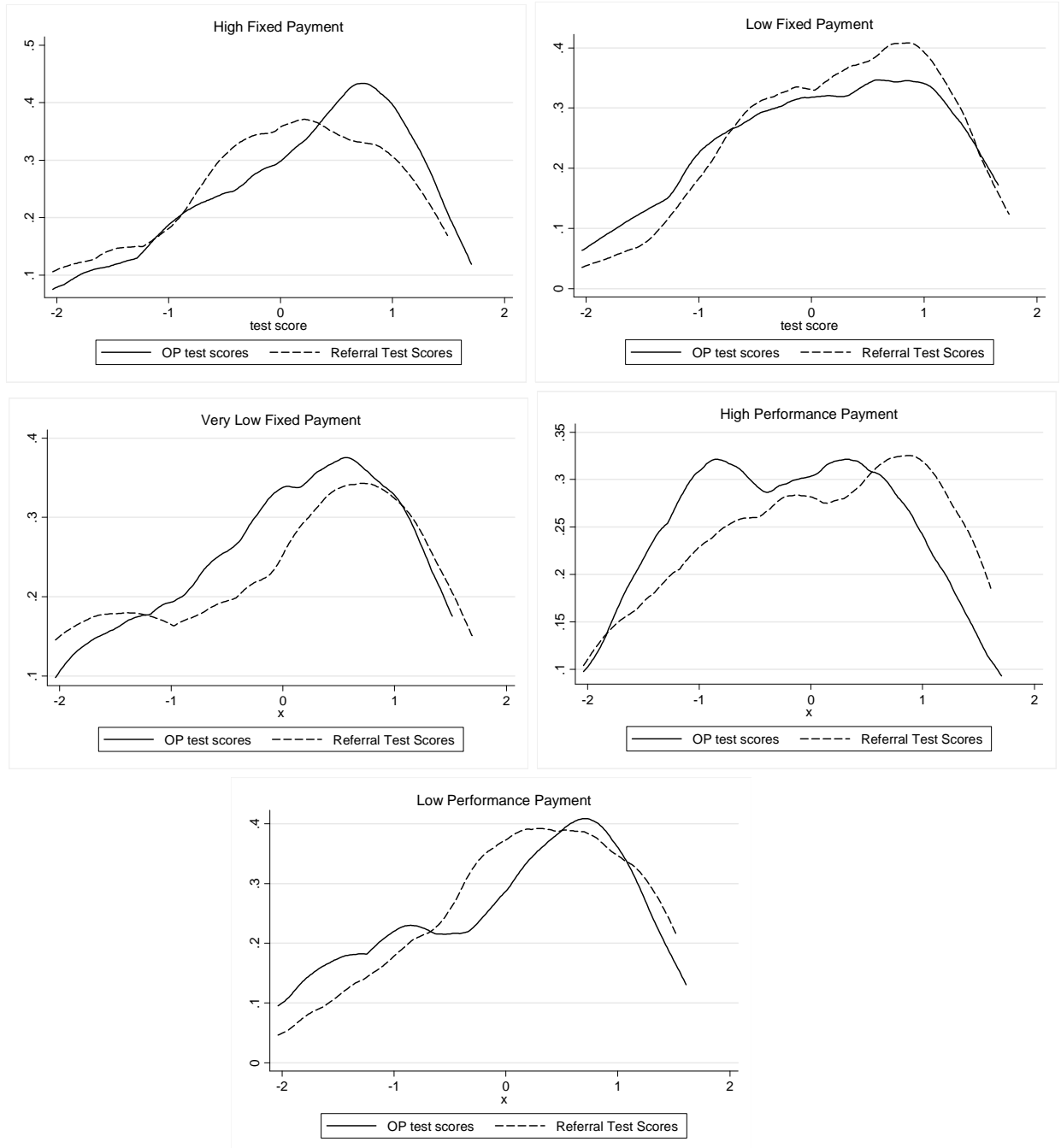
ONLINE APPENDIX FIGURE 3: RELATIONSHIP
BETWEEN OP AND REFERRAL TEST SCORES
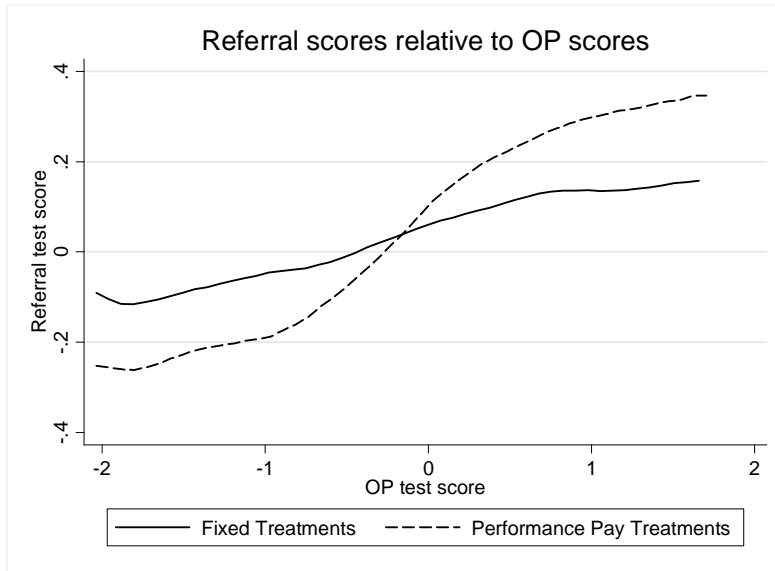
ONLINE APPENDIX FIGURE 4: RELATIONSHIP BETWEEN
OP AND REFERRAL TEST SCORES, COWORKERS AND
RELATIVES
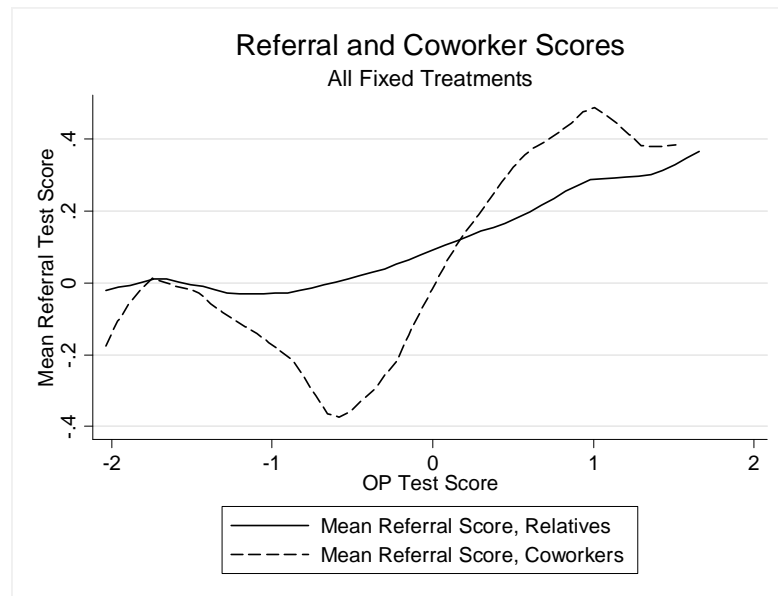
Online Appendix Table 1: Relationship between OP and Referral Specification Check

	OLS Full Sample			
	Co-worker		Relative	
	(1)	(2)	(3)	(4)
Number of Days with Rainfall during OP's Referral Cycle				
Rainfall on OP Arrival Day				
OP Test Score * High Perf Pay		0.049		0.019
		(0.030)		(0.031)
OP Test Score * Low Perf Pay		0.040		-0.012
		(0.031)		(0.033)
OP Test Score		-0.012		0.000
		(0.018)		(0.018)
OP Treatment: High Perf Pay	0.056 *	0.062 **	-0.048	-0.044
	(0.029)	(0.030)	(0.030)	(0.031)
OP Treatment: Low Perf Pay	0.006	0.004	0.039	0.039
	(0.032)	(0.032)	(0.033)	(0.033)
N	561	561	561	561
Mean of Dep Var for Excluded Group	0.099		0.113	
SD	0.300		0.318	

Notes

1 OPs, or Original Participants, are the respondents who were recruited door-to-door.

2 The excluded category is the fixed fee performance treatments.

3 Relative and co-worker are dummy variables indicating the relationship between the Original Participant and the referral. All columns use the the full cognitive treatment sample and OPs who did not bring in a referral are recorded as not having brought in a Co-worker nor a Relative.

4 All columns include additional covariates as described in Table 2, and OP Test Score is defined in Table 2.

Online Appendix Table 2: Cognitive Ability Task Performance Robustness

	Selection Model		
	(1)	(2)	(3)
OP Test Score * Cog High Perf Pay			0.382 **
			(0.173)
OP Test Score * Cog Low Perf Pay			0.092
			(0.151)
OP Test Score		0.164 **	0.036
		(0.080)	(0.085)
OP Treatment: Cog High Perf Pay	-0.146	-0.116	-0.090
	(0.173)	(0.167)	(0.142)
OP Treatment: Cog Low Perf Pay	0.046	0.053	0.056
	(0.190)	(0.183)	(0.156)
Sample	COG	COG	COG
N	561	561	561
Chi2 statistic: joint test of rainfall variables	12.684	13.403	13.012
Mills: Coefficient	1.489	1.442	1.226
Mills: SE	0.639	0.591	0.481
N Censored Obs	155	155	155

Notes

1 Temperature on day the referral performed the cognitive ability task is also included in specifications (1)-(3), in addition to OP characteristics as defined in Table 2. OP Test Score is defined in Table 2.

Online Appendix Table 3: Other Referral Characteristics

	Raven Test		Digit Span Test		Age		Education		Ln Income	
	(1)		(2)		(3)		(4)		(5)	
Referral Puzzle Performance	0.253	***	1.271	***	-1.263	***	0.762	***	-0.375	**
	(0.047)		(0.186)		(0.397)		(0.165)		(0.150)	
N	401		401		401		401		401	
Mean	2.07		12.11		27.41		9.04		7.12	
SD	(0.99)		(3.70)		(9.29)		(3.41)		(2.35)	

Notes

1 The dependent variable is the variable described in the column heading, and the independent variable is referral puzzle performance as previously described in Table 5. Coefficients and standard errors are from OLS.

2 The Raven Test measure is on a scale of 1 to 3, capturing the number of patterns identified correctly. The Digit Span Test measure is the number of series repeated correctly. Each respondent did two trials for the Digits Forward Game and two trials of the Digits Backward Game. The maximum correct score is 32. The mean and standard deviation of each dependent variable among the referral sample is also included.

Online Appendix Table 4: Puzzle Performance with Referral Characteristics

	(1)		(2)	
OP Test Score * High Perf Pay	0.375	**	0.379	***
	(0.158)		(0.142)	
OP Test Score * Low Perf Pay	0.083		0.220	*
	(0.140)		(0.126)	
OP Test Score	0.028		-0.058	
	(0.079)		(0.072)	
OP Treatment: High Perf Pay	-0.094		-0.119	
	(0.131)		(0.115)	
OP Treatment: Low Perf Pay	0.060		0.061	
	(0.147)		(0.133)	
Referral's Ravens Test Score			0.154	***
			(0.052)	
Referral's Digit Span Score			0.060	***
			(0.013)	
Ln Referral Income			-0.039	
			(0.038)	
N	553		553	
Referral Controls	NO		YES	
Chi^2 statistic: joint test of rainfall variables	13.366		13.366	
N Censored Obs	155		155	

Notes

1 OPs, or Original Participants, are the respondents who were recruited door-to-door.

2 All specifications use the Heckman selection model. The dependent variable is referral performance as discussed in Table 5. Also included are individual characteristics of the Original Participant, as defined in Table 2. OP Test Score is defined in Table 2.

3 Resume controls include the following characteristics of the referral: (i) indicators for 5 year age groups; (ii) indicators for each educational level and (iii) occupation code. Ln Referral Income is the ln of (referral income+1).