On Uneven Expected Earnings in the Lab

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ABSTRACT

We discuss ways to cope with uneven expected lab earnings that are the likely results of role assignments. We identify three problems associated with uneven earnings in the lab: of social preferences, of low marginal return for effort, and of perceived deception. Mining the opinions of respondents from the Economic Science Association's (ESA) discussion list, the literature, and drawing on our own experience, we present five responses experimenters can use to mitigate the three problems. We discuss the merits and drawbacks of each strategy.

Keywords: uneven expected lab earnings; social preferences; preferences
JEL classification: B41, C91, C92

1. INTRODUCTION

In Wong, Ortmann, Motta & Zhang (2013), our parameters, which we had tried to calibrate from real-world data, left principals with significantly higher expected earnings than agents. These differences in earnings potential appeared to have triggered social preferences in our *pilot* experiment, as agents rejected over 30 percent of principals' take-it-or-leave-it performance-based contracts. Though high rejection rates are well documented for some classes of experiments such as ultimatum games (e.g., Camerer 2003), and social preferences seem reflected in many experimental results (see Falk & Kosfeld, 2006; Fehr, Klein & Schmidt, 2007; but see Cherry et al., 2002, Bekkers, 2007, and Ziegelmeyer et al., 2012), the principals and agents in our experiment represented organizational entities. Since we believe organizational entities are, for the most part, less likely to have social preferences than individual decision-makers, we wanted to minimize the impact of that confound.

Below we enumerate and outline ways to cope with (highly) uneven expected lab earnings that are the likely results of role assignments. To this end, we provide three reasons why uneven earnings might be a problem (Section 2), and, mining the opinions of respondents from the Economic Science Association's (ESA) discussion list, present five strategies experimenters can use to overcome these problems (Section 3).

2. THREE PROBLEMS WITH UNEVEN EXPECTED EARNINGS

Highly uneven earnings resulting from prior role assignment can be problematic for three reasons: First, social preferences might confound the results of the experiment. Second, low marginal return for making good decisions can lead to motivational issues. Finally, low actual earnings might be considered deception by subjects, which can cause reputational problems for the lab.

1. Social Preferences can confound experimental results

Depending on the experimenter's research question, it might be desirable to remove or alter design features that can elicit social preferences. Relevant types of experiments are: contract design experiments, where competing instruments are compared to test their relative performance; market experiments, where the experimenter wishes to verify whether markets behave in line with the law of supply and demand; and experiments where subjects act as organizational entities, as organizational entities are arguably less motivated by social preferences than individual decision-makers.

To illustrate why social preferences can confound the results of the experiment, suppose an experimenter wanted to compare two take-it-or-leave-it contracts, contract A and contract B.

Due to the specific design of the contracts (owing to, for example, the use of calibrated parameters), principals are likely to earn on average 10 times more experimental currency units (ECU) than agents in contract A. Suppose that in the experiment, contract B outperforms contract A, as agents reject contract A more often than contract B and principals offer contract B more often than contract A. The experimenter is thus left with a puzzle. Did contract B outperform contract A due to an inferior design feature in contract A, or due to principals' and agents' aversion to payoff asymmetry? If the experimenter is concerned about testing the mechanics of the contracts, then altering the design of the experiment to minimize behaviour that is driven by social preferences might be the ideal strategy.

2. <u>The low marginal returns can lead to motivational problems</u>

It is well-documented in the literature that low-powered financial incentives can lead to motivational issues and/or poorer decision-making in the laboratory (e.g., Hertwig & Ortmann 2001; Parco et al., 2002; Holt & Laury, 2002; Gneezy & Rustichini 2000). In Gneezy & Rustichini's (2000) experiment, subjects were either paid 0 New Israeli shekel (NIS), NIS0.1, NIS1 or NIS3 for every IQ question (out of 50) they answered correctly[1]. Subjects who received low-powered incentives (NIS0.1) performed worse than those who received no incentives, answering on average 23 questions correctly in the NIS0.1 treatment and 28 questions correctly in the no incentive treatment (NIS0). This led the authors to conclude that experimenters should "pay [their subjects] enough or don't pay at all". When Rydval & Ortmann (2004) reanalyzed the Gneezy & Rustichini (2000) data, they found that poor performance in the NIS0.1 treatment was driven by the 20 percent of subjects who answered all IQ questions incorrectly. This led the authors to conjecture that "insultingly low" compensation can cause some subjects to sabotage the experiment.

These findings speak to the issue of uneven payoffs in the laboratory. Namely, if the expected marginal return on decision-making is considerably lower for one group of subjects than the other – owing to highly uneven payoffs resulting from prior role assignment – the group with the lower expected marginal return might intentionally misbehave[2].

3. <u>Low actual earnings might be considered deception by subjects, and can lead to reputational issues for the laboratory</u>

[1] The exchange rate was 3.5 NIS (New Israeli Shekel) to $US1 at the time of the experiment.

[2] If the two groups of subjects had the same expected earnings, but ended up with considerably different realized earnings, low marginal incentives are less likely to be an issue. Low marginal returns are likely to be an issue when the two groups of subjects have different expected earnings, where one is considerably lower than the other.

Low earnings can affect the reputation of the laboratory, as subjects who earn considerably less than the advertised, average payout may feel "burned" or deceived by the experimenter. It is reasonably well documented that deception – intentional or unintentional – can bring about significant costs. It can, for example, discourage people from returning to the laboratory, which may induce selection problems. It can also affect participants' affectively and cognitively, which may create suspicions and influence subjects' performance (Ortmann & Hertwig, 2002; Hertwig & Ortmann, 2008).

An important issue is whether subjects understand that the advertised, average payout accounts for potential systematic differences in earnings due to role assignments[3]. For example, suppose the promised average payoff is $20, but the experimenter anticipates that one role would earn on average $10, and the other, $30. One could argue that an announcement such as "Your expected average earnings will be $20" in a recruiting e-mail is not deception by commission, however participants might construe it as deception by omission, which could trigger reactions that, at the minimum, are likely to induce more noise in the data (as suggest by the empirical analysis in Ortmann & Hertwig, 2002.)

3. FIVE RESPONSES TO UNEVEN EXPECTED EARNINGS

Due to the calibrations employed in Wong et al. (2013), we faced the three problems associated with uneven earnings. Mining the opinions of respondents from the ESA discussion list, the literature, and drawing on our own experience, we discuss five responses experimenters can use to mitigate the three problems (Table 3.1)[4]. For each response, subjects are always informed about their own exchange rate.

1. Pay potentially unequal earnings to subjects in their respective roles using the same exchange rate..
2. Pay roughly equal earnings using different exchange rates. Do not tell subjects.

[3] One respondent from the ESA discussion list suggested that as long as the average earnings are equal to what was promised, asymmetric earnings are not an issue. We disagree because it might affect effort, induce social (or anti-social) preferences, and could trigger perceptions of deception.

[4] One respondent from the ESA discussion list suggested rotating agents' and principals' roles in the experiment, and then randomly paying out one of the periods. Expected earnings would thus roughly equalize. Where such rotation is feasible and/or desirable, this strategy offers an easy way out. It was neither feasible nor desirable in Wong et al. (2013) due to the complexity of the experiment, and thus the time it would take to understand the experimental environment..

Another respondent suggested replacing one role with a computer in one treatment, and replacing the other role with a computer in another treatment. Indeed the problem of social preferences is automatically resolved if a computer plays out one role. However using a computerised agent might induce different behaviour in subjects (e.g., see Johnson et al., 2002).

3. Pay roughly equal earnings using different exchange rates. Tell subjects that different exchange rates were used to roughly equalise final earnings, but do not disclose the actual exchange rates.
4. Pay roughly equal earnings by using different exchange rates. Tell subjects that different exchange rates were used, and disclose the exact exchange rates.
5. Vary the number of periods that are drawn for actual payment, depending on what role subjects are randomly assigned to.

TABLE 3.1: FIVE RESPONSES

<table>
<tr><th colspan="2"></th><th>EVEN EXCHANGE RATES</th><th>UNEVEN EXCHANGE RATES</th></tr>
<tr><td>PRIVATE INFORMATION</td><td>Do not disclose exchange rates</td><td rowspan="3">Response 1</td><td>Response 2</td></tr>
<tr><td rowspan="2">PUBLIC INFORMATION
Tell subjects that uneven exchange rates were used</td><td>Do not disclose exchange rates</td><td>Response 3</td></tr>
<tr><td>Disclose exchange rates</td><td>Response 4</td></tr>
<tr><td>PUBLIC INFORMATION</td><td>Vary the number of periods that are drawn for actual payment</td><td>Response 5</td><td></td></tr>
</table>

1. <u>Pay potentially unequal earnings to subjects in their respective roles ("even exchange rates – Response 1")</u>

In Response 1, all subjects have the same exchange rate. About half the ESA discussion list respondents (6 out of 11) recommended paying potentially unequal earnings to subjects in their respective roles, conditional on the experimenter stressing that roles were "randomly assigned" and earnings can "differ dramatically". This response does not allay the three problems presented in Section 2 – of social preferences, low marginal return, and deception – and so in our opinion is not an adequate solution.[5] We thus propose that if uneven earnings, resulting from role assignment, are likely to lead to the three problems (or a subset thereof) described in Section 2, and if the cost of modifying the expected earnings is small, the experimenter should try to equalise expected earnings roughly in line with the advertised, promised earnings.

[5] Whether subjects are being told about it (i.e., whether private or public information about this aspect of the parameterization can make a difference) is an interesting question . One could for example conjecture that public information could elicit stronger social preferences.

2. Pay roughly equal earnings using different exchange rates. Do not tell subjects ("Response 2").

In Response 2, subjects are told their own exchange rates. However, they do not know other subjects' exchange rate, nor are they told that exchange rates are different depending on which role they were assigned to. The issues of low marginal return and deception are attenuated (though may still exist) when principals and agents are paid roughly equal earnings using different exchange rates[6]. However the problem of social preferences still exists if subjects assume, by default, that exchange rates are symmetric for principals and agents.

Using the default assumption of exchange-rate symmetry, agents who are motivated by fairness would reject a take-it-or-leave-it contract that give them X ECUs and principals more than X ECUs, because they believe that unequal experimental ECUs correspond to unequal earnings. Principals who are fair-minded would offer a contract that equalizes ECUs, as they also believe that equal ECUs correspond to equal earnings. Principals who are money maximising and believe that most agents are fair minded would also offer a contract that equalizes ECUs, as they expect fair-minded agents to reject "unfair" contract offers. Depending on subjects' beliefs about the distribution of types in the experiment, the number of "fair" contract offers, on the basis of experimental units, might thus be artificially high due to the parameters employed in the experiment. Similarly, the rejection rate might be artificially high if principals, by design of the experiment, earned on average substantially more experimental units than agents. The experimenter would consequently find it difficult to disentangle whether the results of the experiment was due to a design feature of the *contract*, or due to a design feature of the *experiment*.

3. Pay roughly equal earnings using different exchange rates. Tell subjects that different exchange rates were used to roughly equalise final earnings, but do not disclose the actual exchange rates ("Response 3").

In Response 3, subjects are told their own exchange rates, and are informed that exchange rates are different depending on which role they were assigned to. However, they do not know other subjects' exchange rate. The problems of low marginal return and deception are addressed by paying subjects roughly equal earnings using different exchange rates. The problem of social preferences might also be attenuated if the experimenter disclosed that different exchange rates were used to roughly equalise final earnings; however, its

[6] Note that not informing subjects that different exchange rates are being used might be considered deception by omission.

effectiveness depends on subjects' beliefs on the distribution of types, exchange rates, and the experimenter's ability to roughly equalise earnings through uneven exchange rates.

For instance, suppose principals and agents have asymmetric beliefs about the exchange rates. A fair-minded principal might conjecture that her exchange rate is two times greater than the agent's, and so designs the contract to ensure that she earns a net payoff of 2X EUs, and the agent X EUs. Now suppose the fair-minded agent believes his exchange rate is three times greater than the principal's. He subsequently rejects the contract that was offered by the principal, as he is averse to payoff inequality. However if subjects trust that the experimenter constructed the exchange rate such that expected payoffs roughly equalised, they should not alter their behaviour in an attempt to obtain fairer payoffs.

Example: Comparison of Responses 2 and 3

We draw upon our experience in Wong et al. (2013) to compare Responses 2 and 3. In the experiment, principals (i.e. governments) could offer agents (i.e. not-for-profits) one of two contracts, contract A and contract B[7], which replicated real life not-for-profit contracts. Due to the calibrations we employed, in contract A, agents earned 200 experimental units (EUs) when they accepted and complied with the principal's desired effort levels, while principals could earn up to 1820 EUs. If exchange rates were the same for agents and principals, say at 200 EUs = $1, agents would earn $1 per period whereas principals could earn up to $9.10 per period. We were thus concerned that low payoffs would elicit motivation and/or reputation problems for the laboratory, and so designed the exchange rate to roughly equalize payoffs for principals and agents.

To mitigate potential motivation and reputation issues, in our first pilot experiment we applied uneven exchange rates for principals and agents, and did not tell subjects that the exchange rates were uneven (i.e., Response 2). Subjects, however, knew their own exchange rates. Principals' exchange rate was set at 200EU = $1, agents' exchange rate was set at 60EU = $1, and agents earned 100EU if they accepted contract A (refer to Table 3.2). Since agents earned $1.67 per round for accepting contract A (i.e., 100/60), we conjectured that our high financial incentives would crowd out concerns for fairness. However only 46.7 percent of all offers were contract A offers, and 32 percent of contract A offers were rejected.

We then altered the experimenter's script in a subsequent pilot (and the actual experiment) to inform subjects that uneven exchange rates were used (i.e. Response 3). Specifically, we

[7] Contract A was a social impact bond contract; contract B was a performance-based contract. Refer to the paper for more details.

added to the script: "Note that the experimental currency exchange rate is different depending on what role you have been randomly assigned. We did this so that the expected earnings… are not too dissimilar". We also changed agents' exchange rate to 100 points = $1, and increased the earnings to 200EU if agents accepted contract A (refer to Table 3.2)[8]. As such, agents earned $2.00 per period for accepting contract A (i.e., 200/100). These changes resulted in a large shift in behaviour – in our experiment, 63.5 per cent of all contract offers were contract A offers, and the rejection rate of contract A more than halved to 12.5 per cent.

TABLE 3.2: EXPERIMENTAL DESIGN AND RESULTS OF WONG ET AL. (2013)

	Response 2 **Pilot (1)**	**Response 3** **Pilot (2) and actual experiment**
Script	-	Added: "Note that the experimental currency exchange rate is different depending on what role you were randomly assigned. We did this so that the expected earnings … are not too dissimilar."
Nrof Periods	10	8
Nr of Subjects	12	72
Principals' Exchange rate	200 EU = $1	200 EU = $1
Agents' Exchange Rate	60 EU= $1	100 EU = $1
Points if Accept	100 EU ($1.67)	200 EU ($2)
Proportion of A offers	46.7 percent (32 out of 60 contract offers)	63.5 percent (183 out of 288 contract offers)
Rejection rate of A	32.0 percent	12.5 percent

A smaller proportion of principals offered contract A and a higher proportion of agents rejected it when uneven exchange rates were announced (Response 3). The findings suggest that (1) some subjects will assume, by default, that exchange rates are even; (2) high financial incentives might not be enough to crowd out concerns for fairness; and (3) informing subjects that exchange rates are uneven to ensure that payoffs are not too dissimilar can make it difficult for subjects to determine what "fair" and "unfair" contract offers are, which can also make it difficult for them to behave in line with their social preferences.

In spite of the relative merit of this approach, announcing that the exchange rates were altered so that earnings between the two groups would not be too dissimilar has drawbacks. In particular, it may elicit experimenter demand effects (e.g. see Ortmann 2005; Zizzo, 2010).

[8] We cannot strictly compare the results of the pilot and actual experiment, since principals' and agents' exchange rates were different across the two. We made these changes because we reduced the number of rounds from 10 in the pilot experiment, to 8 in the actual experiment due to time constraints. As there were 10 periods in the pilot experiment, and 8 periods in the actual experiment, we changed the exchange rates such that if principals always offered contract A and agents always accepted it, agents would earn roughly $27 and $26 in the pilot and actual experiment respectively, including the show-up fee of $10. The final expected earnings would thus roughly be the same across the actual and pilot experiment.

For example, it might elicit fairer decisions because the formulation of the script might have suggested that it was expected. However, it could also elicit unfair decisions because subjects might expect that exchange rates, at any case, were adjusted to compensate for differences in earnings. Subjects might also respond to the announcement by exerting less effort because they expect the experimenter to compensate for earnings differences.

4. Pay roughly equal earnings by using different exchange rates. Tell subjects that different exchange rates were used. Disclose the exact exchange rates ("Response 4")[9].

Disclosing principals' and agents' exchange rates does not mitigate the problem of social preferences, as shown in Kagel, Kim & Moser's (1996) experiment. Kagel et al. (1996) used an ultimatum game to test whether using uneven exchange rates, and altering the level of information subjects had about the exchange rate, affected behaviour in the laboratory. In their ultimatum game, proposers were endowed with 100 ECU, from which they could offer any integer number of ECUs between 0 and 100 to the responder. If the responder accepted the offer, she kept the offered ECUs while the proposer kept the residual. If the responder rejected the offer, both players received zero ECUs. Assuming subjects are money maximising, the theoretic prediction is for responders to accept any offer that yields a positive payoff, and for proposers to offer responders the lowest, positive integer number of ECUs possible, regardless of the exchange rate (i.e., 1 ECU).

The design features and results of Kagel et al. (1996) are presented in Table 3.3. The exchange rate was either 1 ECU = \$0.1 or \$0.3. Subjects had different information about the exchange rate. The figures show the average proposer and responder split in terms of ECU and monetary payoffs.

TABLE 3.3: EXPERIMENTAL DESIGN AND RESULTS OF KAGEL ET AL. (1996).

	Private treatment (1) Principal knows both exchange rates. Responder only knows her exchange rate.	**Private treatment (2)** Principals only know his exchange rates. Responder knows both exchange rates.	**Public Treatment** Both know exchange rates.
Proposer (1ECU = 0.1) Responder (1ECU = 0.3)	Proposer: 68.6; \$0.69 Responder: 31.4ECU; \$0.94	Proposer: 70.3ECU; \$0.70 Responder: 29.7ECU;	Proposer: 74.9ECU; \$0.75 Responder: 25.1ECU; \$0.75

[9] A respondent from the ESA forum suggested to increase the earnings of the agent (or subject with the lower expected earnings) X-times after the experiment. Depending on how this is actually implemented in the laboratory, that is, whether it is kept private information, or publicly announced before the experiment commences, whether the multiplying factor is disclosed, the consequences are akin to the consequences associated with Responses 2, 3 and 4 respectively.

		\$0.89	
Proposer (1ECU = 0.3) Responder (1ECU = 0.1)	Proposer: 53.1ECU; \$1.59 Responder: 46.9 ECU; \$0.47	Proposer: 54.3ECU; \$1.63 Responder: 45.7ECU; \$0.46	Proposer: 36.3ECU; \$1.09 Responder: 63.7 ECU; \$0.64

The results suggest that when proposers had perfect information while responders did not, a portion of proposers manipulated the offer to align with their self-serving definition of fairness (see also Dana et al., 2007; Rodriguez-Lara & Garrido, 2012). Namely, in the private treatments when proposers had the lower exchange rate (1 chip = 0.1), they made offers that equalised final chips. When they had the higher exchange rate (1 chip = 0.3), they made offers that more closely resembled equalised payoffs. In the public treatment, they made "fairer" offers in terms of final payoffs only when the proposer had the lower exchange rate[10].

The implication from Kagel et al.'s (2006) study is clear – if the experimenter's aim is to minimise social preferences from informing (or confounding) the results of the experiment, then disclosing the exact exchange rates, especially when they are uneven, is not advisable.

5. Vary the number of periods that are drawn for actual payment, depending on what role subjects are randomly assigned to ("Response 5").

Adopting this response involves the experimenter announcing that the number of periods from which final earnings are based on will differ depending on what role subjects were randomly assigned to. For example, suppose there are 10 periods in the experiment. Role 1's payoffs are expected to be twice as large as role 2's. Therefore to equalize final expected earnings, the experimenter announces that X periods out of the 10 will be paid out for subjects in role 1, whereas 2X periods will be paid out for subjects in role 2.

To the best of our knowledge, the effect of this response on subjects' behavior has not been tested in a laboratory environment. We conjecture, however, that the extent to which it can allay the three problems that we identified as a consequence of uneven expected earnings depends on the level (and timing) of information that is revealed to subjects about how final earnings are calculated. Suppose, for example, the experimenter announces at the beginning of the experiment that earnings for subjects in role 1 are based on 3 periods, whereas earnings for subjects in role 2 are based on 6 periods. Subjects might respond to this announcement by changing their behavior *across* periods in an attempt to equalize final earnings. Now suppose

[10] Kagel et al. (2006) do not have a baseline treatment, where subjects have the same, public exchange rate. Thus, we do not know whether, and how exactly, behaviour changes when exchange rates are public and asymmetric and when they are public and symmetric.

the experimenter informs subjects that, to ensure average earnings are roughly equal for both roles, the number of periods on which earnings are based on will be determined once the experiment concludes. As in Response 3, subjects might respond by exerting less effort, as they expect the experimenter to compensate for earnings differences. Suppose next the experimenter announces that the number of periods on which payments are based have already been set, and will be revealed at the end of the experiment. We conjecture that subjects in this scenario are less likely to exercise social preferences[11].

4. SUMMARY AND FUTURE RESEARCH

This note described three problems associated with uneven expected earnings in laboratory experiments: the problem of social preferences, low marginal return for effort, and deception. In light of our discussion, it seems that for contract design and market experiments, and experiments where subjects act as organizational entities, uneven expected earnings might lead to the three problems identified[12].

Drawing on the opinions of respondents at the ESA discussion forum, the literature, and our own experience, we outlined five responses that can be used to address to the problems associated with uneven expected earnings: 1) Pay potentially unequal earnings to subjects in their respective roles; 2) Pay roughly equal earnings using different exchange rates. Do not tell subjects; 3) Pay roughly equal earnings using different exchange rates. Tell subjects that different exchange rates were used to roughly equalise final earnings, but do not disclose the actual exchange rates; 4) Pay roughly equal earnings using different exchange rates. Tell subjects that different exchange rates were used, and disclose the exact exchange rates; and 5) Vary the number of periods that are drawn for actual payment, depending on what role subjects are randomly assigned to.

About half the respondents from the ESA discussion list (6 out of 11) preferred response 1 to all others – to pay potentially unequal earnings to subjects in their respective roles. Based on our experience and the literature, however, Response 3 appears to most effectively allay the three problems, even though it has limitations, while the effectiveness of Response 5 has yet to be tested. Table 4.1 contains a summary of the responses. YES means that the specific response is likely to address the potential problem.

[11] Another issue with adopting this strategy is that the subject with the higher expected earnings, and thus smaller number of periods that are pay-off relevant, would have a total payoff that is less variable than the other. Risk preferences might thus play a role in decision making, however the effect might not be large enough for it to matter.

[12] Though we focussed our discussion mainly on contract design, normal form games with highly uneven payoffs can create similar problems.

TABLE 4.1: SUMMARY OF THE FIVE RESPONSES

	1. Social preferences	2. Low marginal return	3. Deception
1. Pay potentially unequal earnings to subjects in their respective roles	NO	NO	NO
2. Pay roughly equal earnings using different exchange rates. Do not tell subjects.	NO	YES	Depends – deception by omission YES
3. Pay roughly equal earnings using different exchange rates. Tell subjects that different exchange rates were used to roughly equalise final earnings, but do not disclose the actual exchange rates.	YES, to an extent	YES	YES
4. Pay roughly equal earnings by using different exchange rates. Tell subjects that different exchange rates were used. Disclose the exact exchange rates.	NO	YES	YES
5. Vary the number of periods that are drawn for actual payment, depending on what role subjects are randomly assigned to	Depends on the implementation details of the response		

We have attempted to comprehensively lay out the issues that pertain to uneven expected earnings, and have suggested how to deal with them. We acknowledge that not everyone will agree with our findings and suggestions, and that the optimal response to uneven expected earnings will depend on the specific design of the experiment. We nonetheless argue that the other responses, particularly Response 1, are potentially troubling, and that the experimenter should therefore consider the consequences of adopting them before doing so.

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