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ON THE RELEVANCE AND COMPOSITION OF GIFTS WITHIN THE FIRM: EVIDENCE FROM FIELD EXPERIMENTS*

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We investigate the economic relevance and the composition of gifts within a firm where output is contractible. We develop a structural behavioral model that identifies workers' optimal reaction to monetary gifts received from their employer. We estimate the model using data from two separate field experiments conducted within a tree-planting firm. We use the estimated structural parameters to generalize beyond the experiment, simulating how workers would react to different gifts on the part of the firm, within different labor market settings. We find that gifts have a role to play within this firm, increasing in importance when the workers' outside alternatives deteriorate. Profit-maximizing gifts would increase profits within slack labor markets by up to 10% on average and by up to 17% for certain types of workers.

1. INTRODUCTION

Economists are paying increasing attention to the role that gift giving can play within the firm. Theoretical models (dating to Akerlof, 1982) suggest that gifts induce reciprocal worker effort, implying that gift giving can be part of a firm's personnel policy. Experimental studies (both laboratory and field) have shown that workers do respond to monetary gifts from their employer, at least in the short run, by increasing their productivity (see, for example, Fehr et al., 1993; Gneezy and List, 2006; Bellemare and Shearer, 2009). However, a positive reaction of workers to gifts does not guarantee that gift-giving is a profitable policy option for the firm—the value of marginal effort to the firm may be less than the value of the gift.

Experiments that calculate treatment effects can evaluate profitability only within a specific environment and have provided mixed evidence on this issue (e.g., Fehr et al., 1993; Gneezy and List, 2006).[2] However, experimental gifts are typically chosen by researchers, not the firm. What is more, the lack of profitability of a specific gift, within a specific economic environment, does not rule out the economic relevance of gift-giving in general—other gifts, not observed within a particular experiment, may generate profits.

In this article, we consider the economic return to gift-giving within a tree-planting firm where output is contractible, allowing the firm to pay their workers piece rates. Our econometric analysis is based on field experiments conducted within the firm. We define gifts to be changes in the contract that increase worker utility and are explained to the workers as acts of kindness. We generalize the nonstructural results of Bellemare and Shearer (2009) to investigate whether gifts have an economic role to play within this contracting environment, and if so, under what economic conditions. We also consider the composition of the gift; when output is contractible gifts can be given through base wages and/or increases in the piece rate. We generalize the

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[2] Falk (2007) finds that gift-giving is a profitable device to raise charitable contributions.

definition of a gift to take account of its composition and consider the performance of different types of gifts.

Characterizing the firm's economic return to gifts requires observing (or predicting) the response of workers to different gifts, under different economic conditions. Repeated experiments may not be practical in this regard, particularly in the field. Most experimental work on gifts seeks to isolate the response to the gift from the response to future surpluses within the firm. Consequently, gifts are presented as one-time events (Gneezy and List, 2006), precluding repeated experiments. As well, most field experiments seek to avoid Hawthorne Effects[3] by keeping workers ignorant of the fact that they are participating in an experiment; examples include Gneezy and List (2006) and Bellemare and Shearer (2009). This requires explaining the gift in a manner that is credible to the workers, yet exceptional. Repeating experiments may jeopardize the credibility of these explanations, contaminating the results.[4] Finally, economic (or labor-market) conditions cannot be randomly assigned in typical field (or social) experiments (Heckman and Smith, 1995). This renders impractical the experimental measurement of gift performance in different economic environments.

An alternative approach, taken here, is to exploit the observed behavior within a limited number of experiments to estimate structural behavioral parameters that govern worker responses to gifts. These parameters can then be used to predict the profitability of different gifts under different economic (and labor market) conditions, even those not observed within a particular experiment. Applying structural models to experimental data has been advocated by Heckman and Smith (1995) as a means of permitting generalization. It has been applied to social experiments by Todd and Wolpin (2006) and by Lise et al. (2005) and to firm-level field experiments by Shearer (2004). Our approach is similar to Paarsch and Shearer (2009), who exploit experimental data to analyze the efficiency of piece-rate contracts. We generalize their setting to develop and estimate a structural–behavioral model of gift exchange and reciprocity.

In our model, a worker's effort decision is governed by two key parameters: one measuring the curvature of the cost of effort function and another, a kindness parameter, measuring the worker's response to monetary gifts from the firm. Modeling worker utility as a function of kindness is in the spirit of Rabin's (1993) theoretical work on fairness and reciprocity. We show that optimal gift-giving/piece-rate contracts can be calculated from the knowledge of these parameters and an additional parameter, capturing general working conditions.

We identify our model through a series of field experiments conducted within the tree-planting firm. During the first experiment (which we call "the piece-rate experiment"), the piece rate paid to workers was exogenously increased by between 20% and 28%. The recorded data, containing information on the number of trees each worker planted and the piece rate they received, identifies the curvature of the worker's cost of effort function. During the second experiment (which we denote "the gift experiment"), workers received a monetary gift of $80 (independent of their productivity) from their employer, in addition to their regular piece rate. This represented a substantial amount of money to these workers, approximately 40% of average daily earnings. The recorded data, which contains information on the number of trees planted with and without the gift, identifies the worker's kindness parameter, conditional on the cost of effort.

Our results show that gifts do have a role to play within this firm. Although the experimental gift did not generate a profitable response, other gifts would have been profitable, at least under certain economic conditions. Our analysis points to the importance of the substitutability of piece rates and gifts and crowding out—under economic conditions that lead to low-powered incentives, gifts become more profitable. This is captured in our model by labor-market conditions

[3] If workers know that they are participating in an experiment their behavior may be affected, limiting the generalizeability of the experimental results.

[4] Randomizing gifts within a single experiment can create jealousies among workers within the firm and may be ruled out on principle by firm managers. In Bellemare and Shearer (2009), the firm insisted that the gift be the same to everybody.

that determine piece rates in the absence of gifts. Under slack labor-market conditions, market-clearing piece rates are lower, implying a greater role for gifts within the firm. Moreover, our results indicate that worker sensitivity to the firm's kindness is heterogeneous; approximately one-half of the workers in our sample exhibit no significant preferences for reciprocity.

Our policy analysis concentrates on three questions. First, we consider whether another base-wage gift would have generated a profitable response within the conducted experiment. Here, our results are negative—the explicit incentives provided by the observed piece rate (20 cents per tree) reduce the profitability of base-wage gifts. Second, we ask if a piece-rate gift would have been profitable. In this case, we find that piece-rate gifts would increase firm profits, but only under labor-market conditions that lead to low piece rates in the absence of gifts. Piece-rate gifts are particularly profitable for workers who have strong reciprocal preferences—profit increases can attain 14% for certain workers among this group. Finally, we ask if more general (composite) gifts, including a base wage and a piece rate, would have been profitable. Here, we find that gifts would increase profits per worker by up to 10% on average, and by up to 17% for workers exhibiting strongly reciprocal preferences. In terms of composition, we find that profitable gifts should be provided by setting higher than market clearing piece rates rather than a positive base wage. This is explained in our model by the fact that the workers in our sample respond more strongly to piece-rate gifts than to base wage gifts.

The rest of the article is organized as follows. The next section describes the institutional setting of the tree-planting industry in British Columbia and the firm in which the experiment took place. In Section 3, we describe the experiments. Section 4 presents the economic model. In Section 5, we discuss identification. In Sections 6 and 7, we present the descriptive statistics and the estimation results. Section 8 presents our policy analysis, and Section 9 discusses how worker fatigue and risk aversion may affect our results. Section 10 concludes.

2. TREE PLANTING IN BRITISH COLUMBIA

2.1. *The Industry*. Tree planting is a simple, yet physically exhausting, task. It involves digging a hole with a special shovel, placing a seedling in this hole, and then covering its roots with soil, ensuring that the tree is upright and that the roots are fully covered. The amount of effort required to perform the task depends on the terrain on which the planting is done and weather conditions. Flat plateaux are much easier to plant than steep mountain sides and hard, rocky soil is more difficult to plant than soft terrain.

Tracts of land that have recently been logged are allocated to tree-planting firms through a process of competitive bidding. These auctions typically take place in the autumn of the year preceding the planting season, which generally runs from early spring through to late summer. Planters are paid using piece-rate contracts. Under these contracts, planters are paid in proportion to their output. Generally, no explicit base wage or production standard exists, although firms are governed by minimum-wage laws. Output is measured as the number of trees planted per day.

2.2. *The Firm*. Our experiments were conducted within a medium-sized tree-planting firm that employs approximately 70 planters per year. The planters represent a broad group of individuals, including returning seasonal workers and students working on their summer holidays. They range in age from 19 to 56.

This firm pays its planters piece rates; daily earnings for a planter are determined by the product of the piece rate and the number of trees the planter planted on that day. Blocks to be planted typically contain between 20 and 30 planter-days of work, with some lasting over 100 planter-days. For each block, the firm decides on a piece rate that applies to all planting done on the block. The piece rate for a particular block is set as a function of the labor-market conditions and the planting terrain on that block. Because planting conditions affect the number of trees that workers can plant, blocks for which average conditions are more difficult require higher piece rates to attract planters.

Contracts, comprising a number of blocks in the same geographic area, are planted by crews of workers under a supervisor. Each crew typically has from 10 to 20 planters. All workers planting on the same block receive the same piece rate; no matching of workers to planting conditions occurs. Typically, planters are assigned to plots within a block as they disembark from the ground transportation taking them to the planting site. They also have little contact with other workers during their work day. Thus, to a first approximation, planters were randomly assigned to plots. Identification of our model exploits the exogenous variation induced by two experiments conducted inside this firm.

3. THE FIELD EXPERIMENTS

3.1. *The Piece-Rate Experiment*. The piece-rate experiment took place on three separate blocks, over a three-month period in 2003.[5] During the experiment, each homogeneous block was divided into two parts. One of these parts was then randomly chosen to be planted under the regular piece rate, the other to be planted under the treatment piece rate (equal to the regular piece rate plus five cents). The regular piece rates paid on these blocks were 18 cents and 23 cents, respectively. The treatment piece rates therefore represented an increase of between 21% and 27% above the regular piece rate; 21 planters participated in the piece-rate experiment.

In order to avoid workers interpreting the experimental changes in the piece rate as gifts from the firm, these changes were presented to the workers within the context of the normal daily operations of the firm. To this effect, the firm presented the treatment and control blocks as separate blocks, with separate piece rates.[6] Note that this required spatial separation of the plots to be planted under each piece rate. As such, individual plots could not be randomly assigned to regular and treatment piece rates, but rather half of the block was randomly assigned to regular and half to treatment piece rates.

3.2. *The Gift Experiment*. The gift experiment[7] took place on one homogeneous planting block that was planted over a seven-day period in June 2006. This seven-day period was spread over two weeks. The first and second days of planting on the block took place on Thursday and Friday of the first week. The remaining five days of planting on the block took place from Monday to Friday of the following week. The piece rate paid to planters on this block was $0.20 per tree. Eighteen planters were involved in the experiment, each planting between two and seven days on the experimental block. All 18 planters were present for the second and third days of planting on the experimental block.

On arrival at the experimental block for the second day of planting, planters were informed that they would receive a lump-sum of $80 for that day's work, in addition to the regular piece rate of 20 cents per tree. In order to avoid any effects of the experiment on participation, the $80 was presented to the planters after they had departed from the base camp.

Workers in the gift experiment were unaware that they were participating in an experiment. This allowed us to formulate the money as a gift to the planters from the firm and to observe the worker‘s response to that gift in their natural work environment. To this end, planters were told by the firm manager that there was extra money in the contract because some of the previously planted blocks had been expected to present access problems to the workers. This caused the firm to bid "walkin" compensation to the contract for those blocks.[8] In the end, the

[5] Data from this experiment were first analyzed in Paarsch and Shearer (2009). We refer the reader to that paper for a complete discussion of the experiment and the data.

[6] A convincing explanation for the difference in piece rates was prepared invoking the fact that conditions on the treatment blocks had changed since the original bidding. This sometimes happens when the block has been unexpectedly prepared (cleared of debris) by the government. In practice, no explanation was needed as none of the planters questioned the higher piece rates.

[7] This discussion parallels that found in Bellemare and Shearer (2009), which analyzed these data using an unrestricted econometric framework.

[8] "Walkin-fees" compensate planters for time spent walking into planting sites and are bid into contracts to plant sites that are difficult to access.

access problems did not materialize and the compensation was not needed. In spite of this, the manager had decided to share the extra money with the planters. This represented a realistic explanation to the workers because access problems occur occasionally and “walkin-fees” are the typical solution of the firm when they occur.[9]

A second important feature of our design is that workers were told the gift was a one-time event that would not be repeated. This was reinforced by attaching the gift to an extremely rare occurrence, minimizing any repeated-game effects whereby the workers might respond in the hopes of earning future gifts (or surpluses); see, for example, Shapiro and Stiglitz (1984) or Macleod and Malcolmson (1989). Access problems requiring walkin fees occur on approximately 2% to 3% of all planting blocks. The firm plants approximately 300 blocks in a given year and most workers are affected only once or twice per year. That in itself is a rare event. Even more exceptional is the fact that the originally observed access problems did not materialize—the government unexpectedly opened an access road. Firm managers affirmed that, although this does occur (the government sometimes acts to open up areas to logging), it was an extremely rare event, occurring on perhaps 1% of the blocks for which walkin fees are bid.[10]

Finally, the manager was instructed to treat the day of the gift as a normal working day: Planters worked the same number of hours as a regular workday and were monitored in the same way. What is more, the manager reported that nothing out of the ordinary (such as a truck breaking down or trees being delivered late) occurred on that day that would affect planting.

4. ECONOMIC MODEL

In this section, we present our model, which can be used to analyze the profitability of different gift-giving contracts. The next section discusses the identification of the model using the exogenous variation in piece rates and gifts provided by our field experiments.

4.1. *Technology*. The daily output of worker i on block j, Y_{ij}, is a function of worker effort, E_{ij}, and a random production shock, S_{ij}. We specify

$$Y_{ij} = E_{ij} S_{ij}, \tag{1}$$

where S_{ij} is a positive random variable with

$$S_{ij} \sim \text{IID}(\mu_j, \sigma_j^2). \tag{2}$$

4.2. *Utility*. Workers have utility functions given by

$$U_i(W_{ij}, E_{ij}) = W_{ij} - C_i(E_{ij}) + \beta(Y_{ij} - Y_{ij}^{NG})G_{ij}, \tag{3}$$

where W_{ij} represents daily earnings and $C_i(E_{ij})$ is the worker's cost of effort function and $\beta(Y_{ij} - Y_{ij}^{NG})G_{ij}$ represents the kindness function, capturing how workers respond to gifts from the firm.[11] Following the work of Rabin (1993) on fairness, (3) specifies that the worker receives utility from returning value to the firm (in terms of output Y_{ij}) above Y_{ij}^{NG} (defined in (5b)), the productivity level of the worker in the absence of gifts. The utility gained is proportional to the size of the gift G_{ij} (or kindness) received from the firm (defined in (6)). We specify the cost of

[9] None of the planters questioned this explanation.

[10] This suggests that the event will occur approximately once in every 3,000 blocks planted, implying a worker would have to work, on average, 10 years in the firm to experience it.

[11] βG_{ij} represents the marginal utility of returning value to the firm. β, therefore, represents the marginal utility of returning value to the firm per dollar of gift received.

effort function as a power function

$$C_i(E_{ij}) = \kappa_i \frac{\gamma}{\gamma+1} E_{ij}^{(\gamma+1)/\gamma}, \tag{4}$$

where γ is a curvature parameter and κ_i allows for individual heterogeneity.

We first develop our model under piece rates, in the absence of gifts. This is the typical compensation system of the firm. Later we extend the model to consider gifts. In developing our model, we closely follow the actual piece-rate setting policy of the firm, based on extensive interviews with firm managers.

4.3. *Timing*. The timing of events in our model is as follows:

- for a particular block j to be planted, Nature chooses the pair (μ_j, σ_j^2), the parameters of the distribution of S_{ij};
- the firm observes (μ_j, σ_j^2), and then chooses a contract ω_j;
- the planter observes $(\mu_j, \sigma_j^2, \omega_j)$, and accepts or rejects the contract;
- if the planter accepts the contract, then he is randomly assigned to plant a particular plot on the block (i.e., s_{ij}, a particular value of S_{ij} is attributed to the planter);
- the planter observes s_{ij}, and chooses an effort level E_{ij} producing output Y_{ij};
- the firm observes Y_{ij}, and pays earnings W_{ij}.

To solve the model, we work backwards. First, we solve for the planter's optimal effort level conditional on a given piece rate and productivity shock. Then we solve for the firm's choice of the piece rate, taking the reaction of the planter as given. Note that, in order to induce the planter to accept the contract, the contract must satisfy the planter's participation constraint.

4.4. *Piece Rates*. Under piece-rate contracts all workers receive the same piece-rate r_j on block j: $W_{ij} = r_j Y_{ij}$ and receive no gifts ($G_{ij} = 0$). Substituting (4) into (3) and using (1), optimal effort (for a specific realization of s_{ij}) and output are given by

$$E_{ij}^{NG} = \left[\frac{r_j s_{ij}}{\kappa_i}\right]^{\gamma}, \tag{5a}$$

$$Y_{ij}^{NG} = \left[\frac{r_j}{\kappa_i}\right]^{\gamma} s_{ij}^{\gamma+1}. \tag{5b}$$

4.5. *Definition of Gifts*. Crucial to any analysis of gift giving is the definition of a gift. During our experiment the definition seems simple: It is the size of the bonus paid to workers. Yet, its simplicity is due to the fact that the piece rate is fixed. In settings where the firm can offer a gift by selecting both a piece rate and a base wage the definition must be more general. Here, we define the gift to be the gain in expected utility holding effort fixed at pregift levels. In particular, let the original piece-rate contract be defined by r_j and the effort level $E_{ij}(r_j)$. Under a gift contract, denoted by a piece rate, R_j and a base wage B_j, we define the gift to the worker as

$$\begin{aligned} G_{ij}(R_j, B_j, r_j) &= \mathbf{E}\left\{B_j + R_j E_{ij}(r_j) S_{ij} - C_i\left(E_{ij}(r_j)\right) - \left[r_j E_{ij}(r_j) S_{ij} - C_i\left(E_{ij}(r_j)\right)\right]\right\} \\ &= B_j + (R_j - r_j) r_j^{\gamma} A_{ij}, \end{aligned} \tag{6}$$

where $\mathbf{E}$ represents the expectations operator and

$$A_{ij} \equiv \frac{\mathbf{E}(S_{ij}^{\gamma+1})}{\kappa_i^{\gamma}}. \tag{7}$$

Note, this definition of gifts is empirically tractable—it depends on γ and A_{ij}, both of which are identified given our data (Section 5).[12] Moreover, given (3), the gift is simply the gain in expected earnings at pregift effort levels. Notice, as well, when the piece rate is fixed at pregift levels ($R_j = r_j$ as it was during the gift experiment), the gift is equal to the base wage; i.e., $G_{ij} = B_j$. Otherwise, (6) is very general, defining gifts in terms of contractual changes in both the piece rate and a base wage that raise expected utility. There is, however, a caveat: Recent work suggests that the context in which contractual changes are explained to workers affects reciprocity.[13] We therefore only consider changes in the contract to be gifts if they are explicitly explained to the workers as acts of kindness—changes that are clearly in the short-term interests of the firm or that are implemented without explanation are not considered to be gifts.

4.6. *Gifts and Reciprocity*. When workers receive a monetary gift from the firm, $G_{ij} > 0$ and their response depends on their kindness parameter, β. Worker effort and output (given a realization of s_{ij}) are given by

$$E_{ij}^{G} = \left[\frac{(R_j + \beta G_{ij})s_{ij}}{\kappa_i}\right]^{\gamma}, \tag{8a}$$

$$Y_{ij}^{G} = \left[\frac{R_j + \beta G_{ij}}{\kappa_i}\right]^{\gamma} s_{ij}^{(\gamma+1)}. \tag{8b}$$

Note, under the original piece-rate contract, $R_j = r_j$, $B_j = 0$ and hence $G_{ij} = 0$. Then, (8a) and (8b) are equal to (5a) and (5b), respectively.

4.7. *Expected Utility*. In order for workers to accept a given contract, it must satisfy their participation constraint. Note, this places additional restrictions on the contract. The expected utility constraint takes account not only of the value of the gift, but the reaction of the worker to that gift (in terms of effort).

Substituting optimal effort, (5a) into (3) and taking expectations, worker i's expected utility in the absence of gifts is written

$$\frac{r_j^{\gamma+1} A_{ij}}{(\gamma+1)}. \tag{9}$$

In the presence of gifts, expected utility is given by

$$B_j + \frac{[R_j + \beta G_{ij}]^{(\gamma+1)} A_{ij}}{\gamma+1} - \beta G_{ij} r_j^{\gamma} A_{ij}. \tag{10}$$

[12] Alternatively, it would be possible to define gifts in (6) conditional on the shock $S_{ij} = s_{ij}$. This would not affect our parameter estimates given that our experimental gift was given as a base wage ($G_{ij} = B_j$ in (6)) and thus is independent of the way we treat S_{ij}. It would, however, complicate the policy analysis of optimal gift-giving contracts in Section 8.3. See Footnote 25 for a more detailed discussion.

[13] See Fehr et al., 2009, p. 37.

4.8. *Profits*. The firm's expected profit π from worker i on block j under gift giving is given by

$$\begin{aligned} \mathbf{E}(\pi_{ij}^{G}) &= (P_j - R_j)\mathbf{E}(Y_{ij}^{G}) - B_j \\ &= (P_j - R_j)\,[R_j + \beta G_{ij}(R_j, B_j, r_j)]^{\gamma} A_{ij} - B_j. \end{aligned} \tag{11}$$

Notice that expected profits are a function of the structural parameters γ, β as well as the parameter A_{ij} capturing individual ability and planting conditions.

Profits can be calculated under piece-rate contracts (in the absence of gifts) by evaluating (11) at $R_j = r_j$ and $B_j = 0$, giving

$$\begin{aligned} \mathbf{E}(\pi_{ij}^{NG}) &= (P_j - r_j)\mathbf{E}(Y_{ij}^{NG}) \\ &= (P_j - r_j) r_j^{\gamma} A_{ij}. \end{aligned} \tag{12}$$

5. IDENTIFICATION AND ESTIMATION

From (11) and (12), calculating profits on the experimental block requires identifying γ, β, and A_{ij}.[14] We exploit two sources of experimental data to identify these parameters: the piece-rate experiment and the gift experiment.

5.1. *The Piece-Rate Experiment*. The first source of identification is experimental variation in the piece rate, used to identify γ. A maintained identifying assumption of our model is that γ is constant over time and individuals. This allows us to combine identifying information from experiments conducted in different years of planting.[15] During this experiment the piece rate paid to planters was exogenously increased by 5 cents, from a base of either 18 cents or 23 cents. Let r^T and r^C denote the treatment and control piece rates, respectively. Then, from (5b),

$$\ln\left(Y_{ij}^{T}\right) = \gamma \ln\left(r_j^{T}\right) - \gamma \ln(\kappa_i) + (\gamma + 1)\ln(S_{ij}), \tag{14a}$$

$$\ln\left(Y_{ij}^{C}\right) = \gamma \ln\left(r_j^{C}\right) - \gamma \ln(\kappa_i) + (\gamma + 1)\ln(S_{ij}). \tag{14b}$$

Let J^{pr} denote the number of blocks in the piece-rate experiment, and I^{pr} the number of planters. Furthermore, define $\{Db_j\colon j = 1, 2, ..., J^{pr}\}$ as dummy variables taking a value of 1 for block j and 0 otherwise. Similarly, define $\{DI_i\colon i = 1, 2, ..., I^{pr}\}$ as dummy variables taking a value of 1 for planter i and 0 otherwise. Then, combining (14a) and (14b) gives

$$\ln(Y_{ij}) = a_0 + \sum_{i=2}^{I^{pr}} a_{1i} DI_i + \sum_{j=2}^{J^{pr}} a_{2j} Db_j + \gamma\left(\ln\left(r_j^{T}\right) - \ln\left(r_j^{C}\right)\right) DT_{ij} + \epsilon_{ij}, \tag{15}$$

[14] Generalizing to other blocks would require imposing more structure on the estimation problem. One possibility would be to impose that piece-rate contracts satisfy the participation constraint of the lowest-ability (or marginal) worker in the firm (denoted h), with productivity parameter $\kappa_h = \max\{\kappa_1, \kappa_2, \ldots, \kappa_n\}$. For example, let $\bar{u}$ denote the utility of worker h from leaving the firm (his outside option). Under these circumstances, A_{ij} can be written as

$$A_{ij} = \left[\frac{\kappa_h}{\kappa_i}\right]^{\gamma} \frac{\bar{u}}{r_j^{\gamma+1}}, \tag{13}$$

a function of structural parameters and the piece rate paid on a particular block.

[15] Relaxing this assumption would require performing multiple experiments at the same time.

where

$$
\begin{aligned}
a_0 &= -\gamma \ln(\kappa_1) + \gamma \ln\left(r_1^C\right) + (\gamma+1)\mathbf{E}\left(\ln(S_{i1})\right)\\
a_{1i} &= \gamma\left(\ln(\kappa_1) - \ln(\kappa_i)\right)\\
a_{2j} &= (\gamma+1)\left[\mathbf{E}\left(\ln\left(S_{ij}\right)\right) - \mathbf{E}\left(\ln\left(S_{i1}\right)\right)\right] + \gamma\left(\ln\left(r_j^C\right) - \ln\left(r_1^C\right)\right)\\
\epsilon_{ij} &= (\gamma+1)\left[\ln(S_{ij}) - \mathbf{E}(\ln(S_{ij}))\right]
\end{aligned}
$$

and

$$
DT_{ij} = \begin{cases} 1 & \text{if paid treatment piece rate on block } j,\\ 0 & \text{if paid control piece rate on block } j. \end{cases}
$$

The exogenous variation in the piece rate implies that the expected value of ϵ_{ij} is equal to zero, conditional on the included regressors. Hence, the model in (15) identifies γ.[16]

5.2. *The Gift Experiment*. The second source of identification comes from the gift-giving experiment, used here to identify β and A_{ij} for the block on which the gift-giving experiment took place. From (5b) and (8b), and using the fact that $G_{ij} = B_j$ during the experiment, we can write

$$
\ln\left(Y_{ij}^G\right) = \gamma \ln\left(r_j + \beta B_j\right) - \gamma \ln(\kappa_i) + (\gamma+1)\ln(S_{ij}), \tag{16a}
$$

$$
\ln\left(Y_{ij}^{NG}\right) = \gamma \ln(r_j) - \gamma \ln \kappa_i + (\gamma+1)\ln(S_{ij}). \tag{16b}
$$

Combining (16a) and (16b) gives

$$
\ln Y_{ij}^{\star} = \gamma[\ln(r_j + \beta B_j) - \ln(r_j)]DGIFT_{ij} - \gamma \ln(\kappa_i) + (\gamma+1)\mathbf{E}(\ln(S_{ij})) + v_{ij}, \tag{17}
$$

where

$$
\begin{aligned}
\ln(Y_{ij}^{\star}) &= \ln(Y_{ij}) - \gamma \ln(r_j)\\
v_{ij} &= (\gamma+1)\left[\ln(S_{ij}) - \mathbf{E}(\ln(S_{ij}))\right]
\end{aligned}
$$

and

$$
DGIFT_{ij} = \begin{cases} 1 & \text{if receive gift,}\\ 0 & \text{else.} \end{cases}
$$

The model (17) includes individual-specific effects that are needed to recover an estimate of A_{ij}. In order to gain information over individual-specific heterogeneity we supplement the experimental data with payroll data, collected on the experimental participants, planting on blocks near to the experimental block. We specify $(\gamma+1)\mathbf{E}(\ln S_{ij})$ as a block-specific effect, Db_j, and $\gamma \ln \kappa_i$ as an individual-specific term, DI_i. The estimating equation is

$$
\ln(Y_{ij}^{\star}) = b_0 + \sum_{i=2}^{I^g} b_{1i} DI_i + \gamma[\ln(r_j + \beta B_j) - \ln r_j]DGIFT_{ij} + \sum_{j=2}^{J^g} b_{2j} Db_j + v_{ij}, \tag{18}
$$

[16] Recall, we do not interpret the piece-rate experiment in terms of gifts, since the increase piece rate was not presented to the workers as a gift; see footnote 6 and Section 4.5.

where I^g denotes the number of planters in the gift experiment and J^g the number of blocks. The exogenous variation in the gift implies that the expected value of v_{ij} is equal to zero, conditional on the included regressors. Hence, conditional on γ, the model in (18) identifies β.

Notice as well that

$$S_{ij}^{\gamma+1} = \exp^{(\gamma+1)\ln(S_{ij})} = \exp^{(\gamma+1)\mathbf{E}(\ln(S_{ij}))+v_{ij}}$$

giving

$$\mathbf{E}\left(S_{ij}^{\gamma+1}\right) = \exp^{(\gamma+1)\mathbf{E}(\ln(S_{ij}))}\mathbf{E}\left(\exp^{v_{ij}}\right).$$

Hence,

$$\begin{aligned} A_{ij} &= \frac{\mathbf{E}\left(S_{ij}^{\gamma+1}\right)}{\kappa_i^{\gamma}} \\ &= \frac{\exp^{(\gamma+1)\mathbf{E}(\ln(S_{ij}))}}{\kappa_i^{\gamma}}\mathbf{E}\left(\exp^{v_{ij}}\right) \\ &= \exp^{b_0+\sum_{i=2}^{I^g} b_{1i}DI_i+\sum_{j=2}^{J^g} b_{2j}Db_j} \times \mathbf{E}\left(\exp^{v_{ij}}\right), \end{aligned}$$

which we estimate by

$$\widehat{A}_{ij} = \exp^{\hat{b}_0+\sum_{i=2}^{I^g} \hat{b}_{1i}DI_i+\sum_{j=2}^{J^g} \hat{b}_{2j}Db_j} \times \sum_i \frac{\exp^{\hat{v}_{ij}}}{n_j},$$

where $\hat{v}_{ij}$ denote the residuals from (18).

5.3. *Estimation of Model Parameters*. We estimate our model parameters using a two-step, nonlinear least squares estimator. In the first step, we estimate γ from (15) using the experimental variation in the piece rate. We then estimate β and A_{ij}, conditional on γ, from (18) using the gift experiment data. In order to calculate the critical value for the t-statistic on β, taking account of its dependence on γ, we used the bootstrap technique.[17]

6. DESCRIPTIVE STATISTICS

Table 1 presents the summary statistics of the piece-rate experiment averaged over all planters in both treatment and control conditions. The average daily number of trees planted under the control conditions is 888.95, with a relatively high standard deviation. Under the treatment conditions, the average number of trees planted climbs to 1012.39. This reflects a 13.9% increase in planter productivity relative to the control conditions, a change consistent with the higher piece-rates paid in the treatment conditions.[18]

[17] The bootstrap proceeded as follows. First, we generated 999 bootstrap estimates of γ from the piece-rate experiment. For each estimated value of γ, denoted $\hat{\gamma}_b^{\star}$, we then bootstrapped a sample from the gift-giving experiment, estimated $\hat{\beta}_b^{\star}$ and calculated

$$t_b^{\star} = \frac{\hat{\beta}_b^{\star} - \hat{\beta}}{s_{\hat{\beta}_b^{\star}}}.$$

This gives 999 values of the bootstrapped test statistic, which we order from smallest to largest. The upper-tail (5%) critical value for the test statistic is the 975th value in the ordered series of $t_b^{\star}$; see, for example, Cameron and Trivedi (2005, p. 363).

[18] This pattern holds conditionally as well—productivity is higher under the treatment piece rate for each block; see Paarsch and Shearer (2008, Table 2).

TABLE 1
SUMMARY STATISTICS: PIECE-RATE EXPERIMENT

Variable	Average	SD	Minimum	Maximum
Control sample: 109 observations				
Number of trees	888.85	325.46	390	1765
Piece rate	0.21	0.03	0.18	0.23
Daily earnings	182.65	50.40	89.70	317.70
Treatment sample: 88 observations				
Number of trees	1012.39	351.23	375	1965
Piece rate	0.26	0.02	0.23	0.28
Daily earnings	254.56	68.98	105.00	451.95

TABLE 2
SUMMARY STATISTICS: GIFT EXPERIMENT

Variable	Average	SD	Minimum	Maximum
Control sample: 66 observations				
Number of trees	1063.64	269.96	670	1625
Piece rate	0.2	0	0.2	0.2
Piece-rate earnings	212.73	53.99	134	325
Gift	0	0	0	0
Total daily earnings	212.73	53.99	134	325
Treatment sample: 18 observations				
Number of trees	1153.06	323.23	705	1845
Piece rate	0.2	0	0.2	0.2
Piece-rate earnings	230.61	64.65	141	369
Gift	80	0	80	80
Total daily earnings	310.61	64.65	221	449

TABLE 3
SUMMARY STATISTICS: ALL BLOCKS

Variable	Average	SD	Minimum	Maximum
Control sample: 678 observations				
Number of trees	978.82	309.4249	210	2100
Piece rate	0.23	0.04	0.16	0.35
Piece-rate earnings	219.57	59.25	48.30	420

Table 2 presents the summary statistics of the gift experiment averaged over all planters in both treatment and control conditions. Under the control conditions, planters received $0.20 per tree planted, yielding an average daily productivity of 1063.64 trees planted. When the gift is handed out (treatment conditions), the average daily number of trees planted is 1153.06, an 8.4% increase in planter productivity relative to planting without a gift.

Table 3 presents the summary statistics for the gift-experiment planters, planting on both experimental and nonexperimental blocks. The average number of trees planted per day is equal to 988 trees. This is lower than on the experimental block and reflects the fact that the experiment was conducted on somewhat easier conditions than average. This is also reflected in the fact that the average piece rate is $0.23, higher than that paid on the experimental block. We note, however, that average earnings are very similar—$220 per day when averaged over all blocks and $230 on the experimental block.

7. ESTIMATION RESULTS

The estimate of γ is equal to 0.39.[19] A statistical test of the null hypothesis that γ is equal to zero is rejected at all levels of statistical significance—the p-value is essentially equal to zero.[20]

7.1. *Homogeneous Response.* The estimate of β is equal to 0.00071 and is statistically significant at the 5% level—the t-statistic for β is equal to 1.77, whereas the (bootstrapped) critical value for the t-statistic is equal to 1.67. The worker's marginal utility of reciprocating (returning an additional tree to the firm in response to the gift) is given by βB_j.[21] Given $B_j = \$80$, the marginal utility is estimated to be \$0.057.

7.2. *Heterogeneous Response.* To allow for heterogeneity in response to the gift we allow β to be a function of observable individual characteristics: age and tenure. In particular, we specify

$$\beta_i = \beta_0 + \beta_1 \times tenure_i + \beta_2 \times age_i + \beta_3 \times age_i \times tenure_i. \tag{19}$$

The estimated response function is [22]

$$\begin{array}{l} \hat{\beta}_i = \underset{(0.71)}{0.00042} + \underset{(5.44)^{\star\star\star}}{0.00043} \times tenure_i + \underset{(0.24)}{(2.72e-6)} \times age_i - \underset{(-5.54)^{\star\star\star}}{(9.79e-6)} \times age_i \times tenure_i. \end{array} \tag{20}$$

Here, the estimated t-statistics are given in parentheses; $\star\star\star$ denotes statistical significance at the 1% level.[23] The estimates suggest that reciprocity is associated with a longer tenure within the firm, yet this effect is diminished with age. The positive effect of tenure on reciprocity is consistent with Akerlof's (1982) notion that the benefits from gift giving increase with time spent in the firm; see Bellemare and Shearer (2009) for a more complete discussion.

The estimated individual responses to the gift along with the estimated values of A_{ij} (for the experimental block) are presented in Table 4. In general, the estimates show considerable heterogeneity in response. The small number of treatment observations affects the precision with which we can measure individual responses. Nevertheless, these responses are statistically significant at the 10% level for 10 planters, at the 5% level for eight planters and at the 1% level for two planters. Although the effect is estimated to be negative for one planter, it is not statistically significant. The A_{ij} parameters are all very precisely estimated. This is perhaps not surprising since this parameter represents average productivity of individual i on the experimental block. Notice as well that from (7), $\mathbf{E}(S_{ij}^{\gamma+1})$ is the same across planters on block j, implying that higher values of A_{ij} represent more productive workers (individuals with lower values of κ_i). The estimates show substantial heterogeneity in planter productivity.

Table 5 provides further insight into the heterogeneity of worker responses to gifts and their characteristics. The second column replicates the estimated value of β_i from Table 4. Column 3 presents the estimated marginal utility to the worker of returning value to the firm ($\beta_i \times B_j$) after receiving the experimental gift. These values are measured in dollars per tree planted; they range from 1 to 19 cents per tree planted with an average of 6 cents over the sample. What is more, one-half of the sample displays very weak reciprocal preferences, earning marginal utility from reciprocating the gift of less than 5 cents per tree planted. Columns 4 and 5 give the

[19] Paarsch and Shearer (2009) also estimate a value of γ of 0.39 using the same data.

[20] Controlling for weather in (15) had no effect on the results.

[21] Recall that $G_{ij} = B_j \forall i$ during the experiment.

[22] The bootstrapped 1% critical values for a two-sided alternative are equal to 3.10 (β_0), 4.06 (β_1), 2.94 (β_2), and −3.88 (β_3). The bootstrapped 5% critical values are equal to 2.45 (β_0), 2.90 (β_1), 1.98 (β_2), and −2.85 (β_3).

[23] We controlled for daily temperature, rainfall, and day of the week in the estimation of (18). The estimates of these parameters are available from the authors on request.

TABLE 4
INDIVIDUAL-SPECIFIC RESPONSES

Planter	Estimated β_i	Standard Error	t-Statistic		Estimated A_{ij}	Standard Error	t-Statistic
1	0.00063	0.00039	1.61	⋆⋆	1935.10	283.48	6.83
2	0.00069	0.00043	1.58	⋆	1637.96	242.36	6.75
3	0.00047	0.00043	1.10		1207.93	196.11	6.16
4	0.00146	0.00053	2.74	⋆⋆	2242.82	332.49	6.75
5	0.00025	0.00034	0.72		1566.87	240.64	6.51
6	0.00137	0.00051	2.67	⋆⋆⋆	2434.87	359.21	6.78
7	0.00048	0.00041	1.17		1529.66	235.30	6.50
8	0.00053	0.00036	1.50	⋆⋆	2534.42	384.40	6.59
9	0.00049	0.00039	1.28		1534.89	233.20	6.58
10	0.00053	0.00036	1.48	⋆⋆	1928.05	283.28	6.81
11	0.00064	0.00040	1.61	⋆⋆	1767.96	261.12	6.77
12	0.00052	0.00036	1.48	⋆⋆	2588.63	391.06	6.62
13	0.00135	0.00052	2.57		2412.57	352.77	6.84
14	0.00050	0.00038	1.30		1500.76	231.74	6.48
15	0.00082	0.00041	2.00	⋆	2161.51	330.01	6.55
16	0.00049	0.00039	1.28		1537.70	229.87	6.70
17	−0.00013	0.00033	−0.40		2437.17	359.46	6.78
18	0.00242	0.00069	3.49	⋆⋆⋆	2336.72	345.36	6.77

NOTES: ⋆, ⋆⋆, and ⋆⋆⋆ denote significance at the 10%, 5% and 1% levels respectively. All the estimated A_{ij}s are significant at the 1% level

TABLE 5
INDIVIDUAL-SPECIFIC RESPONSES AND PLANTER CHARACTERISTICS

Planter	Estimated β_i	Marginal Utility of Reciprocity: ($\beta_i \times B_j$)	Estimated Response	Monetary Value	Tenure	Age
1	0.00063	0.05	94.85	14.23	1	31
2	0.00069	0.06	87.00	13.05	1	23
3	0.00047	0.04	45.13	6.77	0	20
4	0.00146	0.12	236.52	35.48	5	24
5	0.00025	0.02	31.14	4.67	3	55
6	0.00137	0.11	242.46	36.37	5	26
7	0.00048	0.04	58.08	8.71	0	23
8	0.00053	0.04	106.01	15.90	0	42
9	0.00049	0.04	59.85	8.98	0	28
10	0.00053	0.04	79.87	11.98	0	40
11	0.00064	0.05	87.56	13.13	1	30
12	0.00052	0.04	106.19	15.93	0	38
13	0.00135	0.11	236.61	35.49	14	38
14	0.00050	0.04	58.82	8.82	0	29
15	0.00082	0.07	134.82	20.22	5	38
16	0.00049	0.04	59.96	8.99	0	28
17	−0.00013	−0.01	−26.98	−4.05	14	49
18	0.00242	0.19	378.64	56.80	14	30
Average	0.00075	0.06	115.36	17.30	3.5	32.89

estimated response to the experimental gift in real and monetary terms.[24] Again, these numbers reflect the heterogeneity in reciprocity among these planters: 7 out of the 18 planters returned value of less than $10 to the firm in response to the $80 gift, whereas three planters returned value greater than $35; the maximum return to the firm was $56.80. The high proportion of planters with weak reciprocal preferences will play an important role in the results of our policy analysis.

[24] The total response can differ for two planters with the same value of $\beta \times B_j$ since total response also depends on A_{ij}, see (8b).

8. POLICY ANALYSIS

The firm received 35 cents for each tree planted on this contract and paid a piece rate of 20 cents to its workers, giving a net revenue of 15 cents per tree. The workers responded to the firm's gift with an increase of output in the order of 117 trees. Hence the 80 dollar gift generated only 17 dollars of revenue—the exchange of gifts was not profitable for the firm. However, it is important to bear in mind that the experimental gift was chosen by economists, not the firm. Other gifts may well have generated profitable responses. In order to investigate this, we use our estimated parameters (allowing for heterogeneous response) to calculate the profits of alternative gift contracts. Throughout this section, $\bar{r}_j$ represents the standard piece rate paid to all planters on the experimental block (denoted j) during the gift experiment.

We consider gifts for which the firm must pay the same piece rate and the same base wage to all planters planting on the same block. This corresponds to current firm practice and avoids introducing extra contracting costs into the counterfactual analysis. Notice, however, that homogeneous contracts do not imply homogeneous gifts—the size of the gift to any planter will generally depend on that planter's ability (see (6)).

A necessary condition for gifts to be profitable is for the profit-maximizing gift to increase profits vis-à-vis profits in their absence. We therefore measure the economic relevance of gifts by comparing profits earned under the profit-maximizing gift to profits earned under piece-rates. We consider a number of cases: base-wage gifts, piece-rate gifts, and composite gifts (comprising both piece rates and base wages). Each is nested within the following program: The firm chooses (R_j, B_j) to maximize[25]

$$\max_{B_j, R_j} \sum_{i=1}^{I^g} (P_j - R_j)\,[R_j + \beta_i G_{ij}(R_j, B_j, \bar{r}_j)]^{\gamma} A_{ij} - B_j \tag{22}$$

subject to:

(i) the participation constraint

$$B_j + [R_j + \beta_i G_{ij}(R_j, B_j, \bar{r}_j)]^{(\gamma+1)} \frac{A_{ij}}{(\gamma+1)} \geq \beta_i G_{ij} \bar{r}_j^{\gamma} A_{ij} + \frac{\bar{r}_j^{\gamma+1} A_{ij}}{(\gamma+1)} \tag{23}$$

holds for each worker.

(ii) gifts are determined by (6).

The participation constraint insures that workers are not worse off with a gift than without a gift, taking into account their response to the contract.

8.1. *Profitable Base-Wage Gifts.* We first considered whether another experimental base-wage, B_j, provided as a gift on the same block, at the same piece rate, and to the same planters, would have been profitable for the firm. In this case, we evaluated (22) at the estimated parameter values, subject to (23) and (6), imposing that $R_j = \bar{r}_j = 0.20$.[26] We found that profit

[25] An alternative discussed in Section 4.5 is to define the gift conditional on the shock s_{ij}, which implies that G_{ij} would depend on the realization s_{ij}. The expected profit from worker i would then be given by

$$\mathbf{E}(\pi_{ij}^G | R_j, B_j, r_j) = \int (P_j - R_j) \left[\frac{R_j + \beta G_{ij}(R_j, B_j, r_j, s_{ij})}{\kappa_i}\right]^{\gamma} s_{ij}^{(\gamma+1)} f(s_{ij}) ds_{ij} - B_j. \tag{21}$$

Given the dependence of G_{ij} on s_{ij}, identification of the expected profit requires identifying the distribution of S_{ij} and the distribution of k_i. This would require possibly different data and/or additional model assumptions.

[26] In practice, we evaluated a more specific problem in this case—allowing the firm to choose individual-specific base-wage gifts. Since this gives the firm finer strategy space, profits will be higher than if one base wage is given to each worker. Hence a finding of no profitable individual-specific base-wage gifts is stronger than finding no profitable homogeneous base-wage gift.

maximizing base-wage gifts were equal to zero. This suggests that no experimental base-wage gift would have generated a profitable response from the workers on the experimental block within the current labor market despite the fact that workers respond significantly to the gift.

A closer look at the effort function (8a) is revealing in considering these results. Since output is measurable (and contractible) gifts and piece rates are substitutes. Furthermore, because the piece-rate incentives are strong and workers' response to the gift is relatively small (the average $\hat{\beta}_i = 0.0009$) the profitability of a gift is attenuated at the observed piece rate.

8.2. *Profitable Piece-Rate Gifts*. Next we considered the profitability of piece-rate gifts. Recall, that these gifts are increases in the piece rate above market clearing levels, $\bar{r}_j$. In this case, we evaluated (22) at the estimated parameter values, subject to (23) and (6) while imposing that $B_j = 0$.[27] Here, as in the case of base-wage gifts, we found the profit maximizing gift to be equal to zero, suggesting there is no role for piece-rate gifts on the experimental block within the current labor market.

8.3. *Profitable Composite Gifts*. Next, we considered composite gifts, allowing the firm to select both a piece rate and a base wage to generate gifts to the workers. One might expect profits to be higher in this situation since the firm now has two instruments to generate gifts. To proceed, we calculated the contract that maximizes (22) subject to (23) and (6).[28]

Here, we found that gifts were positive, although very small. The average gift was equal to \$1.61, whereas the minimum gift was zero and the maximum gift was \$2.94. Surprisingly, the gifts were composed of a negative base wage (−\$2.56) and a small increase in the piece rate (\$0.204 vs. \$0.20). The negative base wage may seem to contradict popular notions of gifts, giving an abstract element to composite gifts. Recall, however, that the gift is defined by the increase in expected utility (earnings) given pregift effort levels. This is assured by the increase in the piece rate. Overall these gifts have a negligible effect on firm profits in this context (less than one-half of 1%), suggesting that (even composite) gifts have little role to play within the firm in the current context.

8.4. *Different Labor Markets*. Some authors have suggested that gifts are most useful in the presence of low-powered explicit incentives.[29] In the tree-planting industry, the level of the piece rate (for a given set of planting conditions) is determined by the labor market; see Section 2.2. In order to consider how gifts would perform in the presence of low-powered incentives, we constructed counterfactuals measuring the profitability of gifts under slack labor-market conditions—conditions in which the firm can lower piece rates on the experimental block and still retain all of its workforce. We hold the output price, worker ability, and planting conditions constant.

Calculating profits under different labor-market conditions requires that we extend our model to capture how piece rates are determined; this requires additional assumptions. We assume that, in the absence of gifts, the firm chooses the piece rate to maximize profits, subject to the participation constraints of the workers. Since workers are heterogeneous in terms of ability (κ_i), we assume that the piece rate must satisfy the participation constraint of the marginal worker in the firm—that worker with the highest cost of effort (lowest ability), denoted κ_h.[30] This ensures that the all workers are willing to participate on every terrain planted. The firm's

[27] We performed a numerical grid search to find the profit-maximizing solution, considering values of $R_j \in [0, P_j]$ where, recall, P_j is the price the firm receives per tree planted (equal to 0.35 in this case).

[28] We performed a numerical grid search to find the profit-maximizing solution, considering values of $R_j \in [0, P_j]$ and $B_j \in [-50, 50]$.

[29] This can be due to crowding out (Fehr and Gachter, 2002) or due to multitasking problems rendering high-powered incentives ineffective (Fehr and Falk, 2002).

[30] Our model follows Shearer (2004) and is based on extensive discussions with firm managers.

problem, for a given planting block, is then given by

$$\max_{r_j} \sum_{i=1}^{I^g} \mathbf{E}\big(\pi_{ij}^{NG}\big) = \sum_{i=1}^{I^g} (P_j - r_j)\mathbf{E}\big(Y_{ij}^{NG}\big) = \sum_{i=1}^{I^g} (P_j - r_j) r_j^{\gamma} A_{ij}. \tag{24}$$

subject to:

$$\frac{r_j^{\gamma+1} A_{hj}}{(\gamma+1)} \geq \bar{u}. \tag{25}$$

The solution to this problem is given by

$$\tilde{\mathbf{r}}_j = \max\left\{\frac{\gamma}{\gamma+1} P_j, \bar{r}_j\right\} \tag{26}$$

where

$$\bar{r}_j = \big[(\gamma+1)\bar{u}A_{h,j}^{-1}\big]^{\frac{1}{(\gamma+1)}}, \tag{27}$$

the piece rate that solves the marginal worker's participation constraint (25).

The effect of the labor market operates through $\bar{u}$, changing the value of the worker's outside alternative. Hence, holding conditions and ability (A_{hj}) constant, a decrease in the value of $\bar{u}$ decreases the piece rate $\bar{r}_j$ that guarantees the participation of the workers. In all cases, we consider values of $\bar{r}_j \in [0.01, P_j]$.

Profit maximization censors the piece rate at $\gamma/(\gamma + 1)P_j$, that rate at which the marginal benefit of effort to the firm equals the marginal cost (the increase in earnings paid). Hence, although the firm could set a piece-rate lower than $\gamma/(\gamma + 1)P_j$ when labor market conditions deteriorate sufficiently, the incentive incorporated in such rates is too low. As a result, the firm maintains the piece-rate at the profit maximizing level $\gamma/(\gamma + 1)P_j$ in this range of labor market conditions. Given P_j equals \$0.35 in our data, the censored value of the piece rate is 0.1. Note, as well, since $\tilde{\mathbf{r}}$ now represents the piece rate that the firm would pay on this block under the prevailing labor-market conditions, we now define the piece-rate gift relative to $\tilde{\mathbf{r}}_j$.

8.4.1. Base-wage gifts. To investigate the profitability of base-wage gifts, we calculated the expected profits (based on (22)) for different values of $B_j \in [0, 100]$, holding R_j fixed at $\tilde{\mathbf{r}}_j \in [0, P_j]$. We find that there exists no value of B_j such that the firm profits increase relative to the benchmark profit maximizing level in the absence of gifts. This is true for all values of $\tilde{\mathbf{r}}_j$ considered. Hence, base-wage gifts would never be used in equilibrium. This suggests that base-wage gifts have little role to play in this firm, even under labor-market conditions leading to low-powered incentives.

8.4.2. Piece-rate gifts. To investigate the profitability of piece-rate gifts we calculated the expected profits (based on (22)) for different values of $R_j \in [0, P_j]$, holding B_j fixed at zero. We then computed the overall profit change (averaging over all workers) relative to benchmark profits, that is profits without gifts (based on (24) and (25)). We also computed the profit change relative to benchmark profits for each worker. The latter was done in recognition of the fact that workers have various predispositions to reciprocate to a gift from the firm, as revealed by the heterogenous estimates of β_i in Table 4.

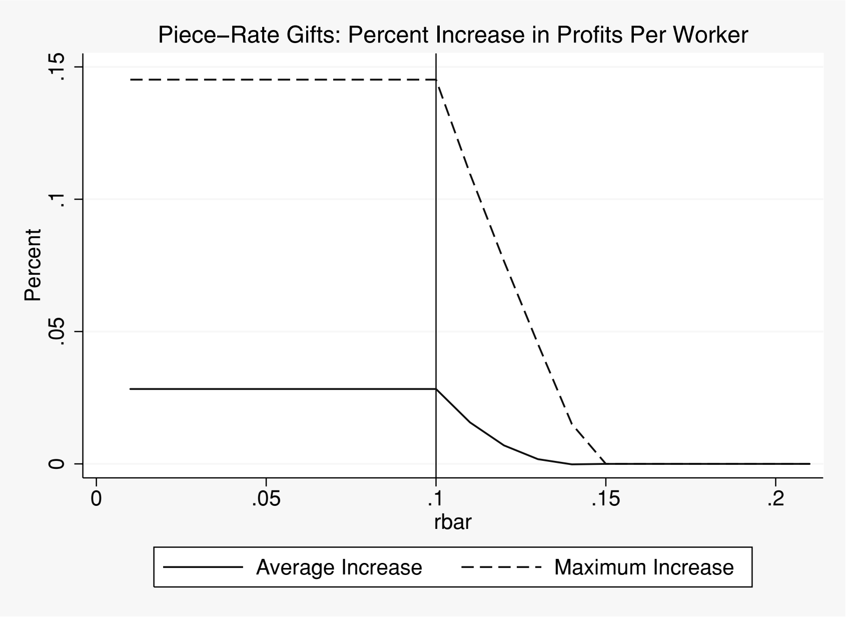

FIGURE 1

PIECE-RATE AND GIFT-GIVING PROFITS WITH PIECE-RATE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\bar{r}$)

The results are presented graphically in Figure 1 . Note, the figure plots results only on the range of $\bar{r}_j$ where gifts are greater than zero. The vertical line at $\bar{r}_j = 0.1$ divides the figure into two regions: $\bar{r}_j > \gamma/(\gamma+1)P_j$ and $\bar{r}_j <= \gamma/(\gamma+1)P_j$. Consider first the region $\bar{r}_j > \gamma/(\gamma+1)P_j$. Recall, in this region, the participation constraint binds and hence the non-gift piece rate is determined by labor-market conditions. Here we found an economic role for gifts, particularly in the range $\bar{r}_j < 0.15$.[31] Profits from gift giving increase modestly in the range $0.1 < \bar{r}_j <= 0.15$, reaching their peak at $\bar{r}_j = 0.1$ and remaining constant for all labor-market conditions in the range $\bar{r}_j <= 0.10$. Over this range a piece-rate gift would increase overall firm profits, vis-à-vis the regular piece-rate contract, by 3%. However, there is substantial heterogeneity in the relative profitability of the gift across workers—we find that the maximal increase in per-worker profits relative to the benchmark is close to 15%.

More information on the heterogeneity of profits is given in Figure 2 . Here we present different percentiles from the distribution of the percent increase in profits across workers, for different values of $\bar{r}_j$. As in Table 5 we see evidence of considerable heterogeneity across workers. The percent increase in profits from a piece-rate gift is over 6% for 20% of the workers when $\bar{r}_j \le 0.1$.[32] Yet, it is less than 2% for at least one-half of the workers in the firm. In fact, it is negative for three planters—those with the lowest values of β_i. This is due to the fact that when $\beta_i = 0$, the effort and profit functions collapse to the piece-rate effort and profit functions. Any increase in the piece rate above the profit-maximizing level $\tilde{\mathbf{r}}_j$ under such circumstances necessarily decreases profits for those workers.

Figure 3 presents the average and maximal gifts of workers across the different labor-market conditions. Here, we find that for $\bar{r}_j \le 0.10$ the average gift is \$21 and the maximum gift is \$28. Average and maximal gifts progressively decline to zero as $\bar{r}_j$ approaches 0.15. Figure 4 presents the relative importance of gifts (measured as the gift as a proportion of expected earnings in

[31] There are no relevant gifts when r_j is greater than 0.20.

[32] The workers for whom gifts are the most profitable are those who have worked at the firm for a long period of time yet remain relatively young; those for whom the percent increase in profits is above 6% are planters 4, 6, 13, and 18, all of whom are less than 40 years old and have tenure of 5 years or more (Table 5).

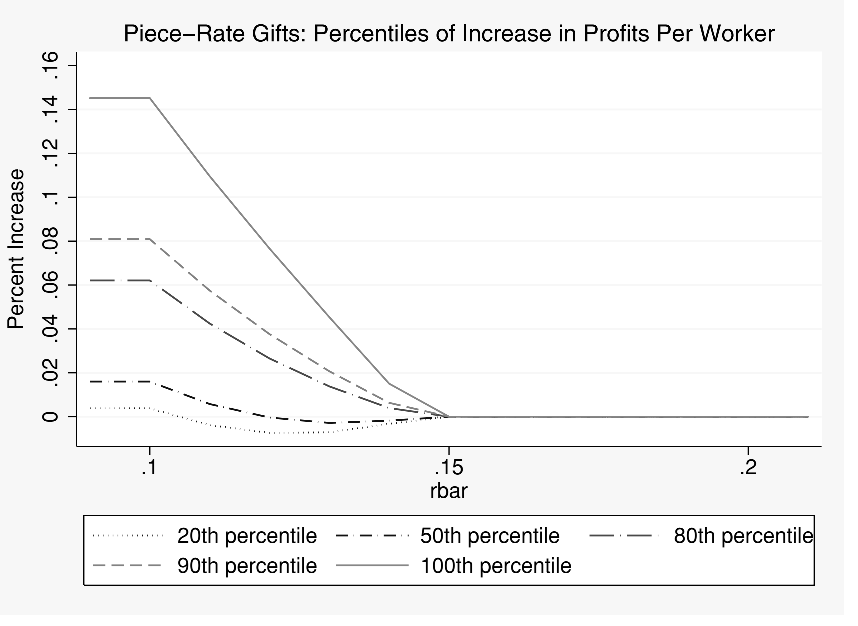

FIGURE 2

PERCENTILES OF PROFIT INCREASES WITH PIECE-RATE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\bar{r}$)

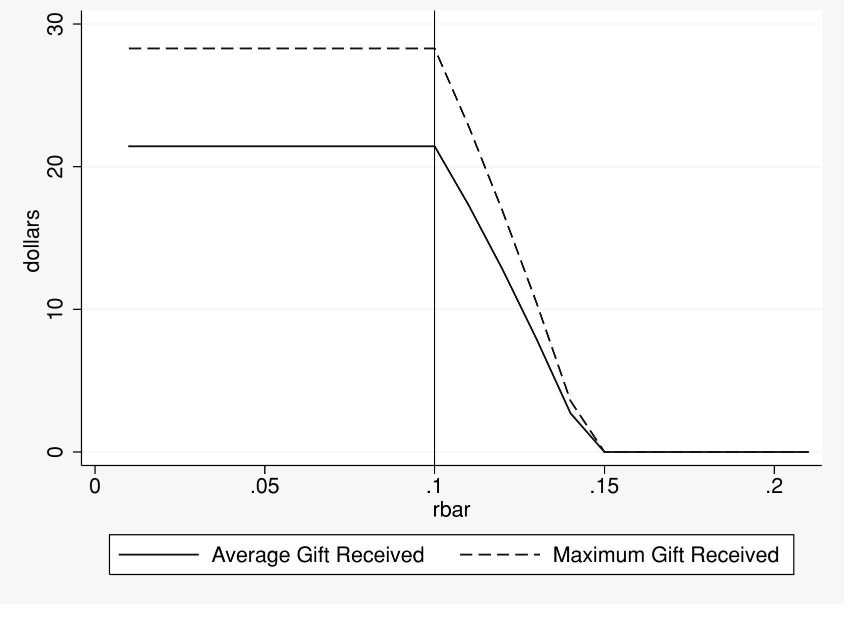

FIGURE 3

AVERAGE AND MAXIMUM GIFTS WITH PIECE-RATE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\bar{r}$)

the absence of gifts).[33] Here we see that gifts increase in relative importance as labor-market conditions worsen, attaining 27% of expected piece-rate earnings for $\bar{r}_j < 0.10$.[34]

[33] The relative importance of gifts is constant across workers for piece-rate gifts: Expected earnings in the absence of gifts are given by $\bar{r}_j^{\gamma+1} A_{ij}$. It then follows from (6) that the relative importance of individual *i*s gift is $(R_j - \bar{r}_j)/\bar{r}_j$.

[34] Average earnings would be $80.00 in this case, reduced from $195 when the piece rate is 0.20.

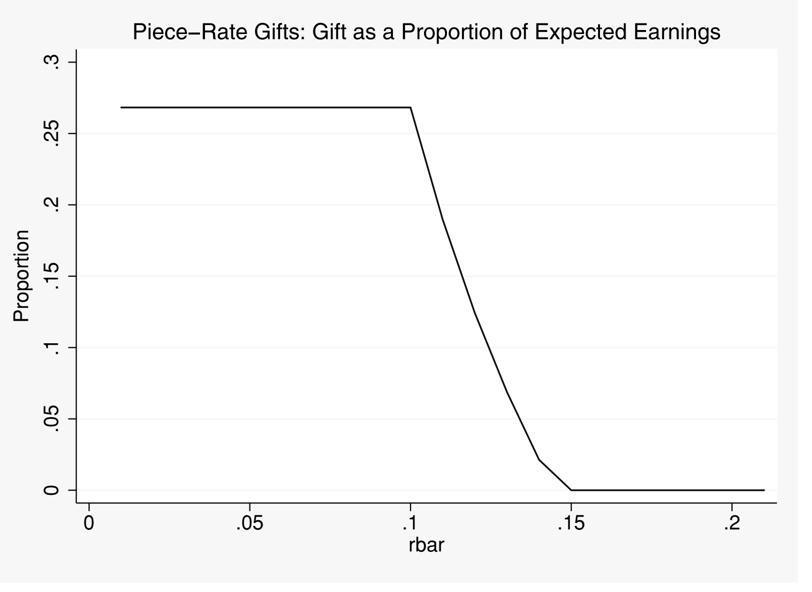

FIGURE 4

GIFTS AS PROPORTION OF EARNINGS WITH PIECE-RATE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\overline{r}$)

The increase in the profitability of gift-giving as labor market alternatives deteriorate is directly related to the associated decrease of incentives. Slack labor market conditions allow the firm to reduce the piece-rate paid to workers and still satisfy the participation constraints of workers. In doing so, the marginal cost (in terms of effort) of responding to the gift is also reduced. As a result crowding out diminishes—the marginal effect of increasing the gift on average worker productivity increases.[35]

8.4.3. Composite gifts Finally, we considered composite gifts in different labor markets, allowing the firm to select both a piece rate and a base wage to generate gifts to the workers. To proceed, we calculated the contract that maximizes (22) subject to (23) for different values of $\overline{r}_j \in (0.01, 0.35)$. The results, presented graphically in Figures 5–10, suggest there is a potentially important role for composite gifts within this firm under slack labor-market conditions. Again, the vertical line at $\overline{r}_j = 0.1$ divides the graphs into two regions: $\overline{r}_j > \gamma/(\gamma+1)P_j$ and $\overline{r}_j <= \gamma/(\gamma+1)P_j$. Figure 5 shows that for the region $\overline{r} > \gamma/(\gamma+1)P_j$ the firm could increase overall profits by up to 10% by introducing composite gifts.

The distribution of profit increases is presented in Figure 6. Note, we plot the distribution of profit increases only over the range of $\overline{r}_j$ where gifts are non-zero. Again, there is considerable heterogeneity in the profitability of the gift across workers, although composite gifts are generally more profitable than piece-rate gifts. We find that the maximal profit increase, for a given worker, is 17% in the region $\overline{r}_j <= \gamma/(\gamma+1)P_j$. The median profit increase is 11.1%, close to the average increase of 10.4%. Notice, even workers in the 20th percentile of the distribution will provide profits over 8% under composite gifts.

[35] This can be illustrated using the model of Section 4. It follows from (8b) that the marginal effect of increasing the gift G_{ij} on average worker productivity is given by

$$\frac{\partial^2 \mathbf{E}(Y_{ij}^G)}{\partial R_{ij}\partial G_{ij}} = (\gamma - 1)\gamma\beta_i \left[\frac{R_{ij} + \beta G_{ij}}{\kappa_i}\right]^{\gamma-2} \mathbf{E}(s_{ij}^{(\gamma+1)}). \tag{28}$$

This cross partial derivative is negative when evaluated at the estimated parameter values ($\hat{\gamma} = 0.39, \hat{\beta}_i > 0.$). This indicates that all workers respond more to a gift when incentives are lower.

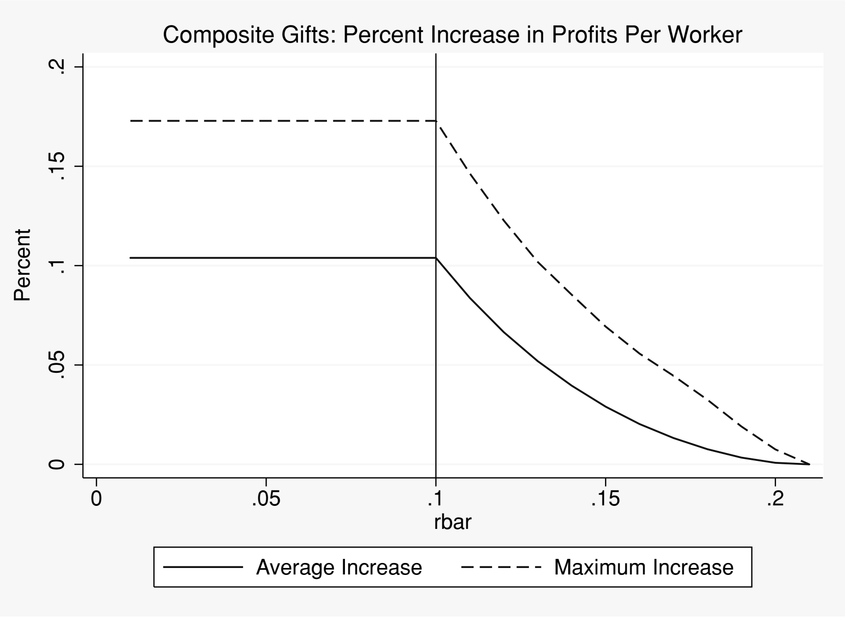

FIGURE 5

PIECE-RATE AND GIFT-GIVING PROFITS WITH COMPOSITE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\bar{r}$)

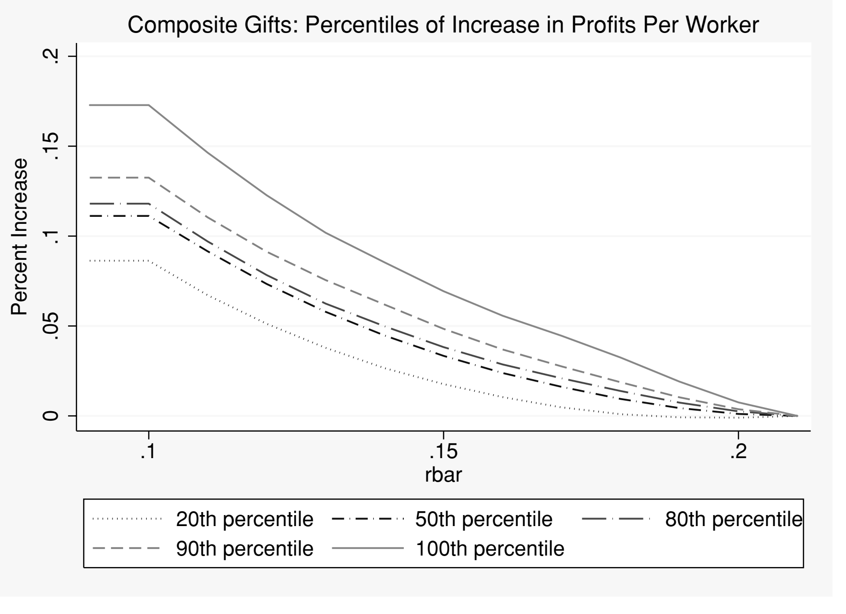

FIGURE 6

PERCENTILES OF PROFIT INCREASES WITH COMPOSITE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\bar{r}$)

Figure 7 shows the monetary size of the gifts. Gifts would be positive for $0.1 < \bar{r}_j < 0.20$, with average gifts up to \$20 and a maximum gift of up to \$37.50. Average gifts vary between \$20 and \$21.50 whereas the maximum gift varies between \$28 and \$49. The importance of gifts decreases as we approach the observed piece rate, yet the maximum gift is still above \$10 at a piece rate of \$0.18. Figure 8 shows the relative importance of the average and maximum gifts,

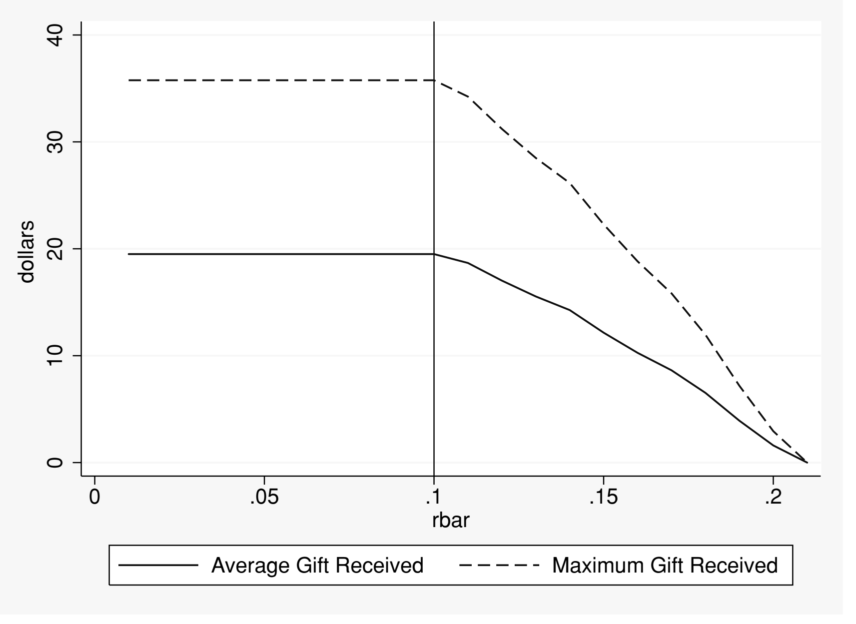

FIGURE 7

AVERAGE AND MAXIMUM GIFTS WITH COMPOSITE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\bar{r}$)

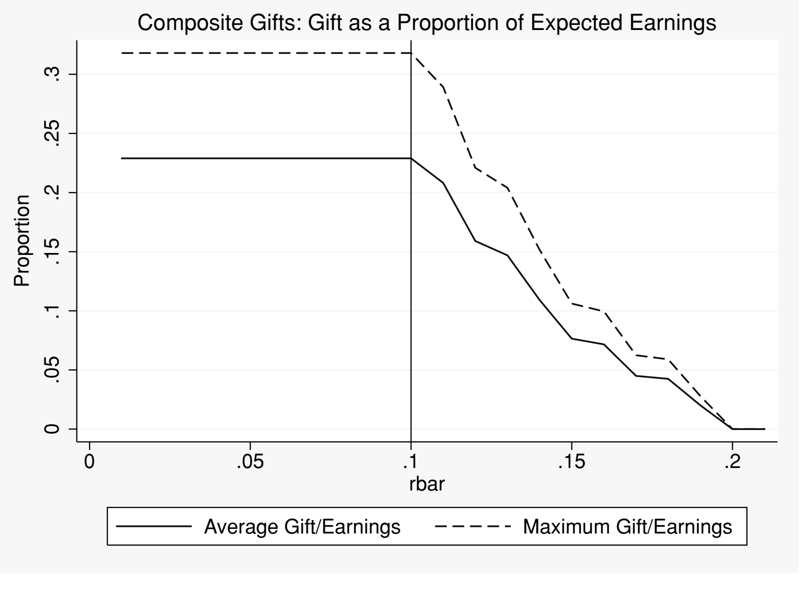

FIGURE 8

GIFTS AS PROPORTION OF EARNINGS WITH COMPOSITE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\bar{r}$)

again measured as the gift as a proportion of expected earnings in the absence of gifts. As in Figure 4, gifts increase in importance as labor-market conditions worsen, with the average gift attaining 23% of average expected earnings for $\bar{r}_j <= \$0.10$; the maximum proportion is over 0.3.

Figures 9 and 10 show the composition of the gift. Again, we find that the composite gift takes an unexpected form: an increase in the piece-rate offset by a negative base-wage. These gifts

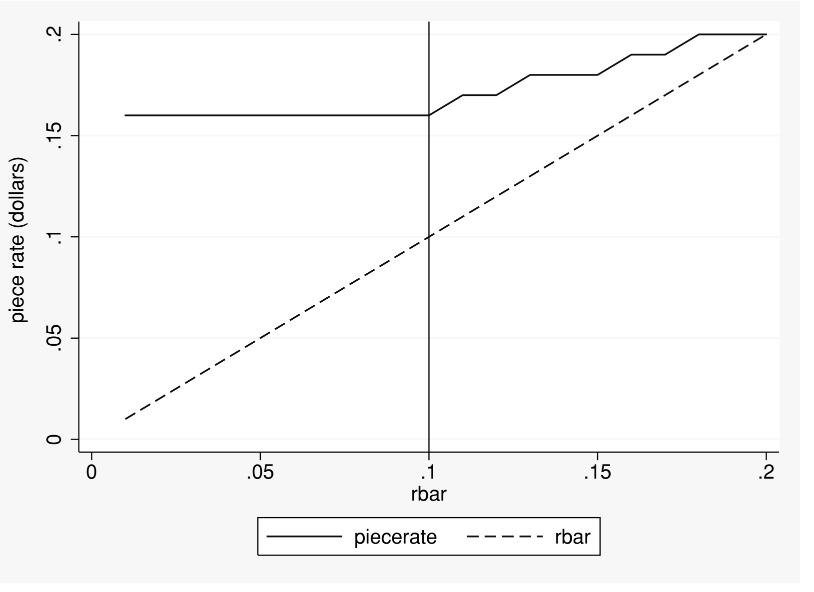

FIGURE 9

COMPOSITION OF GIFTS (THE PIECE RATE) WITH COMPOSITE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\bar{r}$)

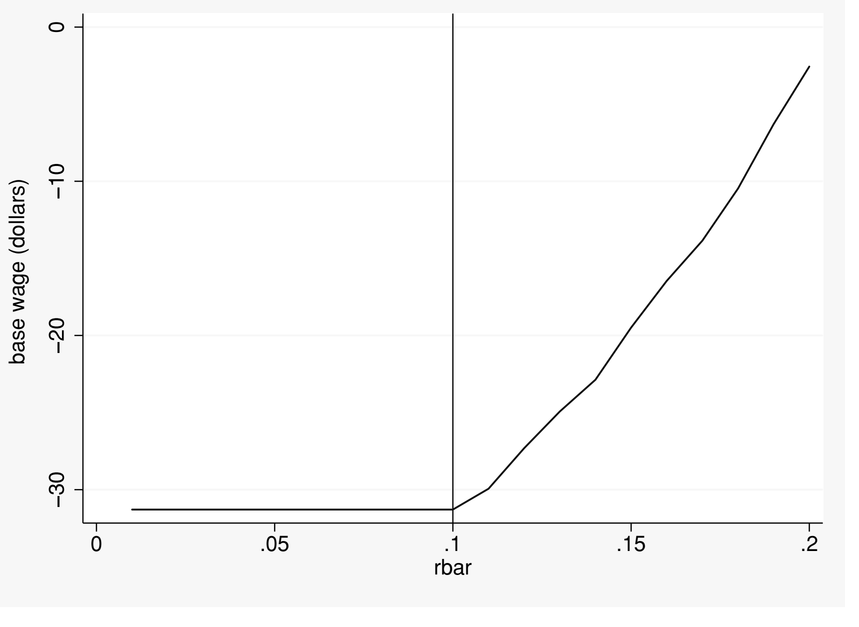

FIGURE 10

COMPOSITION OF GIFTS (THE BASE WAGE) WITH COMPOSITE GIFTS UNDER DIFFERENT LABOR-MARKET CONDITIONS ($\bar{r}$)

allow the firm to increase profits even for workers with $\beta_i = 0$.[36] In effect, a gift in the form of a higher piece rate generates effort on two levels: first, through the increase in the marginal return to effort and, second, through the reciprocal response to the gift. The negative base wage allows the firm to claw back some of the excess rents that the high-incentive piece rate generates.

[36] Workers for whom $\beta_i = 0$ will still participate in such contracts as long as $B_j + (R_j^{(\gamma+1)} - \bar{r}_j^{(\gamma+1)})A_{ij}/(\gamma+1) \geq 0$. The firm increases profits on such individuals if $[(P_j - R_j)^\gamma - (P_j - \bar{r}_j)^\gamma]A_{ij} - B_j \geq 0$.

9. DISCUSSION

In this section we consider how our results might be sensitive to some of the assumptions of our model, in particular risk neutrality and the absence of fatigue effects.

9.1. *Risk Preferences.* Our model assumes that workers are risk neutral. In order to investigate the effect of introducing risk preferences, we generalize utility to the CRRA function

$$U_i(W_{ij}, E_{ij}) = \begin{cases} \frac{1}{\delta} X_{ij}^{\delta} & \text{if } X_{ij} > 0 \\ -\infty & \text{otherwise,} \end{cases} \tag{29}$$

where $X_{ij} = W_{ij} - C_i(E_{ij}) + \beta(Y_{ij} - Y_{ij}^{NG})G_{ij}$ is income net of effort costs.

Conditional on a gift, G_{ij}, the effort decision is still given by (8a), unchanged from the risk-neutral model. This is due to the fact that effort is chosen after the shock is revealed—risk preferences have no effect on effort. However, the size of the gift will now depend on risk preferences. This follows from the fact that gifts are defined as the change in expected utility, holding effort constant at pre-gift levels. We generalize (6) to

$$G_{ij}^{\delta}(R_j, B_j, r_j) = \frac{1}{\delta} \int_{S_{ij}} \left\{ \left[B_j + \frac{r_j^{(\gamma+1)} s_{ij}^{(\gamma+1)}}{\kappa_i^{\gamma}} \left(\frac{R_j}{r_j} - \frac{\gamma}{\gamma+1} \right) \right]^{\delta} - \left[\frac{r_j^{(\gamma+1)} s_{ij}^{(\gamma+1)}}{\kappa_i^{\gamma}(\gamma+1)} \right]^{\delta} \right\} f(s_{ij}) ds_{ij}. \tag{30}$$

When the gift components are restricted to a base wage as in the experiment, the definition of the gift reduces to

$$G_{ij}^{\delta}(r_j, B_j, r_j) = \frac{1}{\delta} \int_{S_{ij}} \left\{ \left[B_j + \frac{r_j^{(\gamma+1)} s_{ij}^{(\gamma+1)}}{\kappa_i^{\gamma}(\gamma+1)} \right]^{\delta} - \left[\frac{r_j^{(\gamma+1)} s_{ij}^{(\gamma+1)}}{\kappa_i^{\gamma}(\gamma+1)} \right]^{\delta} \right\} f(s_{ij}) ds_{ij}. \tag{31}$$

Under these circumstances the value of the gift collapses to B_j when workers are risk neutral.[37]

Recent empirical work on contracts has emphasized the importance of labor market sorting across risk environments based on risk preferences (Ackerberg and Botticini, 2002; Chiappori and Salanié, 2003; Bonin et al., 2007). Sorting leads to risk-tolerant workers being attracted to risky contractual environments. Our own work (Bellemare and Shearer, 2010), analyzing the risk preferences of tree-planters, gives results that are consistent with sorting. We found that a sample of tree planters exhibited (on average) close to risk-neutral behavior. This suggests that any effect of risk aversion on our results should be minimal.

9.2. *Fatigue.* In the presence of fatigue, forward-looking workers will take into account the impact of their response to the gift on future productivity. Under these circumstances the effect of the gift may differ depending on the day of the week it is implemented. Moreover, the presence of fatigue implies that it may be optimal for workers to substitute effort across time when a gift is given over several consecutive days, again affecting worker response. We address these issues by incorporating fatigue in a two period version of our model where the gift can be given either on the first day t or on both days. We assume that after two periods the worker rests, completely regenerating. For expositional purposes we consider only base wage gifts and omit individual and block specific subscripts.

[37] It is possible, under further assumptions on the distribution of the shocks s_{ij}, to sign the direction of the bias in the case of risk aversion. See the Appendix for details.

We begin by allowing the cost of effort parameter in period $t+1$ to depend on effort in the previous period

$$k_{t+1} = e^{(\kappa_0 + \kappa_1 E_t)}. \tag{32}$$

Fatigue implies that $\kappa_1 > 0$. The contemporaneous utility at time t given a baseline gift B_t and a realization $S_t = s_t$ is given by

$$U(W_t, E_t) = rE_t s_t + B_t - k_t \frac{\gamma}{\gamma+1} E_t^{\frac{\gamma+1}{\gamma}} + \beta\left(E_t s_t - Y^{NG}\right) B_t.$$

The discounted utility at time t is given by

$$V(W_t, E_t) = U(W_t, E_t) + \theta \mathbf{E}(U(W_{t+1}, E_{t+1}) | E_t) \tag{33}$$

$$\begin{aligned} &= rE_t s_t + B_t - k_t \frac{\gamma}{\gamma+1} E_t^{\frac{\gamma+1}{\gamma}} + \beta\left(E_t s_t - Y^{NG}\right) B_t \\ &+ \theta\left[B_{t+1} + \left[\frac{[r+\beta B_{t+1}]^{(\gamma+1)}}{\gamma+1} - \beta B_{t+1} r^{\gamma}\right] \frac{\mathbf{E}(S_{t+1}^{\gamma+1})}{k_{t+1}^{\gamma}}\right], \end{aligned} \tag{34}$$

where θ is the discount factor applied to the indirect utility at time $t+1$ (see Equation (10)). The second term is derived from the fact that workers rest after period $t+1$; hence, optimal effort is given by (8a) from the static model. Differentiating (33) with respect to E_t gives the equilibrium condition determining optimal effort at time t

$$rs_t + \beta s_t B_t = k_t E_t^{*\frac{1}{\gamma}} + \theta\gamma\kappa_1 \left[\frac{[r+\beta B_{t+1}]^{(\gamma+1)}}{\gamma+1} - \beta B_{t+1} r^{\gamma}\right] \frac{\mathbf{E}\left(S_{t+1}^{\gamma+1}\right)}{k_{t+1}^{\gamma}} = 0, \tag{35}$$

where the last term on the right-hand side is positive if $\gamma > 0$ and $\kappa_1 > 0$. Equation (35) reveals two things. First, the marginal benefit of effort (the left-hand side) is determined by the monetary incentive rs and the marginal utility of reciprocity $\beta s_t B_t$. Second, the marginal cost of effort (the right-hand side) depends on the curvature of $C(E_t)$ as well as on the loss in future expected utility caused by effort in period t.

The following comparative static predictions, derived in the Appendix, follow from (35)

$$\frac{\mathrm{d}E_t^G}{\mathrm{d}B_t} = \frac{\beta s_t}{\left(k_t \frac{1}{\gamma} E_t^{\frac{1-\gamma}{\gamma}} - \theta\gamma^2\kappa_1^2 \left[\frac{[r+\beta B_{t+1}]^{(\gamma+1)}}{\gamma+1} - \beta B_{t+1} r^{\gamma}\right] \frac{\mathbf{E}\left(S_{t+1}^{\gamma+1}\right)}{k_{t+1}^{\gamma}}\right)}, \tag{36}$$

$$\frac{\mathrm{d}E_t^G}{\mathrm{d}B_{t+1}} = -\frac{\theta\gamma\kappa_1 \left[\beta\left[r+\beta B_{t+1}\right]^{\gamma} - \beta r^{\gamma}\right] \frac{\mathbf{E}\left(S_{t+1}^{\gamma+1}\right)}{k_{t+1}^{\gamma}}}{k_t \frac{1}{\gamma} E_t^{\frac{1-\gamma}{\gamma}} - \left(\theta\gamma^2\kappa_1^2 \left[\frac{[r+\beta B_{t+1}]^{(\gamma+1)}}{\gamma+1} - \beta B_{t+1} r^{\gamma}\right] \frac{\mathbf{E}\left(S_{t+1}^{\gamma+1}\right)}{k_{t+1}^{\gamma}}\right)}, \tag{37}$$

where the denominators in (36) and (37) are positive when the second-order conditions for optimal effort hold. In the absence of fatigue ($\kappa_1 = 0$), $\frac{\mathrm{d}E_t^{\star}}{\mathrm{d}B_t} > 0$ and $\frac{\mathrm{d}E_t^{\star}}{\mathrm{d}B_{t+1}} = 0$. With fatigue ($\kappa_1 > 0$), $\frac{\mathrm{d}E_t^{\star}}{\mathrm{d}B_t} > 0$ and $\frac{\mathrm{d}E_t^{\star}}{\mathrm{d}B_{t+1}} < 0$. Hence, optimal effort in period t is predicted to increase with the value of the gift in period t but to decrease with the value of the gift given in period $t+1$.

Intuitively, forward-looking workers lower their effort at period t to better reciprocate to the increasing gift in period $t+1$.

These simple predictions have implications for the generalizability of our results. We note that the same-period response to a monetary gift will not generally be constant across periods in this setting,

$$\frac{\mathrm{d}E_t^G}{\mathrm{d}B_t} \neq \frac{\mathrm{d}E_{t+1}^G}{\mathrm{d}B_{t+1}}. \tag{38}$$

This is due to two factors. First, the cost of effort will differ across periods due to fatigue ($\kappa_t \neq \kappa_{t+1}$). Second, the value of the future changes as the worker gets closer to a day of rest—the second term in the denominator of (36) is missing in $\frac{\mathrm{d}E_{t+1}^G}{\mathrm{d}B_{t+1}}$.

The effect of the gift on effort in period t will also depend on whether it is given over one day or two. Suppose, for example, that instead of giving a gift of \$80 in period t, the firm gave \$40 in both periods t and $t+1$. The resulting reduction in the gift in period t would have a direct effect, reducing on effort through (36). There would also be an indirect effect on effort in period t (through (37)), the worker wishing to withhold effort in period t in order to be able to reciprocate in period $t+1$.

Evaluating the empirical importance of these effects experimentally requires a multiple treatment framework, allowing for gifts to be given to workers over multiple days and on different days of the week. This may be difficult to accomplish within a field setting, where exposing workers to multiple gifts may affect their expectation of future surpluses within the firm, leading to confounding effects in the response. An alternative approach would be to use the experimental data to identify a structural dynamic model of effort determination in the presence of fatigue and reciprocity.[38]

10. CONCLUSIONS

This article adds to the empirical literature on gift giving, concentrating on the profitability of gifts within the firm. We have used field experiments to measure worker responses to gifts, identifying structural parameters that permit the generalization of results beyond the experimental setting.

Our results suggest that gifts do have a role to play in this firm. Although the experimental gift was not profitable, other gifts would have been. We estimate that firm profits for a given worker would increase by up to 17%, vis-à-vis a piece-rate contract, by the introduction of a profit maximizing gift. However, only one-half of the workers in this firm are predicted to reciprocate to a gift from their employer by increasing their effort level. This reduces the overall profits the firm can attain through gift giving—average profits increase 10%.

It is notable that gifts have an economic impact within a firm where output is measurable. The principle of reciprocity states that workers will respond to gifts by returning value to the firm. Yet, if measurable output is valuable (as in tree planting), then piece rates and gifts are close substitutes, and their use is determined by relative cost (or relative worker reaction to incentives). In our case, worker response to piece rates is relatively high; hence, piece rates limit

[38] Some indication of the importance of fatigue can be obtained by estimating a reduced-form dynamic panel data model with individual fixed effects

$$\ln(y_{it}) = \alpha_i + \lambda \ln(y_{it-1}) + \mathbf{x}_{it}'\boldsymbol{\phi} + \epsilon_{it},$$

where $\mathbf{x}_{it}$ denotes a vector of variables capturing weather and day of the week effects, and α_i denotes an individual specific effect. The elasticity parameter λ measures the percentage change in current period productivity associated with a percent change in productivity from the previous day. We estimated $[\lambda, \boldsymbol{\phi}]$ on the experimental data, implementing the approach proposed by Arellano and Bond (1991). We find that the estimated value of λ is negative, consistent with fatigue, but statistically insignificant (p-value = 0.11). Of course, a more structured model may capture dynamics in a more precise manner; hence, we caution the reader against forming strong conclusions on the basis of this result.

the effect of gifts during the experiment. In situations where the market clearing piece rate is low, however (due to labor-market conditions in our model), then the relative value of gifts increases. In other industries measurable output may not generate value to the firm (Holmstrom and Milgrom, 1991; Baker, 1992), further increasing the relative value of gifts.

This article also provides insights concerning the profitability of gift giving within the firm. First, our results suggest that profitability will depend on the labor market conditions of the workers. Indeed, the value of gifts is predicted to increase in periods of economic downturn when workers have lower outside alternatives. Interestingly, these results parallel efficiency-wage models: Shapiro and Stiglitz (1984) and MacLeod and Malcomson (1989) derive efficiency wages as self-enforcing implicit contracts that best supply effort incentives within slack labor markets (when unemployment is high). Akerlof's (1982) original work on gift exchange was largely attributed to the efficiency-wage literature, yet the mechanism here is very different; slack labor-market conditions allow profit-maximizing firms to reduce the piece rate paid to their workers and still satisfy their participation constraints. In doing so, the marginal cost (in terms of effort) of responding to the gift is also reduced, increasing the effect of a gift on average worker productivity. Second, the composition of the monetary gift is predicted to have an important impact on its profitability. Our analysis has revealed that gifts should be provided in the form of above market clearing piece-rates as opposed to handing out (mostly unprofitable) fixed wages. This finding has implications for existing experimental results that have failed to find profitable base-wage gifts in environments with contractible output (Gneezy and List, 2006, for example). In such environments workers respond more strongly to piece-rate gifts than to base-wage gifts—piece-rate gifts may be more effective.

Our results also have implications for the analysis of experimental data. Experiments provide exogenous variation in contracts, simplifying the identification of treatment effects. Yet economists are increasingly calling for the generalization of experimental results. Applying economic models to experimental data allows for the identification of structural parameters, permits generalization, and adds value to experiments. This is particularly useful when seeking to generalize in directions not attainable using experimental methods (such as different labor-market conditions).

Finally, we note that our model is static and neglects some dynamic issues associated with gift giving. Perhaps the most important is the rate at which gifts can or should be distributed by the firm. Our results suggest that gifts have an effect on worker productivity and can, under certain conditions, be profitable. Yet, an increasing body of evidence suggests that the effects of gifts are short term (Gneezy and List, 2006; Bellemare and Shearer, 2009). Whether or not gifts can form the basis of a profitable, long-term personnel policy or should only be used on special occasions remains a question for future research.

APPENDIX: PROOFS OF RESULTS IN SECTION 9

We first present conditions under which we can sign the direction of the bias in the case of risk aversion. For example, if extremely low shocks have zero probability such that earnings are bounded by $(1+\gamma)$, then the $G_{ij}^{\delta} < B_j$, the monetary transfer given during the experiment. This follows from the strict concavity of the utility function. From (30) the gift will be less than B_j if

$$\frac{\frac{1}{\delta}\left[B_j + \frac{r_j^{\gamma+1} s_{ij}^{\gamma+1}}{\kappa_i^{\gamma}(\gamma+1)}\right]^{\delta} - \frac{1}{\delta}\left[\frac{r_j^{\gamma+1} s_{ij}^{\gamma+1}}{\kappa_i^{\gamma}(\gamma+1)}\right]^{\delta}}{B_j} < 1 \quad \forall s.$$

But for any strictly concave, differentiable function $f()$ and any two points $y > x$ in the domain of f, $f(x) + f'(x)(y-x) > f(y)$. Setting $x = \frac{r_j^{\gamma+1} s_{ij}^{\gamma+1}}{\kappa_i^{\gamma}(\gamma+1)}$ and $y = B_j + \frac{r^{\gamma+1} s_{ij}^{\gamma+1}}{\kappa_i^{\gamma}(\gamma+1)}$ and rearranging gives

$$\text{(A.1)} \qquad \frac{\frac{1}{\delta}\left[B_j + \frac{r_j^{\gamma+1}s_{ij}^{\gamma+1}}{\kappa_i^{\gamma}(\gamma+1)}\right]^{\delta} - \frac{1}{\delta}\left[dis\frac{r_j^{\gamma+1}s_{ij}^{\gamma+1}}{\kappa_i^{\gamma}(\gamma+1)}\right]^{\delta}}{B_j} < \left[\frac{r_j^{\gamma+1}s_{ij}^{\gamma+1}}{\kappa_i^{\gamma}(\gamma+1)}\right]^{(\delta-1)} < 1 \quad \text{if}$$

$$\frac{r_j^{\gamma+1}s_{ij}^{\gamma+1}}{\kappa_i^{\gamma}(\gamma+1)} > 1 \quad \text{or} \quad W_{ij}(s) > (\gamma+1).$$

We next show that we underestimate β if workers are risk-averse and $W_{ij}(s) > (\gamma + 1) \quad \forall s$. To proceed, let $\tilde{G}_{ij} = B_j - \Delta$, $\Delta > 0$ be the true value of the gift. From (18), β is identified from

$$\frac{\exp\left\{\frac{\mathbf{E}(\ln(Y_{ij}^*)|\text{Gift})-\mathbf{E}(\ln(Y_{ij}^*)|\text{No Gift})+\gamma\ln(r_j)}{\gamma}\right\} - r_j}{\tilde{G}_{ij} + \Delta}.$$

The result follows from inspection of the previous equation.

The comparative static results (36) and (37) are derived by totally differentiating (35)

$$\begin{aligned} &\beta s_t \mathrm{d}B_t \\ &+ \left(\theta\gamma^2\kappa_1^2\left[\frac{[r+\beta B_{t+1}]^{(\gamma+1)}}{\gamma+1} - \beta B_{t+1}r^{\gamma}\right]\frac{\mathbf{E}(S_{t+1}^{\gamma+1})}{k_{t+1}^{\gamma}} - k_t\frac{1}{\gamma}E_t^{G\frac{1-\gamma}{\gamma}}\right)\mathrm{d}E_t^G \\ &- \left(\theta\gamma\kappa_1\left[\beta[r+\beta B_{t+1}]^{\gamma} - \beta r^{\gamma}\right]\frac{\mathbf{E}(S_{t+1}^{\gamma+1})}{k_{t+1}^{\gamma}}\right)\mathrm{d}B_{t+1} \\ = {}& 0. \end{aligned}$$

The results follow from inspection of the equation above.

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