Reciprocity, Matching, and Wage Competition

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Abstract

The presented model demonstrates how the coexistence of reciprocal and selfish types influences the formation of employment relationships, their profitability, wage differentials, wage competition, and unemployment in the presence of moral hazard. Wage and profitability differentials result from the differences in workers’ reactions to the managers’ wage offers. Moreover, these behavioral differences affect managers’ preferences for worker types. Thus, managers might make higher offers to attract the preferred worker type in a competitive labor market with excess supply of labor compared to a situation without competition. The resulting competitive matching allocates favored reciprocal workers to reciprocal managers. Consequently, unemployment arises first among unfavored reciprocal and selfish workers, respectively.

Keywords: reciprocity, gift exchange, matching, profitability, wage differentials, wage competition, unemployment

JEL classification: D03, D21, E24, J31

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1 Introduction

In real world labor relations, firms spend a considerable amount of resources to identify the types of potential workers by way of assessment centers, job interviews or close observation during the worker’s probation period. Besides productivity aspects like intelligence or experience, potential employees are also evaluated with regard to their social behavior or, put differently, their social preferences. As confirmed by numerous experimental findings, people exhibiting other-regarding preferences coexist with selfish individuals (see, e.g., Fehr and Gächter (1998) and Fehr and Schmidt (2006)). The difference in behavior of these two types has important implications for their employer.

To understand why social preferences might play a role in employment relationships, consider reciprocity: As a source of gift exchange between employer and employee, positive reciprocity offers a prominent explanation for non-minimal wage offers and effort choices beyond the selfishly rational minimum effort (for a theoretical treatment, see, e.g., Akerlof (1982) and Rabin (1993), for experimental evidence, e.g., Fehr and Falk (1999) and Charness (2004), and for empirical findings Dohmen et al. (2009)). On the other hand, negative reciprocity can result in shirking and sabotage activities (see, e.g., Bewley (1999), Krueger and Mas (2004), and Dohmen et al. (2009)).

The aim of this paper is to theoretically explore how reciprocity between a firm or manager and a worker can explain why some firms or teams are more profitable than others, although the production technology remains unchanged. Moreover, I investigate how the coexistence of reciprocal and selfish types influences the formation of employment relationships, wage differentials, wage competition, and unemployment in the presence of moral hazard.

My model examines small firms consisting of a manager who employs a worker to produce output. Although effort itself is not verifiable, output is. Based on expected output, the manager offers a contract that lets the worker participate in output. Both, manager and worker, can either be selfish or reciprocal. Depending on matching, offered shares, just as efforts, and outputs can differ, making some firms more profitable than others. I show that a purely reciprocal match is characterized by a strictly higher output share for the employee and a strictly higher effort, as compared to a mixed match led by a selfish manager if the worker is positively reciprocal. In contrast, both manager types offer the same low share to a selfish worker because they anticipate that selfish workers will not provide costly gifts. Furthermore, both manager
types can increase their utilities by employing reciprocal workers with low reference points, while the workers’ preferences for managers are only based on the size of the share offer but not on the type of employer.

So far, there is little theoretical research based on vertical social preferences. Akerlof (1982) states that gift exchange between firms and its employees can be a reason for above minimum wages and enhanced efforts due to higher effort norms introduced together with higher wages. A recent field experiment and the corresponding model by Englmaier and Leider (2012) is closely related to my setup. They investigate worker reactions to gifts by the manager and find that worker reciprocity enhances effort if the worker is able to influence manager payoff in return for the gift. However, in contrast to their setup that investigates vertical outcome-based reciprocity, the model presented here incorporates vertical intention-based reciprocity.

In addition, the coexistence of different types in relation to social preferences has rarely been considered explicitly in theory. Approaches to this question have been made, among others, by von Siemens (2011) and Kosfeld and von Siemens (2011). In both models workers differ in the extent to which they experience social preferences. However, they focus on optimal contracts offered by the firm to attract a worker type that maximizes expected profits and do not allow for social preferences of employers. My model differs in that it examines the equilibrium behavior of both, the employer and the worker, by additionally taking into account the reciprocity of the manager through endogenous profit shares.

Rotemberg and Saloner (1993) formally investigate the influence of leadership styles on the participation of employees in project proposals, and hence firm profitability, and find that participation in a firm led by a profit maximizing supervisor is lower than in a team led by a supervisor who also cares about the employee’s utility. Thus, the authors vary manager types but not worker types. Moreover, they do not address vertical reciprocity.

In the competition setting, I focus on managers’ preference for the favored reciprocal workers to investigate its implications for the labor market. Therefore, I introduce a labor market without frictions where the total number of workers available exceeds the total number of vacancies in the market but the share of positively reciprocal workers is not sufficient to fill all vacancies. In this setting, competing managers might offer higher shares than without competition to attract a preferred reciprocal worker. The resulting competitive matching allocates preferred reciprocal workers to reciprocal managers. Consequently, unemployment arises first among unfavored reciprocal and selfish workers. Thus, all scarce preferred reciprocal workers will be
employed, while selfish workers, followed by unfavored reciprocal workers, are only hired if there are still vacant jobs in the market.

This last result is in line with the findings of Dohmen et al. (2009), who relate measures of reciprocity of 20,774 individuals to their labor market outcomes. They find that positively reciprocal workers are associated with higher wages, efforts, and a higher probability to be employed, while negatively reciprocal workers are associated with lower efforts, and a lower probability to be employed.

An early attempt to infer labor market outcomes from gift exchange was made by Akerlof (1982). He shows that wages in labor markets with gift exchange lie above the market-clearing level and thus result in unemployment. Nevertheless, according to his model it does not pay for firms to cut wages because of the positive relationship between wages and effort norms. My approach is different in the sense that it focuses not at the emergence of unemployment but on the type of unemployed workers in a labor market with an excess labor supply. A competitive labor market with heterogeneous workers is also assumed by Kosfeld and von Siemens (2011). But again, the focus of their work is different. They are interested in incentives and self-selection of workers and the resulting corporate cultures in equilibrium rather than unemployment and the type of unemployed workers. Wage differentials and unemployment are usually investigated within the framework of search-theoretic labor market models that include search frictions by assumption. In these models unemployment is voluntary since workers can decide whether to participate in a (sub)market for labor or not, depending on the (sub)market wage and the probability to find a job in this (sub)market. My model gives an explanation of wage and profitability differentials without assuming any search frictions. Furthermore, unemployment in my model is involuntary and type-dependent.

The paper is structured as follows: Section 2 introduces the formal model. Section 3 derives individually rational shares, efforts, and outputs of different exogenous firm compositions and the corresponding comparative statics. In section 4, matching preferences are analyzed. Section 5 captures the outcomes of wage competition and unemployment. Section 6 concludes. All proofs can be found Appendix A.2.

1For an overview, see Rogerson et al. (2005).
2 Model Setup

I assume that a firm consists of two parties – the manager (supervisor or firm owner) and the worker, who are both risk neutral. The worker produces verifiable output $\pi(e) = \varepsilon e$, where $e \geq 0$ denotes the worker’s observable but non-verifiable effort and comes at a convex cost $K(e) = \frac{1}{2}e^2$ while $\varepsilon \in [0, 2]$ is a random variable with expected value $E[\varepsilon] = 1$. Furthermore, the worker is protected by limited liability that forbids negative wages, and his outside option is normalized to zero.

The manager offers a contract $C(\beta, \pi(e)) = \beta \pi(e)$ with $\beta \in [0, 1]$ to the worker to compensate him for his effort. A microeconomic condition for the optimality of a pure profit share contract can be found in Appendix A.1. An alternative interpretation of the contract might be that, due to a bargaining process, a share $\beta$ of output accrues to the worker in form of a wage, without explicitly considering the form of the optimal wage contract.

Both, the manager and the worker, can be of two different types, either selfish ($s$) or reciprocal ($r$). While $s$-types only care about their monetary outcome, $r$-types gain additional utility from reciprocity, i.e., reciprocating the behavior of reference agents. As a consequence, reciprocal types are willing to incur costs to reward friendly behavior or punish hostile behavior of their reference agents. Note that types are perfectly observable in this model. As argued before, firms spend a considerable amount of resources on screening. The same is true for the worker during his probation period.

The difference in types is captured by the reciprocity parameters $\mu \in [0, 1]$ and $\omega \in [0, 1]$, respectively, where $\mu$ refers to the manager type and $\omega$ refers to the worker type. While $\mu = 0$ and $\omega = 0$ describe selfish types, $\mu > 0$ and $\omega > 0$ represent reciprocal types. The reciprocity parameters have an upper bound to avoid unusually high reciprocal utilities that would completely outweigh monetary payoffs.

The corresponding manager’s expected utility is given by

$$U_m = (1 - \beta) E[\pi(e)] + \mu \left[ K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e} \right] [\Gamma(\beta) - R]$$

$^2$Especially in small firms the observability of effort is not absurd. When working together on a daily basis, all members of the firm develop a good idea of how much everybody contributes to the overall output. Nevertheless, their observations are hardly verifiable in court or by another third party, whereas output is usually verifiable.
while the worker’s utility is represented by

\[ U_w = \beta E [\pi(e)] - K(e) + \omega [\Gamma(\beta) - R] \left[ K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e} \right]. \] (2)

The first part of the manager’s utility is his monetary payoff which consists of his profit share. In addition, the second part of his utility function captures the reciprocal utility. Reciprocal utility consists of the worker’s friendliness measured by \(K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e}\) multiplied by the manager’s friendliness measured by \([\Gamma(\beta) - R]\), where \(\Gamma(\beta) = \beta\) with \(\Gamma(\beta) \in [0, 1]\) measures the generosity of the offered contract and \(R \in [0, 1]\) stands for a reference point of the worker which represents the share a reciprocal worker perceives as fair. Finally, the product of worker friendliness and manager friendliness is weighted by \(\mu\), the manager’s reciprocity parameter, which indicates the importance of reciprocal utility to the manager.

Thus, if the worker’s behavior is perceived as friendly, i.e., \(\mu[K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e}] > 0\), the manager experiences positive reciprocal utility if his offered share exceeds the worker’s reference value, i.e., \(\beta > R\), but would suffer from negative reciprocal utility if he reacted hostile to the worker’s friendliness by offering \(\beta < R\). Similarly, if the worker’s behavior is perceived as hostile, i.e., \(\mu[K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e}] < 0\), the manager gains positive utility from reciprocity by reacting hostile, i.e., offering \(\beta < R\), but loses utility if he reacts friendly to the worker’s hostility, i.e., \(\beta > R\).

However, the friendliness of the worker’s action is not simply measured by \([\pi(e) - \hat{\pi}]\) where \(\hat{\pi}\) denotes a reference output. Even for selfish types the optimal effort and hence the expected output increase in \(\beta\) as will be seen in the next section. Thus, if the worker’s friendliness is captured by \([\pi(e) - \hat{\pi}]\), a manager offering a share \(\beta > R\) could perceive \([\pi(e) - \hat{\pi}]\) as a costly gift from a reciprocal worker, although it is a selfish worker who considers it optimal to increase his effort due to a higher share \(\beta\) without incurring a cost. Instead, I measure the worker’s friendliness by \(K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e}\). Only if the worker increases effort, and thus also the expected output, beyond the selfishly optimal amount, i.e., \(K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e} > 0\), implying a monetary loss in form of a suboptimal monetary payoff, is his behavior perceived as friendly. Note that the worker’s hostile behavior or punishment, i.e., \(K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e} < 0\), also incurs a cost in form of a reduced monetary payoff of the worker. In contrast, the behavior of a selfish worker entails a binding first order condition, i.e., \(K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e} = 0\).

Similar to the manager’s utility function, the first part of the worker’s utility is the monetary
payoff as his profit share net of effort costs. Again, the second part represents reciprocal utility with manager friendliness $\beta - R$ multiplied by the worker’s friendliness $K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e}$ and weighted by $\omega$, the worker’s reciprocity parameter, which measures the importance of worker’s reciprocal utility. Thus, if the manager’s behavior is perceived as friendly, i.e., $\omega [\beta - R] > 0$, the worker experiences additional reciprocal utility if he reacts friendly, i.e., $K'(e) > \frac{\partial C(\beta, E[\pi(e)])}{\partial e}$, but loses utility if he behaves hostile, i.e., $K'(e) < \frac{\partial C(\beta, E[\pi(e)])}{\partial e}$. The reverse is true for hostility on the part of the manager.

Note that an offer $\beta = R$, which exactly meets the worker’s reference point, is perceived as neutral by the worker and induces selfish worker behavior (maximizing monetary payoff) even if he is of the $r$-type. Similarly, even a reciprocal manager reacts selfishly, if the worker’s effort choice is characterized by $K'(e) - \frac{\partial C(\beta, E[\pi(e)])}{\partial e} = 0$. Consequently, the manager’s reference point corresponds to the utility maximizing effort of a selfish worker.

The presented utility functions are modified versions of the reciprocity utility function presented by Rabin (1993) that was used in a related form by, e.g., Englmaier and Leider (2012). Rabin’s utility function also includes a multiplicative term of manager friendliness and worker friendliness. But he measures friendliness by a deviation of the monetary payoff from an equitable payoff as the mean of possible monetary outcomes and so does not allow for different reference points. Moreover, friendliness is normalized by the range of possible monetary outcomes. In contrast, Englmaier and Leider (2012) abandon this normalization and introduce a simpler multiplicative form of manager and worker friendliness. In addition, they allow for a general reference point and introduce a reciprocity weight to mimic heterogeneous reciprocity concerns. However, their measure of friendliness is still based on monetary payoffs, thus referring to the concept of outcome based fairness. The reciprocal part of utility in this model is measured differently. Instead of comparing total payoffs to a reference payoff, in my model, reciprocal agents compare offered shares and effort choice behavior. Thus, they are concerned with procedural fairness and evaluate the other’s behavior directly. Recall that although effort is not verifiable, it is observable. Consequently, although effort cannot be prescribed in a contract, it can be used to evaluate worker behavior.

The timing of the model is as follows: First, types are observed. Then the manager makes a binding offer. After observing the offered share, the worker decides about effort. Finally, output is realized and the wage payment is made.
3 Individual Optimization

First, I solve the optimization problem for a purely reciprocal match. The results of the other possible matches are then deduced from the obtained solutions by manipulating $\mu$ and $\omega$.

3.1 Purely reciprocal match

As derived before, the expected utilities in a purely reciprocal match are given by (1) and (2). Incentive compatibility requires that the worker choose his effort to maximize his utility, i.e., $e = \arg \max U_w$.

**Lemma 1. Optimal Worker Behavior**

- The optimal effort of a reciprocal worker is given by $e = \beta + \omega (\beta - R)$.
- If the offered share is perceived as friendly by the worker, i.e., $(\beta - R) > 0$, a reciprocal worker provides a gift of $\omega (\beta - R)$ additional effort units.
- Otherwise, if the offered share is perceived as hostile, i.e., $(\beta - R) < 0$, a reciprocal worker punishes the manager by reducing his effort $\omega (R - \beta)$ effort units.

In addition, limited liability prescribes that wages must be non-negative for every outcome of $\pi(e)$, which is always satisfied for $\beta \geq 0$. The equilibrium share offered by a reciprocal manager to a reciprocal worker is then given by $\beta = \arg \max E[U_m]$ with $\beta \geq 0$, subject to the incentive compatibility constraint $e = \beta + \omega (\beta - R)$.

**Lemma 2. Equilibrium Behavior in the Purely Reciprocal Match**

The reciprocal manager offers a share $\beta^*_{rr} = \frac{1 + \omega (1 + R (1 - 2\mu))}{2(1 + \omega (1 - \mu))}$ to the reciprocal worker and thus implements effort $e^*_{rr} = \frac{(1 + \omega)^2 - \omega R (1 + (2\mu + \omega))}{2(1 + \omega (1 - \mu))}$.

Moreover, evaluating the firm’s optimal behavior allows for further inferences about employment relations by combining the results of Lemmas 1 and 2.

**Proposition 1. Reference Share and Employment Relations**

- If the reference share of the worker is low, i.e., $R < \frac{1 + \omega}{2 + \omega}$, the employment relationship is characterized by positive reciprocity (gift exchange).
- Otherwise, if $R > \frac{1 + \omega}{2 + \omega}$, negative reciprocity (hostility) is a feature of employment.
The distinction between positive and negative reciprocity is important to understand the equilibrium behavior of both, the firm and the worker. If the reference share of the reciprocal worker is low, i.e., \( R < \frac{1+\omega}{2+\omega} \), the share offered by a manager in equilibrium is higher than the worker’s reference point, i.e., \( \beta^* > R \). This implies that the worker perceives the manager’s behavior as friendly and is willing to provide a gift of \( \omega (\beta^* - R) \) effort units. Otherwise, if the reference share of the reciprocal worker is high, i.e., \( R > \frac{1+\omega}{2+\omega} \), the equilibrium offer will fall short of the worker’s reference share, i.e., \( \beta^* < R \), implying that the worker perceives the manager’s behavior as hostile and punishes him with a decrease in effort of \( \omega (R - \beta^*) \) effort units. Thus, depending on whether the worker is positively or negatively reciprocal, equilibrium shares, equilibrium efforts, and the corresponding comparative statics will differ.

### 3.2 Comparative Statics

While the optimal share \( \beta^*_{rr} \) increases in the worker’s reference share \( R \), his effort \( e^*_r \) decreases in \( R \). The higher the entitlement of the reciprocal worker, the lower the perceived manager friendliness given \( \beta^*_{rr} \), resulting in a decrease in worker friendliness. This effect can only be curtailed by an increase in \( \beta^*_{rr} \). However, the optimal increase in \( \beta^*_{rr} \) can not entirely compensate the reduction in manager friendliness, causing a decrease in optimal effort \( e^*_r \).

The higher \( \omega \), the stronger the reaction of the worker to manager friendliness (hostility). The manager thus has an incentive to increase the optimal share \( \beta^*_{rr} \) to enhance gifts (avoid punishment) from the worker as his reciprocity concern increases. In contrast, the effect of an increase in the manager’s reciprocity concern \( \mu \) is twofold. If the employment relationship is characterized by positive reciprocity, i.e., \( R < \frac{1+\omega}{2+\omega} \), an increase in \( \mu \) indicates that the worker’s behavior is perceived as more friendly. As a consequence, a reciprocal manager then wants to repay the worker’s gift by a larger gift in return, i.e., a higher \( \beta^*_{rr} \). Instead, if the employment relationship is characterized by negative reciprocity, i.e., \( R > \frac{1+\omega}{2+\omega} \), an increase in \( \mu \) implies that the worker’s behavior is perceived as more hostile, which is punished by the manager with a decrease in \( \beta^*_{rr} \).

The impacts of the reciprocity concerns \( \mu \) and \( \omega \) on the equilibrium effort \( e^*_r \) also depend on employment relations. If the worker is positively reciprocal, \( e^*_r \) rises with \( \mu \) and also with \( \omega \). Otherwise, if the worker is negatively reciprocal, \( e^*_r \) decreases with \( \mu \) due to a decreased share \( \beta^*_{rr} \). Furthermore, \( e^*_r \) might also decrease in \( \omega \). A negatively reciprocal worker perceives manager behavior as hostile and repays manager hostility by hostility in form of reduced effort.
This effect can only be curtailed by an increase in $\beta^*_{rr}$. But if the increase is too small to outweigh the worker’s increased hostility, which is the case for $\frac{(1+\omega)^2+\mu(1+\omega^2)}{(1+\omega)^2+\mu(2+\omega^2)} < R$, $e^*_{rr}$ will decrease in $\omega$.

3.3 Other matches

Given Lemma 2 from the previous subsection, the results for all the other matches can be deduced by manipulating $\mu$ and $\omega$.

**Selfish manager and reciprocal worker**

In case a selfish manager faces a reciprocal worker, $\mu = 0$ and $\omega > 0$ apply.

**Lemma 3. Equilibrium Behavior in a Mixed Match with a Selfish Manager**

In a mixed match with a selfish manager, optimal outcomes are given by $\beta^*_{sr} = \frac{1+\omega(1+R)}{2(1+\omega)}$ and $e^*_{sr} = \frac{1+\omega(1-R)}{2}$. Again, an increase in the worker’s reference share $R$ has an enhancing effect on the optimal share $\beta^*_{sr}$ but the opposite effect on the optimal effort $e^*_{sr}$. As in a purely reciprocal match, the optimal share $\beta^*_{sr}$ increases with the worker’s reciprocity concern $\omega$. This is driven by conditional cooperation of selfish managers. Knowing that a positively reciprocal worker is willing to reciprocate a gift, a selfish manager is willing to behave friendly by choosing a share above the worker’s entitlement $R$. This result corresponds to the results of many laboratory experiments that have shown that people are willing to cooperate conditional on the cooperation of others (for an overview, see Gächter (2007)). Otherwise, when facing a negatively reciprocal worker, the selfish manager has to face punishment. He tries to reduce this punishment by offering a share that is larger than the share he would offer to a selfish worker. Moreover, in contrast to the purely reciprocal match, $e^*_{sr}$ is definitely increasing in $\omega$ since the selfish manager refrains from punishing the worker even if the latter is negatively reciprocal. Consequently, the increase in $\beta^*_{sr}$ outweighs the increase in the worker’s hostility.

**Matches with selfish workers**

In case a reciprocal manager, i.e., $\mu > 0$, meets a selfish worker, i.e., $\omega = 0$, Lemma 4 applies.

**Lemma 4. Equilibrium Behavior in a Mixed Match with a Reciprocal Manager**

Optimal outcomes in a mixed match with a reciprocal manager are given by $\beta^*_{rs} = \frac{1}{2}$ and $e^*_{rs} = \frac{1}{2}$. 

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The reciprocal manager anticipates that a selfish worker will never reciprocate friendly manager behavior and thus contribute nothing to the manager’s reciprocal utility. For this reason the reciprocal manager offers a selfish worker a share that maximizes only the manager’s monetary payoff given the optimal behavior of a selfish worker.

The same is true in case a selfish manager, i.e., $\mu = 0$, meets a selfish worker, i.e., $\omega = 0$.

**Lemma 5. Equilibrium Behavior in a Purely Selfish Match**

Optimal outcomes in a purely selfish match are identical to the outcomes in a mixed match with a reciprocal manager, i.e., $\beta_{rs}^* = \beta_{ss}^*$ and $e_{rs}^* = e_{ss}^*$.

As the reciprocal manager, the selfish manager anticipates a selfish worker not to reciprocate a gift. Thus, his offer and the resulting worker effort will equal the results of a mixed match with a reciprocal manager.

### 3.4 Individually optimal outcomes

Given the results of section 3.3 equilibrium shares and efforts can be compared by pairs, either for a fixed worker type or a fixed manager type.

#### 3.4.1 Fixed worker type

A reciprocal worker can either be employed by a reciprocal or a selfish manager. As stated by Lemma 1, employment by a reciprocal manager implies $\beta_{rr}^* = \frac{1 + \omega(1 + R(1 - 2\mu))}{2(1 + \omega(1 - \mu))}$ and $e_{rr}^* = \frac{(1 + \omega)^2 - R\omega(1 + (2\mu + \omega))}{2(1 + \omega(1 - \mu))}$ while employment by a selfish manager is characterized by $\beta_{sr}^* = \frac{1 + \omega(1 + R)}{2(1 + \omega)}$ and $e_{sr}^* = \frac{1 + \omega(1 - R)}{2}$, as stated by Lemma 3.

**Lemma 6. Outcomes with a Reciprocal Worker**

- If the worker is positively reciprocal, i.e., $R < \frac{1 + \omega}{2 + \omega}$, $\beta_{rr}^* > \beta_{sr}^*$ and $e_{rr}^* > e_{sr}^*$.

- Otherwise, if the worker is negatively reciprocal, i.e., $R > \frac{1 + \omega}{2 + \omega}$, $\beta_{sr}^* > \beta_{rr}^*$ and $e_{sr}^* > e_{rr}^*$ hold.

Lemma 6 indicates that in case of positively reciprocal workers, manager reciprocity has an enhancing effect on both, the offered share and the effort. This is due to the fact that the reciprocal manager is willing to reciprocate the worker’s enhanced effort by further increasing the worker’s share. This is in turn perceived as more friendly by the worker and results in a further increase in effort. In contrast, a negatively reciprocal worker perceives manager behavior
as hostile. He repays this hostility by hostility in form of reduced effort which, in turn, pro-
vokes more hostile behavior on the part of the reciprocal manager in form of a further decrease in the worker’s share. In contrast, a selfish manager would not react to the worker’s hostile behavior.

A selfish worker’s situation is independent of manager type as previously stated by Lemma 5.

**Lemma 7. Outcomes with a Selfish Worker**

Independent of manager type, the selfish worker receives $\beta_{rs}^* = \beta_{ss}^* = \frac{1}{2}$ and provides effort $e_{rs}^* = e_{ss}^* = \frac{1}{2}$.

Summing up the results of Lemmas 6 and 7 leads to Proposition 2:

**Proposition 2. Fixed Worker Type**

- A positively reciprocal worker receives a higher share and exerts more effort in a match with a reciprocal manager.
- In contrast, the share and effort of a negatively reciprocal worker are higher in a match with a selfish manager.
- The share and the effort of a selfish worker is independent of manager type.

### 3.4.2 Fixed manager type

A reciprocal manager can either employ a reciprocal or a selfish worker. Employment of a reciprocal worker implies $\beta_{rr}^* = \frac{1+\omega(1+R(1-2\mu))}{2(1+\omega(1-\mu))}$ and $e_{rr}^* = \frac{(1+\omega)^2-R\omega(1+2\mu+\omega)}{2(1+\omega(1-\mu))}$, as stated by Lemma 2, while employment of a selfish worker is characterized by $\beta_{rs}^* = \frac{1}{2}$ and $e_{rs}^* = \frac{1}{2}$ as given by Lemmas 4 and 5.

**Lemma 8. Outcomes with a Reciprocal Manager**

- If the worker is positively reciprocal, i.e., $R < \frac{1+\omega}{2+\omega}$, $\beta_{rr}^* > \beta_{rs}^*$ and $e_{rr}^* > e_{rs}^*$ hold.
- If the worker is negatively reciprocal, i.e., $R > \frac{1+\omega}{2+\omega}$,
  - $\beta_{rs}^* > \beta_{rr}^*$ is true whenever $\mu > \frac{1}{2}$ and $R < \frac{\mu}{2\mu+1}$, but $\beta_{rr}^* > \beta_{rs}^*$ otherwise, and
  - efforts are characterized by $e_{rr}^* \geq e_{rs}^*$ for $R \leq \frac{1+\mu+\omega}{1+2\mu+\omega}$ and $e_{rs}^* > e_{rr}^*$ for $R > \frac{1+\mu+\omega}{1+2\mu+\omega}$.
As before, if the worker is positively reciprocal, reciprocity has an enhancing effect on both, offered share and effort. In contrast, a negatively reciprocal worker perceives manager behavior as hostile and repays manager hostility with hostility which in turn forces optimal shares downwards. This might even lead to a drop in $\beta_{rs}^*$ below $\beta_{rs}^*$ if the manager’s hostility implies a substantial decrease in the worker’s share due to a high $\mu$. Otherwise, despite hostility a negatively reciprocal worker might still receive a higher share than a selfish worker employed by the same reciprocal manager.

In addition, even with hostility the effort of a negatively reciprocal worker ($e_{rr}^*$) can exceed the effort of a selfish one ($e_{rs}^*$) if hostility is not too high, i.e., $R \leq \frac{1+\mu+\omega}{1+2\mu+\omega}$. In this case, fearing the punishment of his highly reciprocal manager, the reciprocal worker punishes the manager by only slight reductions in effort. Otherwise, if the employment relationship is characterized by very hostile behavior, i.e., $R > \frac{1+(\mu+\omega)}{1+(2\mu+\omega)}$, $e_{rr}^*$ drops below $e_{rs}^*$.

A selfish manager’s situation is described by Lemmas 2 and 3. Employment of a reciprocal worker thus implies $\beta_{sr}^* = \frac{1+\omega(1+R)}{2(1+\omega)}$ and $e_{sr}^* = \frac{1+\omega(1-R)}{2}$ while the employment of a selfish worker implies $\beta_{ss}^* = \frac{1}{2}$ and $e_{ss}^* = \frac{1}{2}$.

**Lemma 9.** Outcomes with a Selfish Manager

A selfish manager always offers a higher share to the reciprocal worker, i.e., $\beta_{sr}^* > \beta_{ss}^*$, and thus implements effort $e_{sr}^* > e_{ss}^*$.

If a selfish manager employs a positively reciprocal worker, it pays for him to increase the worker’s share (compared to the share of a selfish worker) to benefit from enhanced effort. Otherwise, if employment is characterized by hostility, the selfish manager does not react hostile to worker effort below the selfishly optimal level. Thus, hostile behavior is only one-sided and can be reduced by increasing the worker’s share. Consequently, the share offered to a reciprocal worker will be higher than the one offered to a selfish worker in equilibrium. In addition, higher shares have a positive effect on effort even in the presence of worker hostility.

Lemmas 8 and 9 can be combined into Proposition 3:

**Proposition 3.** Fixed manager type

- A reciprocal manager pays a higher share to a positively reciprocal worker than to a selfish one and thus implements a higher effort.
Even with a negatively reciprocal worker the share and the effort in a purely reciprocal match can be higher than in a mixed match led by a reciprocal manager.

A selfish manager offers a higher share to a reciprocal worker than to a selfish one and receives a higher effort in return.

4 Matching Preferences

Propositions 2 and 3 show that equilibrium shares and efforts differ with matches implying different utility levels of both, the manager and the worker. While managers can choose what type of worker to employ and workers can choose the type of their employer, both compare their utility levels given the different worker and manager types, respectively, and choose the one that generates a larger utility.

Denote the expected indirect utility of a manager of reciprocity concern $\mu$ as $U_m(\beta_{rr}^*) = V_m(\mu, \omega)$ with $\mu, \omega \geq 0$. Comparing $V_m(\mu, \omega)$ to $V_m(\mu, 0)$ leads to Lemma 10.

**Lemma 10. Managers’ Matching Preferences**

- If the reciprocal worker is positively reciprocal,
  
  - $V_m(\mu, \omega) > V_m(\mu, 0)$ whenever $R < \frac{1 + 2\mu + \omega}{4\mu + \omega} - \frac{\sqrt{1 + \omega - \mu\omega}}{(4\mu + \omega)^2}$, but $V_m(\mu, \omega) < V_m(\mu, 0)$ for $
  \frac{1 + 2\mu + \omega}{4\mu + \omega} - \frac{1}{2} < \frac{1 + \omega}{\omega} < R < \frac{1 + \omega}{2},$
  
  - and $V_m(0, \omega) > V_m(0, 0)$ whenever $R < \frac{1}{\omega} - \sqrt{1 + \omega - \mu\omega}$, but $V_m(0, \omega) < V_m(0, 0)$ for 
  $\frac{1}{\omega} - \sqrt{1 + \omega - \mu\omega} < R < \frac{1 + \omega}{2\omega}.$

- Otherwise, if the reciprocal worker is negatively reciprocal, $V_m(\mu, \omega) < V_m(\mu, 0)$ and $V_m(0, \omega) < V_m(0, 0)$ is true.

Note that $R < \frac{1 + \omega}{\omega} - \sqrt{1 + \omega}$ is a more restrictive condition than $R < \frac{1 + 2\mu + \omega}{4\mu + \omega} - \frac{\sqrt{1 + \omega - \mu\omega}}{(4\mu + \omega)^2}$.

Thus, for $R < \frac{1 + \omega}{\omega} - \sqrt{1 + \omega}$ both manager types prefer positively reciprocal workers to selfish workers. In contrast, for $\frac{1 + \omega}{\omega} - \sqrt{1 + \omega} < R < \frac{1 + 2\mu + \omega}{4\mu + \omega} - \frac{\sqrt{1 + \omega - \mu\omega}}{(4\mu + \omega)^2}$ selfish managers prefer to employ selfish workers, while reciprocal managers still prefer employing positively reciprocal ones. Finally, for $\frac{1 + \omega}{2\omega} > R > \frac{1 + 2\mu + \omega}{4\mu + \omega} - \frac{\sqrt{1 + \omega - \mu\omega}}{(4\mu + \omega)^2}$, although workers are still positively reciprocal and are willing to engage in gift exchange, they generate a lower manager utility than selfish workers. The reason is that a higher reference point $R$ forces equilibrium shares upward,
while the increase in the worker’s gift in return is not sufficient to compensate the increase in wage costs. Consequently, managers can only increase their utility by employing a positively reciprocal worker as long as the increase in wage costs is small enough.

The expected indirect utility of a worker of type $\omega$ is given by $U_w(\beta^*) = V_w(\mu, \omega)$ with $\mu, \omega \geq 0$. Comparing $V_w(\mu, \omega)$ to $V_w(0, \omega)$ leads to Lemma 11.

**Lemma 11. Workers’ Matching Preferences**

- For $R < \frac{1+\omega}{2+\omega}$, $V_w(\mu, \omega) > V_w(0, \omega)$ holds,

- while $V_w(\mu, \omega) < V_w(0, \omega)$ is true if $R > \frac{1+\omega}{2+\omega}$.

- Furthermore, $V_w(\mu, 0) = V_w(0, 0)$.

However, the reciprocal worker’s priority is to find an employer who offers the highest share since $\frac{dU_w(\beta)}{d\beta} = \frac{2(\beta^2 + \beta \cdot \omega^2)}{\beta^2} > 0$. Thus, his preference for manager types is only due to the higher share offer in equilibrium and not to the type of employer. If the worker is positively reciprocal, the share offered by a reciprocal manager is higher than that offered by a selfish manager. Otherwise, if the worker is negatively reciprocal, the share offered by a selfish employer is higher than that offered by a reciprocal employer. This explains workers’ preferences for managers.

**Proposition 4. Matching Preferences**

- Managers of both types prefer hiring reciprocal workers instead of selfish ones if $R < \frac{1+\omega}{\omega}$ but prefer hiring a selfish worker to a reciprocal one with $R > \frac{1+\omega}{\omega} - \sqrt{\frac{1+\omega}{\omega^2} - \frac{1+\omega}{4\mu+\omega}}$.

- For $\frac{1+\omega}{\omega} - \sqrt{\frac{1+\omega}{\omega^2}} < R < \frac{1+\omega}{4\mu+\omega} - \sqrt{\frac{1+\omega - \mu \omega}{(4\mu+\omega)^2}}$, manager types will differ in their preferences, with reciprocal managers preferring reciprocal workers but selfish managers preferring selfish workers.

- Positively reciprocal workers prefer employment by reciprocal managers, while negatively reciprocal workers prefer employment by selfish managers.

- Selfish workers are indifferent about manager type.
5 Wage Competition

As stated in Proposition 4, both manager types can increase their utilities by employing a positively reciprocal worker instead of a selfish one. However, if the number of positively reciprocal workers is not sufficiently large to fill all vacancies, competition among managers is likely to occur.

Assume that in the competitive labor market of interest without frictions workers are either selfish or reciprocal with \( \omega = \bar{\omega} \) and \( R = \frac{1}{2} \). This is a natural reference point to evaluate the manager’s behavior because it represents the optimal share an employed selfish worker earns in the labor market. Note that \( R = \frac{1}{2} \) satisfies \( R < \frac{1 + \bar{\omega}}{2 + \bar{\omega}} \) and thus implies that reciprocal workers are positively reciprocal. Furthermore, \( R = \frac{1}{2} \) also satisfies \( R < \frac{1 + \bar{\omega}}{\bar{\omega}} - \sqrt{\frac{1 + \bar{\omega}}{\bar{\omega}}} \) ensuring that \( V_m(\mu, \bar{\omega}) > V_m(\mu, 0) \) for \( \mu \geq 0 \). Nevertheless, given Proposition 4 the results of this section can be expanded to simultaneously allow for negatively reciprocal workers, as will be discussed in the last part of this section.

The total number of workers denoted by \( W \) is the sum of selfish workers \( (W_s) \) and reciprocal workers \( (W_r) \). \( W \) is assumed to be sufficiently large to team up with the available total number of managers \( M \) (selfish managers \( (M_s) \) and reciprocal managers \( (M_r) \)), i.e., \( W \geq M \). However, the number of reciprocal workers is small such that not every manager will succeed in hiring a reciprocal worker i.e., \( W_r < M \).

A manager will then be willing to pay a share \( \beta^C(\mu, \bar{\omega}) \) to a reciprocal worker (instead of the equilibrium share without competition \( \beta^*(\mu, \bar{\omega}) \)) as long as his utility from employing a reciprocal worker at a share \( \beta^C(\mu, \bar{\omega}) \) exceeds his utility from employing a selfish worker at \( \beta^*(\mu, 0) = R = \frac{1}{2} \) i.e., \( U_m(\beta^C(\mu, \bar{\omega})) \geq U_m(\beta^*(\mu, 0)) \).

5.1 Competitive shares

Recall that a manager can win favor with a worker by simply offering a share that at least matches the share a rivaling manager is willing to pay.

**Lemma 12. Maximum Competitive Share**

The maximum competitive share \( \beta^C_{\text{max}}(\mu, \bar{\omega}) = \frac{1 + \bar{\omega}(2 - \mu)}{2[1 + \bar{\omega}(1 - \mu)]} \) is increasing in \( \mu \). Thus, a more reciprocal manager can always out-compete less reciprocal managers whenever competing for a reciprocal worker with \( \omega = \bar{\omega} \) and \( R = \frac{1}{2} \). Consequently, the maximum amount of purely reciprocal matches is realized.
in a competitive equilibrium with homogeneous reciprocal workers.

**High competitive shares**

Define the last reciprocal manager to employ a reciprocal worker by \( \mu \). If \( W_r < M_r \), there are still reciprocal managers \( \mu_1 < \mu \) in the market but only selfish workers for hire. Consequently, the competition for reciprocal workers solely takes place among reciprocal managers. Thus, reciprocal managers with \( \mu \geq \mu_1 \) competing for a reciprocal worker with reciprocity concern \( \bar{\omega} \) have to fulfill an additional constraint stating that a manager who was successful in hiring a reciprocal worker must have offered a wage \( \beta^C(\mu, \bar{\omega}) \geq \beta^C(\mu_1, \bar{\omega}) \geq \beta^C_{\text{max}}(\mu_1, \bar{\omega}) \). Since \( \beta^C_{\text{max}}(\mu_1, \bar{\omega}) > \beta^C_{\text{max}}(0, \bar{\omega}) \), as shown by Lemma 3, competition among reciprocal managers with \( \mu \geq \mu_1 \) and selfish managers need not be considered explicitly.

**Lemma 13. High Competitive Share for Reciprocal Workers**

If \( W_r < M_r \), the share a reciprocal manager offers to a reciprocal worker with reciprocity concern \( \bar{\omega} \) when competing with other managers is given by \( \beta^C(\mu, \bar{\omega}) = \beta^C_{\text{max}}(\mu_1, \bar{\omega}) > \beta^* (\mu, \bar{\omega}) \). As a result, managers gain smaller utilities while workers gain larger utilities compared to a situation without competition.

Since both \( \beta^* (\mu, \bar{\omega}) \) and \( \beta^C_{\text{max}}(\mu, \bar{\omega}) \) are increasing in \( \mu \), highly reciprocal managers can always out-compete reciprocal managers with lower reciprocity concerns (including selfish managers). Thus, only the managers with the highest reciprocity parameter \( \mu \) will be able to hire a reciprocal worker. Consequently, competition represents a matching mechanism that allocates the managers with the highest possible reciprocity concern to reciprocal workers. Efforts are enhanced due to an exchange of larger gifts because of higher shares under competition. Anyhow, managers are left with a smaller utility since the increase in effort cannot balance the increased costs.

When all reciprocal workers are employed, only selfish workers are available in the labor market. The manager’s utility from employing a selfish worker is then independent of manager type if there is no competition for workers among the remaining managers.

**Lemma 14. Competitive Share for Selfish Workers**

For \( W_r < M_r \) both manager types offer a share \( \beta^* (\mu, 0) = R = \frac{1}{2} \) to selfish workers and gain utilities \( V_m(\mu, 0) \), while their workers gain utilities \( V_w(\mu, 0) \).
Low competitive shares

If, instead, the labor market is characterized by $W_r \geq M_r$, $\mu$ represents the last reciprocal manager in the market. This manager competes exclusively with selfish employers. Thus, the reciprocal managers maximize their utilities given the additional competition constraint $\beta C (\mu, \bar{\omega}) \geq \beta C (\bar{\mu}, \bar{\omega}) \geq \beta_{\text{max}}^C (0, \bar{\omega})$. If there are enough reciprocal workers to be employed by all the reciprocal managers, these do not have to compete among each other but only with the selfish managers who they can out-rival already at a share $\beta_{\text{max}}^C (0, \bar{\omega})$. Again, efforts are enhanced due to an exchange of larger gifts because of higher shares under competition. But still, managers are left with smaller utilities due to increased wage costs.

If there are still some reciprocal workers left after all reciprocal managers have hired a reciprocal worker, all remaining reciprocal workers will work for selfish managers who will compete among each other.

**Lemma 15. Low Competitive Share for Reciprocal Workers**

- If $W_r \geq M_r$, the optimal share a reciprocal manager offers to a reciprocal worker with $\omega = \bar{\omega}$ and $R = \frac{1}{2}$ when competing with other managers is given by $\beta C (\mu, \bar{\omega}) = \beta_{\text{max}}^C (0, \bar{\omega}) > \beta^* (\mu, \bar{\omega})$. As a result, managers gain smaller utilities while workers gain larger utilities compared to a situation without competition.

- For $W_r \geq M_r$, selfish managers offer reciprocal workers a share $\beta_{\text{max}}^C (0, \bar{\omega})$ and gain utilities $V_m (0, 0)$, while their workers gain larger utilities compared to a situation without competition.

The remaining selfish managers will employ selfish workers.

**Lemma 16. Competitive Share for Selfish Workers**

For $W_r \geq M_r$, selfish managers who could not attract a reciprocal worker offer their optimal share $\beta^* (\mu, 0) = R = \frac{1}{2}$ to selfish workers and gain utilities $V_m (0, 0)$ while their workers gain utility $V_w (0, 0)$.

Low competitive shares for positively reciprocal workers are due to a larger supply of such workers in the labor market. Nevertheless, as long as they are scarce, competition forces their shares upward and implies larger utilities for positively reciprocal workers.
5.2 Output and total utilities

Recall that output is assumed to be \( \pi(e) = ee \) with the individual optimal worker effort \( e = \beta + \omega(\beta - R) \). Lemmas 13 and 15 show that positively reciprocal workers earn shares \( \beta^C(\mu, \omega) > \beta^*(\mu, \omega) \), implying \( e^C(\mu, \omega) = \beta^C(\mu, \omega) + \omega(\beta^C(\mu, \omega) - R) > e^*(\mu, \omega) \). Thus, managers employing a positively reciprocal worker have a larger expected output with competition than without.

However, this increase in output cannot outbalance the loss in manager utility due to smaller managers’ shares of output if they are involved in competition, as already stated by Lemmas 13 and 15. But the increase in workers’ utilities with competition, when earning a higher share \( \beta^C(\mu, \omega) > \beta^*(\mu, \omega) \), increases far more than managers’ utilities decrease, leaving the teams with larger total utilities with competition than without.

5.3 Unemployment

Also recall that \( W \geq M \) by assumption. Since positively reciprocal workers are scarce and offer potentially larger utilities to their employers, competition among managers for those workers leads to their full employment. The remaining workers in the market are selfish and their number potentially exceeds the number of the remaining managers still looking for an employee. Thus, the workers that are left unemployed after all managers have filled their vacancies can only be of the selfish type.

5.4 Other reciprocal workers

The results in this section can also be extended to contain not only preferred reciprocal workers but also unfavored reciprocal workers. Recall that managers are only willing to compete for reciprocal workers as long as \( R \leq \frac{1 + 2\mu + \omega}{4\mu + \omega} - \sqrt{\frac{1 + \omega - \mu\omega}{(4\mu + \omega)^2}} \), implying \( V_m(\mu, \omega) > V_m(\mu, 0) \) for \( \mu \geq 0 \). Thus, for \( R > \frac{1 + 2\mu + \omega}{4\mu + \omega} - \sqrt{\frac{1 + \omega - \mu\omega}{(4\mu + \omega)^2}} \) – which is a more restrictive condition than \( R > \frac{1 + \omega}{2 + \omega} \) – managers will not be willing to engage in competition since the resulting gift exchange is not sufficient to outweigh the increase in wage costs. Consequently, workers who are willing to behave positively reciprocal but offer a small gift due to a high reference point are less attractive than selfish workers. Note that \( \frac{1 + 2\mu + \omega}{4\mu + \omega} - \sqrt{\frac{1 + \omega - \mu\omega}{(4\mu + \omega)^2}} \) is increasing in \( \mu \), indicating that more reciprocal managers allow for higher reference shares before they switch their attention to selfish workers. Moreover, \( R > \frac{1 + 2\mu + \omega}{4\mu + \omega} - \sqrt{\frac{1 + \omega - \mu\omega}{(4\mu + \omega)^2}} \) includes not only reciprocal
workers who were positively reciprocal in equilibrium without competition, i.e., $R < \frac{1+\bar{\omega}}{2+\bar{\omega}}$, but also those who were negatively reciprocal, i.e., $R > \frac{1+\bar{\omega}}{2+\bar{\omega}}$. Consequently, managers’ preferences are given as follows: Their first choice is to employ a positively reciprocal worker with $R \leq \frac{1+2\mu+\bar{\omega}}{4\mu+\bar{\omega}} - \sqrt{\frac{1+\bar{\omega}-\mu\bar{\omega}}{(4\mu+\bar{\omega})^2}}$, their second choice are selfish workers, and their third and last choice are reciprocal workers with $R > \frac{1+2\mu+\bar{\omega}}{4\mu+\bar{\omega}} - \sqrt{\frac{1+\bar{\omega}-\mu\bar{\omega}}{(4\mu+\bar{\omega})^2}}$.

Thus, managers will compete first for highly positively reciprocal workers and then for selfish workers. Moreover, managers who were not successful in hiring a highly positively reciprocal worker will be willing to offer a share to selfish workers that is higher than the one offered without competition to avoid hiring an unfavored worker (a less-positively reciprocal or a negatively reciprocal worker). As a result, selfish workers who are offered a share that is higher than the one offered without competition will increase their effort, produce larger output, and gain larger utilities. In this setting, negatively reciprocal workers are the first to be unemployed, followed by unfavored workers and selfish workers.

5.5 Competition and unemployment

Summarizing the results of the competition setting leads to Proposition 5:

Proposition 5. Competition and Unemployment

- The lower the number of desired reciprocal and selfish workers in the labor market, the higher the wages they are paid and the larger the output they produce with wage competition.

- Managers who are competing for a certain worker type and offer shares $\beta^C > \beta^*$ suffer from lower utilities while their workers enjoy larger utilities compared to a situation without competition. However, total utilities with competition are at least as high as total utilities without competition.

- Negatively and less positively reciprocal workers, followed by selfish workers, are the first to be affected by unemployment.

This result is perfectly in line with the findings of Dohmen et al. (2009), that positively reciprocal workers are associated with higher wages, efforts and probability to be employed while negative reciprocity has no significant effect on overall wage but leads to lower efforts and lower probability to be employed.
6 Summary

This paper provides a theoretical model to investigate how the coexistence of reciprocal and selfish types influences the formation of employment relationships and the corresponding implications for the profitability of firms, wage differentials, wage competition, and unemployment.

In section 3, I demonstrate that in a workplace where the manager and the worker can be either selfish or reciprocal, depending on matching, profit shares and efforts can differ, making some matches more profitable than others although the production technology remains unchanged. I find that a positively reciprocal worker receives a higher share and exerts more effort in a match with a reciprocal manager, while the share and effort of a negatively reciprocal worker are higher in a match with a selfish manager. In contrast, both the share and effort of a selfish worker are independent of manager type.

The differences in workers’ reactions to the offered profit shares drive managers’ preferences for worker types. Comparing manager and worker utilities in different matches in section 4 reveals that both manager types can increase their utilities by hiring a favored reciprocal worker instead of a selfish one but prefer selfish workers to unfavored reciprocal ones. This result implies that competition among managers for favored reciprocal workers as well as selfish workers is likely to occur if their number is sufficiently small.

In section 5, to investigate competition behavior, I consider a labor market without frictions where the total number of workers available exceeds the total number of vacancies but the number of favored reciprocal workers is not sufficient to fill all vacancies. In this setting, managers might offer higher shares than without competition to attract favored reciprocal and selfish workers, respectively. Thus, the resulting competitive matching allocates favored workers to reciprocal managers. Consequently, unemployment arises first among unfavored reciprocal and selfish workers.

These results are similar to experimental and empirical findings as, e.g., Fehr and Falk (1999), Charness (2004), Gächter (2007) and Dohmen et al. (2009). However, further research needs to be done to test the underlying model.
Appendix

A.1 Optimal Linear Contract

Assume that the manager offers the worker a linear contract \( C(\alpha, \beta) = \alpha + \beta \pi(e) \) with \( \alpha, \beta \geq 0 \) due to limited liability. Furthermore, let \( \Gamma(\alpha, \beta) \) denote a measure of the generosity of the offered contract, which the worker uses to evaluate the friendliness of the manager by comparing it to a reference point \( R \). The manager’s expected utility can then be written as

\[
U_m = E[\pi(e)] - C(\alpha, \beta) + \mu \left[ K'(e) - \frac{\partial C(\alpha, \beta)}{\partial e} \right] [\Gamma(\alpha, \beta) - R],
\]

while the worker’s utility is given by

\[
U_w = C(\alpha, \beta) - K(e) + \omega \left[ \Gamma(\alpha, \beta) - R \right] \left[ K'(e) - \frac{\partial C(\alpha, \beta)}{\partial e} \right],
\]

where \( \pi(e) = \epsilon e \) with \( \epsilon \geq 0 \) and \( \epsilon \in [0, 2] \) with \( E[\epsilon] = 1 \), \( K(e) = \frac{1}{2} e^2 \), \( \mu \in [0, 1] \), and \( \omega \in [0, 1] \).

Moreover, \( \Gamma(\alpha, \beta) \geq 0 \), \( \frac{\partial \Gamma(\alpha, \beta)}{\partial \alpha} > 0 \) and \( \frac{\partial^2 \Gamma(\alpha, \beta)}{\partial \alpha^2} = 0 \), and \( \frac{\partial \Gamma(\alpha, \beta)}{\partial \beta} > 0 \) and \( \frac{\partial^2 \Gamma(\alpha, \beta)}{\partial \beta^2} = 0 \) just as \( R > 0 \).

To determine the optimal linear contract, first derive the incentive compatibility constraint, since the worker will choose an effort that maximizes his expected utility. Optimal worker effort is thus given by \( e = \beta + \omega \left[ \Gamma(\alpha, \beta) - R \right] \).

Taking the worker’s optimal behavior into account, the manager solves the following optimization problem:

\[
\max_{\alpha, \beta} U_m(\alpha, \beta) \text{ s.t. } e = \beta + \omega \left[ \Gamma(\alpha, \beta) - R \right].
\]

The corresponding first order conditions are given by

\[
\frac{\partial U_m(\alpha, \beta)}{\partial \alpha} = \omega(1 - \beta) \frac{\partial \Gamma(\alpha, \beta)}{\partial \alpha} - 2\mu \omega \left[ \Gamma(\alpha, \beta) - R \right] - 1 \tag{3}
\]

and

\[
\frac{\partial U_m(\alpha, \beta)}{\partial \beta} = 2\mu \omega \frac{\partial \Gamma(\alpha, \beta)}{\partial \beta} \left[ \Gamma(\alpha, \beta) - R \right] + (1 - \beta) \left[ 1 + \omega \frac{\partial \Gamma(\alpha, \beta)}{\partial \beta} \right] - [\beta + \omega \left[ \Gamma(\alpha, \beta) - R \right]]. \tag{4}
\]

From (3) rearranging yields the condition for \( \alpha^* > 0 \), i.e.
\[
\omega \frac{\partial \Gamma (\alpha, \beta)}{\partial \alpha} [(1 - \beta) - 2\mu \omega [\Gamma (\alpha, \beta) - R]] = 1, \tag{5}
\]

while
\[
\omega \frac{\partial \Gamma (0, \beta)}{\partial \alpha} [(1 - \beta) - 2\mu \omega [\Gamma (0, \beta) - R]] < 1
\]
is the condition for \(\alpha^* = 0\).

Similarly, rearranging (4) gives an interior solution for \(\beta^*\), i.e.
\[
\beta^* = \frac{1 + \omega \left[ \frac{\partial \Gamma (\alpha, \beta)}{\partial \beta} (1 + 2\mu [\Gamma (\alpha, \beta) - R]) - [\Gamma (\alpha, \beta) - R] \right]}{2 + \omega \frac{\partial \Gamma (\alpha, 0)}{\partial \beta}}
\]

while
\[
\frac{1 + \omega \left[ \frac{\partial \Gamma (\alpha, 0)}{\partial \beta} (1 + 2\mu [\Gamma (\alpha, 0) - R]) - [\Gamma (\alpha, 0) - R] \right]}{2 + \omega \frac{\partial \Gamma (\alpha, 0)}{\partial \beta}} < 0
\]
represents the condition for \(\beta^* = 0\).

From condition (5) we know that only reciprocal workers might receive a positive fixed payment \(\alpha^*\), since only with \(\omega > 0\) the LHS of (5) is different from zero. Nevertheless, even for reciprocal workers \(\alpha^* = 0\) is optimal whenever \(\frac{\partial \Gamma (0, \beta)}{\partial \alpha} < \frac{1 - \beta}{2\mu}\) with \(R \leq \frac{1 - \beta}{2\mu}\) or with \(R > \frac{1 - \beta}{2\mu}\) and \([R - \Gamma (0, \beta)] < \frac{1 - \beta}{2\mu}\). Alternatively, \([R - \Gamma (0, \beta)] \geq \frac{1 - \beta}{2\mu}\) also yields \(\alpha^* = 0\).

Similarly, it is optimal for the manager to offer no profit share if \(\frac{\partial \Gamma (\alpha, 0)}{\partial \beta} < \frac{\omega [\Gamma (\alpha, 0) - R] - 1}{\omega [1 + 2\mu [\Gamma (\alpha, 0) - R]]}\) with \(\Gamma (\alpha, 0) - R \geq -\frac{1 - \beta}{2\mu}\).

Thus, depending on \(\Gamma (\alpha, \beta)\) it is possible, that the optimal linear contract is of the form \(C (0, \beta) = \beta \pi (e)\) and offers no fixed payment but only a profit share for all acceptable \(\omega, \mu\) and \(R\). This in turn allows to restrict attention to generosity measures which depend only on \(\beta\) as assumed in this paper.

A.2 Proofs

Proof of Lemma 1 The worker chooses effort to solve
\[
\max_e \beta E [\pi (e)] - K (e) + \omega [\Gamma (\beta) - R] \left[ K' (e) - \frac{\partial C (\beta, E [\pi (e)])}{\partial e} \right]
\]
\[= \beta e - \frac{1}{2} e^2 + \omega [\beta - R] [e - \beta].\]
The corresponding FOC is given by

\[ \beta - e + \omega [\beta - R] = 0. \]

Rearranging yields

\[ e = \beta + \omega (\beta - R), \]

implying that a selfish worker with \( \omega = 0 \) chooses \( e = \beta \). Thus, a reciprocal worker with \( \omega > 0 \) will choose a higher effort than a selfish worker whenever \( (\beta - R) > 0 \), but a lower effort than a selfish one whenever \( (\beta - R) < 0 \).

**Proof of Lemma 2** The manager’s optimization problem is given by:

\[
\max_{\beta} (1 - \beta) E[\pi(e)] + \mu \left[ K'(e) - \beta \frac{\partial E[\pi(e)]}{\partial e} \right] [\Gamma(\beta) - R]
\]

with \( \beta \geq 0 \) subject to the incentive compatibility constraint \( e = \beta + \omega (\beta - R) \). This can also be written as

\[
\max_{\beta} (1 - \beta) [\beta + \omega (\beta - R)] + \mu \omega (\beta - R)^2.
\]

The corresponding FOC is given by

\[- [\beta + \omega (\beta - R)] + [1 + \omega] (1 - \beta) + 2 \mu \omega (\beta - R) = 0.\]

Rearranging yields

\[
\beta_{rr}^* = \frac{1 + \omega(1 + R(1 - 2\mu))}{2(1 + \omega(1 - \mu))}.
\]

Inserting \( \beta_{rr}^* \) into the incentive compatibility constraint finally yields

\[
e_{rr}^* = \frac{(1 + \omega)^2 - \omega R(1 + (2\mu + \omega))}{2(1 + \omega(1 - \mu))}.
\]

**Proof of Proposition 1** Lemma 1 states that a reciprocal worker will exert more effort than a selfish worker thus behaving positively reciprocal if \( (\beta - R) > 0 \) or more precisely \( (\beta_{rr}^* - R) > 0 \). Rearranging this condition for \( R \) yields \( R < \frac{1 + \omega}{2 + \omega} \). In contrast a reciprocal worker will exert less effort than a selfish one, i.e., behave hostile, whenever \( (\beta_{rr}^* - R) < 0 \) which is true for \( R > \frac{1 + \omega}{2 + \omega} \).
Proof of Lemma 7 Given Lemma 2, $\beta^*_{sr}$ and $e^*_{sr}$ can be derived by setting $\mu = 0$ and $\omega > 0$ in $\beta^*_{rr} = \frac{1+\omega(1+R(1-2\mu))}{2(1+\omega(1-\mu))}$ and $e^*_{rr} = \frac{(1+\omega)^2-\omega^R(1(2+\omega))}{2(1+\omega(1-\mu))}$. As a result $\beta^*_{sr} = \frac{1+\omega(1+R)}{2(1+\omega)}$ and $e^*_{sr} = \frac{1+\omega(1+R(1-2\mu))}{2(1+\omega(1-\mu))}$.

Proof of Lemmas 4 and 5 The results can be derived by manipulating $\beta^*_{rr} = \frac{1+\omega(1+R(1-2\mu))}{2(1+\omega(1-\mu))}$ and $e^*_{rr} = \frac{(1+\omega)^2-\omega^R(1(2+\omega))}{2(1+\omega(1-\mu))}$. Since the worker is assumed to be selfish in both cases, setting $\omega = 0$ leads to $\beta_{rs}^* = \beta_{ss}^* = \frac{1}{2}$ and $e^*_{rs} = e^*_{ss} = \frac{1}{2}$ irrespective of the value of $\mu$.

Proof of Lemma 6 $\beta^*_{sr} > \beta^*_{sr}$ implies that $\frac{1+\omega(1+R(1-2\mu))}{2(1+\omega(1-\mu))} > \frac{1+\omega(1+R)}{2(1+\omega)}$. Rearranging this inequality for $R$ leads to $R < \frac{1+\omega}{2+\omega}$. Furthermore, since $\beta^*_{rr} > \beta^*_{sr}$, $e^*_{rr} > e^*_{sr}$ must be true given Lemma 1. Similarly, $\beta^*_{rr} < \beta^*_{sr}$ implies $\frac{1+\omega(1+R(1-2\mu))}{2(1+\omega(1-\mu))} < \frac{1+\omega(1+R)}{2(1+\omega)}$ which is true whenever $R > \frac{1+\omega}{2+\omega}$. Given Lemma 1 this implies $e^*_{sr} > e^*_{rr}$.

Proof of Lemma 7 Lemma 7 corresponds to the findings of Lemmas 4 and 5.

Proof of Proposition 2 Proposition 2 combines the results of Lemmas 3 to 7.

Proof of Lemma 8 $\beta^*_{rr} > \beta^*_{sr}$ implies that $\frac{1+\omega(1+R(1-2\mu))}{2(1+\omega(1-\mu))} > \frac{1}{2}$. Rearranging this for $R$ leads to $R > -\frac{\mu}{2\mu+1}$ for $\mu < \frac{1}{2}$, which is always satisfied for $R \in [0, 1]$, and $R < \frac{\mu}{2\mu+1}$ for $\mu > \frac{1}{2}$. If $e^*_{rr} > e^*_{sr}$ is true, $\frac{(1+\omega)^2-\omega^R(1(2+\omega))}{2(1+\omega(1-\mu))} > \frac{1}{2}$ must hold. This is true whenever $R < \frac{1+\mu+\omega}{1+2\mu+\omega}$. Otherwise, if $e^*_{rs} > e^*_{rr}$, $R > \frac{1+\mu+\omega}{1+2\mu+\omega}$ must hold.

Proof of Lemma 9 $\beta^*_{sr} > \beta^*_{ss}$ implies that $\frac{1+\omega(1+R)}{2(1+\omega)} > \frac{1}{2}$, which is always satisfied for the given parameter intervals.

Proof of Proposition 3 Proposition 3 combines the results of Lemmas 8 and 9.

Proof of Lemma 10 $V_m(\mu, \omega) > V_m(\mu, 0)$ implies that $\frac{1-\omega(1-R)(4\mu R-\omega(1-R)-2)}{4(1-\omega(1-\mu))} > \frac{1}{4}$. Rearranging for $R$ yields $R < \frac{1+2\mu+\omega}{4\mu+\omega} - \sqrt{\frac{1+\omega}{4\mu+\omega}^2 + \frac{1+\omega}{4\mu+\omega}} < \frac{1+\omega}{4\mu+\omega}$ only with positively reciprocal workers. Since $\frac{1+2\mu+\omega}{4\mu+\omega} - \sqrt{\frac{1+\omega}{4\mu+\omega}^2 + \frac{1+\omega}{4\mu+\omega}} < \frac{1+\omega}{2+\omega}$. Thus, with positively reciprocal workers $V_m(\mu, \omega) > V_m(\mu, 0)$ is possible with positively reciprocal workers. Thus, with negatively reciprocal workers $V_m(\mu, \omega) < V_m(\mu, 0)$ must hold. Similarly, $V_m(0, \omega) > V_m(0, 0)$ is true whenever $R < \frac{1+\omega}{\omega} - \sqrt{\frac{1+\omega}{\omega}^2 + \frac{1+\omega}{\omega}} < \frac{1+\omega}{2+\omega}$. Consequently, with negatively reciprocal workers $V_m(0, \omega) < V_m(0, 0)$ must hold.
Lemma 13 and 15 indicate that the higher the number of desired
Proof of Proposition 5
ers represent the least choice of a manager, managers will also be willing to compete for selfish
panded to include selfish and unfavored reciprocal workers. Since unfavored reciprocal work-

\[ \frac{\omega^2(2R-\omega(1-R)-1)^2}{8(1+\omega)^4} + \frac{(1+\omega(1+R(1-2\mu)))^2}{4(1+\omega(1-\mu))^2} > 0 \] Rearranging for \( R \) yields \( R < \frac{1+\omega}{2+\omega} \). This in turn implies that
whenever \( R > \frac{1+\omega}{2+\omega} \), \( V_w(\mu, \omega) < V_w(0, \omega) \) must hold. Furthermore, \( V_w(\mu, 0) = \frac{1}{4} \) irrespective of \( \mu \).

Proof of Proposition 4  Proposition 4 combines the results of Lemmas 10 and 11.

Proof of Lemma 12  The maximum competitive share \( \beta^C_{\max}(\mu, \omega) \) is defined as the share which satisfies \( U_m(\beta^C(\mu, \omega)) = U_m(\beta^*(\mu, 0)) \). \( U_m(\beta, \mu, \omega) \) is given by \( U_m(\beta, \mu, \omega) = \mu\omega(\beta - \frac{1}{2})^2 + (1 - \beta)(\beta + \omega(\beta - \frac{1}{2})) \) for \( R = \frac{1}{2} \) while \( U_m(\beta^*(\mu, 0)) = \frac{1}{4} \). Solving for \( \beta \) then yields \( \beta^C_{\max}(\mu, \omega) = \frac{1+\omega(2-\mu)}{2[1+\omega(1-\mu)]} \).

Proof of Lemma 13  A manager who was successful in hiring a reciprocal worker in a setting with \( W_R < M_R \) must have offered a wage \( \beta^C(\mu, \omega) \geq \beta^C(\mu, \omega) \geq \beta^C_{\max}(\mu-, \omega) \). Since \( \beta^C_{\max}(\mu-, \omega) > \beta^*(\mu, \omega) \) for all \( \mu > \mu_- \), \( U_m(\beta^C) \) must be decreasing in \( \beta^C \). Consequently, the reciprocal managers offer the smallest possible share which attracts a reciprocal worker, i.e. \( \beta^C(\mu, \omega) = \beta^C_{\max}(\mu-, \omega) > \beta^*(\mu, \omega) \).

Proof of Lemma 14  Since there is no competition for selfish workers, managers offer them \( \beta^*(\mu, 0) = R = \frac{1}{2} \).

Proof of Lemma 15  For \( W_R \geq M_R \) all managers who have attracted a reciprocal worker must have offered \( \beta^C(\mu, \omega) \geq \beta^C(\mu, \omega) \geq \beta^C_{\max}(0, \omega) \). Since \( \beta^C_{\max}(0, \omega) > \beta^*(\mu, \omega) \) for all \( \mu > 0 \), \( U_m(\beta^C) \) must be decreasing in \( \beta^C \). Consequently, all managers offer the smallest possible share which attracts a reciprocal worker, i.e. \( \beta^C(\mu, \omega) = \beta^C_{\max}(0, \omega) > \beta^*(\mu, \omega) \).

Proof of Lemma 16  The proof of Lemma 16 corresponds to the proof of Lemma 14.

Proof of Proposition 5  Lemmas 13 and 15 indicate that the higher the number of desired workers, the lower the share they get in a competitive equilibrium. This result can also be expanded to include selfish and unfavored reciprocal workers. Since unfavored reciprocal workers represent the least choice of a manager, managers will also be willing to compete for selfish
workers. This in turn implies that the competitive share offered to selfish workers will be higher if their number is less.

Higher shares result in redistribution from the managers to the workers. Thus managers’ monetary payoffs decrease while workers’ monetary payoffs increase. In addition, higher shares enhance reciprocal utility and gift exchange. This results in higher worker utilities. However, managers’ utilities decrease because $U_m(\beta^C)$ is decreasing in $\beta^C$ for $\mu \geq 0$ and $\beta^C > \beta^*$. Nevertheless, match utilities increase due to enhanced gift exchange and the additional reciprocal utility.

Managers’ preferences for different worker types were derived as follows: Their first choice is to employ a positively reciprocal worker with $R \leq \frac{1+2\mu+\omega}{4\mu+\omega} - \sqrt{\frac{1+\omega-\mu\omega}{(4\mu+\omega)^2}}$, their second choice are selfish workers, and finally their last choice are reciprocal workers with $R > \frac{1+2\mu+\omega}{4\mu+\omega} - \sqrt{\frac{1+\omega-\mu\omega}{(4\mu+\omega)^2}}$. Thus undesired reciprocal workers with $R > \frac{1+2\mu+\omega}{4\mu+\omega} - \sqrt{\frac{1+\omega-\mu\omega}{(4\mu+\omega)^2}}$ are the last to be employed followed by selfish workers.
References


