CESifo WORKING PAPERS

6635
2017

August 2017

What Drives Reciprocal Behavior? The Optimal Provision of Incentives over the Course of Careers

Matthias Fahn, Anne Schade, Katharina Schüßler

CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editors: Clemens Fuest, Oliver Falck, Jasmin Gröschl
www.cesifo-group.org/wp

An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
· from the RePEc website: www.RePEc.org
· from the CESifo website: www.CESifo-group.org/wp

CESifo *Working Paper No. 6635*
Category 13: Behavioural Economics

What Drives Reciprocal Behavior? The Optimal Provision of Incentives over the Course of Careers

Abstract

We explore how inherent preferences for reciprocity and repeated interaction interact in an optimal incentive system. Developing a theoretical model of a long-term employment relationship, we first show that reciprocal preferences are more important when an employee is close to retirement. At earlier stages, repeated interaction is more important because more future rents can be used to provide incentives. Preferences for reciprocity still affect the structure of an employment relationship early on, though, because of two reasons: first, preferences for reciprocity effectively reduce the employee's effort costs. Second, they allow to relax the enforceability constraint that determines the principal's commitment in the repeated interaction. Therefore, reciprocity-based and repeated-game incentives are dynamic *substitutes*, but *complements* at any given point in time. We test our main predictions using data from the German Socio-Economic Panel (SOEP) and find evidence for a stronger positive effect of positive reciprocity on effort for older workers.

JEL-Codes: C730, D210, D220, D860, D900, D910.

Keywords: reciprocity, relational contracts, dynamic incentives.

Matthias Fahn
Department of Economics
LMU Munich / Germany
matthias.fahn@econ.lmu.de

Anne Schade
TNS Infratest
Munich / Germany
Anne.Schade@tns-infratest.com

Katharina Schüßler
Department of Economics
LMU Munich / Germany
katharina.schuessler@econ.lmu.de

August 25, 2017
The authors are grateful to Steffen Altmann, Daniel Barron, Thomas Dohmen, Florian Englmaier, Bob Gibbons, Raphael Guber, Steve Leider, Michael Powell, Dirk Sliwka, Giorgio Zanarone, participants of the ORG seminar, the Micro Workshop, LEOH 2016 and the Bavarian Micro Workshop 2016 at LMU Munich, the SIOE annual conference 2016 (Paris), COPE 2017 (Zürich), the RES meeting 2017 (Bristol) for valuable comments and suggestions. Katharina Schüßler gratefully acknowledges funding through the International Doctoral Program "Evidence-Based Economics" of the Elite Network of Bavaria.

1 Motivation

Humans reciprocate. They repay kindness with kindness and hostility with hostility. Several possible explanations exist for why individuals display reciprocal behavior, where the most prominent ones are inherent preferences for reciprocity and repeated interaction (see Sobel, 2005, for an overview). Whereas inherent preferences for reciprocity reflect the idea that an individual can enjoy additional utility when returning favors one has received (based on Akerlof (1982)'s conceptual idea of gift exchange), repeated interaction can give rise to reciprocal behavior even if individuals only care about their own material payoffs. A vast amount of evidence supports both drivers of reciprocal behavior, however mostly trying to isolate one from the other.

In this paper, we address the questions whether inherent preferences for reciprocity are also relevant in long-term employment relationships, and if and how they affect relational contracts, where incentives generated by repeated interaction. We show that both kinds of incentives do interact with each other in an optimal incentive system, and that their relative importance depends on the phase of a career. At early stages, incentives generated by repeated interaction are more important because more future rents can be used to provide incentives. At later stages, reciprocity-based incentives become more and more important and gradually replace repeated-game incentives. However, preferences for reciprocity are still important early on. First, they reduce an employee's effective effort costs. Second, they relax the employer's enforceability constraint which determines its commitment in the relational contract. Therefore, reciprocity-based and repeated-game incentives are dynamic *substitutes*, but *complements* at any given point in time.

After deriving these – and other – results within a theoretical model, we test its implications using data from the German Socio-Economic Panel (SOEP). As predicted, we find evidence for a positive effect of reciprocity on effort, and that this effect is stronger for older employees. These results indicate that reciprocity-based as well as repeated-game incentives interact in real-world incentive systems.

More precisely, we develop a dynamic principal-agent model with a finite time horizon. Effort is observable but not verifiable, and yields a verifiable output measure. Standard spot contracts based on output are feasible but necessarily associated with a rent going to the agent. Furthermore, the agent reacts reciprocally towards any *voluntary* rent, i.e., any unconditional wage payment. We first show that in a static spot contract, the principal either uses a standard "bonus contract" (with a wage of zero) or – if the agent's preferences for reciprocity are sufficiently strong – a "reciprocity contract" (with no bonuses). In a next step, we take into account that also repeated-game incentives based on effort can be provided, using a so-called relational contract. There, the principal promises a bonus based on the agent having exerted the desired effort level. Because effort is not verifiable, the principal's promise must be credible. It is credible if paying the promised effort-based bonus triggers sufficiently higher continuation profits than refusing to do so. In our case, this can be achieved despite a finite time horizon, because we assume that once the principal reneged on promises made in the relational contract, the agent's preferences for reciprocity towards the principal disappear. Therefore, the principal can be punished for reneging on a bonus if a reciprocity contract is optimal in a spot relationship – because upon reneging, she only has the option to use (less profitable) bonus spot contracts.

Generally, the enforceability of effort in the relational contract is determined by a so-called dynamic enforcement constraint, which states that the effort-based bonus must not exceed the difference between future discounted profits on and off the equilibrium path. This yields a first source of complementarity between relational and reciprocity contracts because the principal has more to lose when reneging if the difference between profits generated by a reciprocity contract and the profits generated by a bonus contract in the last period is larger. Therefore, the relational contract can implement higher effort if the agent's preferences for reciprocity are more pronounced. Moreover, there exist two additional channels how the agent's reciprocal inclinations amplify the performance of the relational contract. First, receiving an extra rent effectively reduces the agent's effort costs. Therefore, it is optimal for the principal to always pay a fixed wage. Second, a binding dynamic enforcement constraint is relaxed and more effort can consequently be implemented with a higher fixed wage. All this implies that incentives triggered by reciprocal preferences and relational contracts are *complements* at any given point in time. However, they are dynamic *substitutes* in a sense that – as time proceeds – repeated-game incentives which are utilized by the relational contract are gradually replaced by reciprocal incentives. This is because the dynamic enforcement constraint is automatically tightened as time moves on (less remaining periods reduce the difference between the principal's on- and off-path continuation profits), and a tighter constraint amplifies the benefits of reciprocity-based incentives.

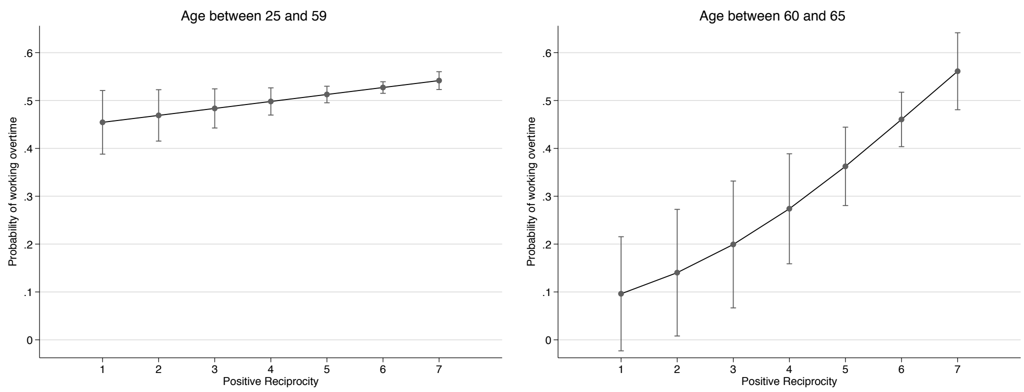
The optimal incentive scheme has implemented effort at its highest level in early stages of the employment relationship. It remains there until the dynamic enforcement starts to bind. Then, the principal's reduced credibility effectively constrains her ability to pay a sufficiently high effort-based bonus. This decreases implementable effort, which lets the principal respond with an increase of the fixed wage in order to mitigate the necessary effort reduction. Overall, however, a binding dynamic enforcement constraint reduces equilibrium effort because implementing an additional unit of effort then is more expensive with reciprocity-based incentives than with relational incentives. Therefore, although these two are dynamic substitutes, the substitution is incomplete. Concluding, once the dynamic enforcement constraint starts binding, effort gradually goes down and reaches its lowest level in the last period of the game. The effort reduction goes hand in hand with a gradual increase of the fixed wage.

We explore the empirical validity of our theoretical results using representative survey data on ~8,000 employees from the German Socio-Economic Panel (SOEP). We utilize the fact that in the 2005 wave of the survey, the SOEP included measures of intrinsic reciprocity. Our approach follows Dohmen et al. (2009), who use overtime as a proxy for non-contractible effort and show that reciprocal inclinations are linked to high effort, high wages, and general life success. Their results hence support the notion that reciprocal preferences help to enforce effort. However, because the SOEP does not contain information on actual incentives systems, Dohmen et al. (2009) do not explore the extent to which reciprocal preferences are optimally utilized in a firm's incentive system – in particular in interaction with repeated-game incentives. Our model, though, allows to draw conclusions from observable outcomes on actually used incentive systems, because we state that reciprocal inclinations and repeated interaction assume different roles in different stages of a career. More precisely, we develop the following predictions in Section 3: First, we predict that an individual with stronger reciprocal preferences is expected to exert more effort, and, second, that effort is decreasing over time. Third, we predict that the positive effect of reciprocal preferences on effort becomes stronger over the course of an employment relationship. This prediction directly follows from reciprocal and relational incentives being dynamic substitutes: At later stages of a career, the incentive system puts more weight on reciprocal incentives, in particular for individuals with more pronounced preferences for intrinsic reciprocity. Therefore, equilibrium effort responds more strongly to reciprocal preferences later on.

Furthermore, we use the agent's realized utility levels to derive empirical predictions. The SOEP contains a measure on an individual's job satisfaction, which we think is a good proxy for utility experienced in the employment relationship. Our model then generates the predictions that more reciprocal individuals enjoy higher levels of job satisfaction, that job satisfaction increases over time, and in particular that the positive effect of reciprocal preferences on satisfaction becomes stronger over the course of an employment relationship.

Our empirical analysis, conducted in Section 4, largely confirms our model's predictions. More specifically, we are able to show that while positive reciprocity generally has a positive effect on the propensity to work overtime – a result that corresponds to those reported by Dohmen et al. (2009) –, this effect is much more pronounced for older workers and workers who indicate that they are close to retirement. For example, when including an interaction term between reciprocity and a dummy indicating that an employee is at least 60 years old, we find that the positive effect of positive reciprocity is much more pronounced for workers above the age cutoff. This is illustrated in Figure 1, which depicts the predicted marginal effects of positive reciprocity on the propensity to work overtime as proxy for effort in the subsamples.

Figure 1: Predictive marginal effects of positive reciprocity on effort by age group



Notes: The figure plots predicted marginal changes of the propensity to work overtime at different levels of positive reciprocity depending on age group (left panel) and retirement propensity (right panel), holding all other factors constant. Error bars indicate 95% confidence intervals.

Furthermore, when estimating the effect of reciprocity on job satisfaction, our predictions are largely confirmed; in particular, the effect of positive reciprocity on job satisfaction is larger for individuals who are close to retirement.

In Section 4.2, we explore alternative specifications. First, we show that our results are robust to different specifications of the propensity to work overtime (Section 4.2.1), in particular if only unpaid overtime is considered (our main specifications follows Dohmen et al. (2009) and includes all forms of overtime). Second, we explore the intensive margin of effort by using overtime hours instead of only a binary question whether individuals have worked overtime or not (Section 4.2.2). Finally, we also use data from 2010 and 2015, where reciprocity was again included in the SOEP. There, we still observe the expected patterns and can thus exclude that those are mainly driven by cohort effects

(Section 4.2.3).

Finally, note that a specific age cutoff (we use 60 in our main specification) is not crucial for our results. We present results for a large number of specifications (for different age cutoffs, overtime measures, or included survey waves). Whereas significance levels differ among the specifications, all of them indicate that preferences for reciprocity assume a larger role in later stages of a career.

Related Literature

The deviation from the assumptions of self-interest and greed is one of the most robust, thoroughly researched, fundamentals in the field of behavioral economics (DellaVigna, 2009). There, inference on intrinsic reciprocity is based on Akerlof (1982)'s conceptual idea of gift exchange, i.e., that employees exert voluntary effort if they feel well treated by firms. Seminal work by Fehr et al. (1993, 1998) attempts at testing the gift-exchange paradigm experimentally and has inspired a plethora of research that establishes the prevalence of the norm of reciprocity (see, e.g., Camerer and Weber (2013), for an overview over existing experimental research). This is important for organizations because the existence of reciprocal individuals has the potential to influence the employment relationship in fundamental ways. But employment relationships are inherently dynamic, and most of the approaches identifying reciprocal preferences have been careful in muting all incentives potentially stemming from repeated interaction. Some recent experimental studies have started to address this issue by disentangling strategic (i.e., generated by repeated interaction) and intrinsic motives for cooperation. Reuben and Suetens (2012) use an infinitely-repeated prisoner's dilemma to assess the relative importance of strategic motives and intrinsic reciprocity and find that cooperation is mostly driven by strategic concerns. Similarly, Dreber et al. (2014) find that strategic motives seem to be more important than social preferences in an infinitely repeated prisoner's dilemma. Cabral et al. (2014) conduct an infinitely repeated veto game to distinguish between different explanations for generous behavior. They find strategic motives to be the predominant motivation, however also present evidence for the importance of intrinsic reciprocity.

Hence, experimental evidence suggests that repeated-game incentives not only are relevant in situations of repeated interaction, but rather seem to be the dominant mode to support cooperation. However, to understand how cooperation is achieved in long-term employment relationships, and in particular if and how incentive systems respond to the existence of reciprocal preferences, real-world evidence is needed. As described above, Dohmen et al. (2009) use data on individual-level survey measures for reciprocity from the German Socio-Economic Panel (SOEP) (where individuals are asked for their reciprocal inclinations), and show that reciprocal inclinations are linked to high effort, high wages, and general life success. Moreover, based on a double moral-hazard problem that can be overcome with promotion incentives for reciprocal agents, Dur et al. (2010) follow Dohmen et al. (2009) and use data from the German Socio-Economic Panel (SOEP) to show that reciprocal preferences are linked to performance appraisals, which serve as a proxy for promotion incentives. Furthermore, existing papers have linked firm-level proxies for reciprocity, like screening for work ethic or personality, to management practices and outcomes such as monitoring, teamwork, wage levels, and firm productivity. These papers provide at least suggestive evidence for the importance of reciprocity in employment relationships (Huang and Cappelli, 2010; Englmaier et al., 2015). Conducting field experiments, Bellemare and Shearer (2009, 2011) show that monetary gifts increase effort in a real-world working environment.

The theoretical literature on intrinsic reciprocity can be arranged along the lines whether reciprocal behavior is triggered by intentions or by outcomes, i.e., whether one counterpart's preferences for reciprocity can be used strategically. In the already-mentioned work by Akerlof (1982) – probably the first to formally model the idea of intrinsic reciprocity – employees are willing to exert additional effort if they are paid more than the market-clearing wage. Hence, firms can strategically raise wages in order to induce their employees to work harder. Applying this idea to a moral hazard framework, Englmaier and Leider (2012a) show that generous compensation can be a substitute for performance-based pay.

On the other hand, Rabin (1993) argues that the perceived kindness of an action should be the driving force to induce reciprocal behavior. He develops the techniques for incorporating intentions into game theory. Dufwenberg and Kirchsteiger (2004) apply these techniques to extensive games and explicitly account for the sequential structure of the respective games. Netzer and Schmutzler (2014) show that if only intentions matter, a self-interested firm cannot benefit from its employees' reciprocal preferences.

Whereas these two approaches assume that either only outcomes or only intentions are relevant, there is vast evidence that both aspects matter. Gneezy et al. (2000), Rabin and Charness (2002), or Falk et al. (2006) (among many others) present results that can be explained only if both aspects, fairness intentions as well as preferences for the distribution of outcomes, are taken into account. Falk and Fischbacher (2006) develop a theory incorporating both aspects. They assume that an action is perceived as kind if the opponent has the option to treat someone less kind. Hence, intentions matter, however reciprocity can also be used strategically.

We build upon these ideas and assume that reciprocity is triggered by a generous wage and hence can be used strategically. However, intentions matter as well because only non-contingent payments matter, and because the agent's inclination to reciprocate disappears once the principal has broken any implicit promise made in the past.

We also contribute to the literature on relational contracts – self-enforcing, dynamic agreements based on non-verifiable information. Bull (1987) and MacLeod and Malcomson (1989) derive relational contracts with observable effort, whereas Levin (2003) shows that those also take a rather simple form in the presence of asymmetric information with respect to effort and the agent's characteristics. Malcomson (2013) delivers an extensive overview on relational contracts. Dur and Tichem (2015) incorporate social preferences into a model of relational contracts. They show that altruism undermines the credibility of termination threats which may reduce productivity and utilities. Contreras and Zanarone (2017) assume that employees suffer when their formal wage is below that of their colleagues. They show that these "social comparison costs" can be managed by having a homogeneous formal governance structure, while achieving necessary customizations through relational contracts. To the best of our best knowledge, we are the first to incorporate intrinsic preferences for reciprocity into a relational contracting framework. This allows us to derive specific predictions with respect to the interaction and relative importance of repeated-game incentives and reciprocity in an optimal incentive scheme. In light of the somewhat conflicting evidence on the interaction of the two mechanisms, we show that both are dynamic substitutes, but complements at any given point in time.

On a general note, various papers have been investigating how agents with standard preferences respond to the (potential) existence of reciprocal agents. Work by Kreps et al. (1982) forms the basis for the notion that repeated-game incentives amplify intrinsic reciprocity (see Mailath and Samuelson, 2006, for an excellent overview of the literature). The authors show that uncertainty about the presence of reciprocal types is enough for selfish types to rationally imitate reciprocal behavior in a finitely repeated prisoner's dilemma game. Andreoni and Miller (1993) and, utilizing gift-exchange games, Gächter and Falk (2002) present experimental evidence that is in line with this conception. Fehr et al. (2009a) also make a case for the complementary effects of reciprocal preferences and reputation. They state that cooperation is usually way more pronounced in repeated than in one-shot interaction and claim that this is due to selfish types imitating fair types.

We complement these arguments by showing that the positive effect of a long-run interaction on cooperation does not have to rely on signaling, but can also be generated by the optimal incentive scheme designed for individuals with reciprocal preferences.

2 Theoretical Model

2.1 Model Setup

2.1.1 Environment and Technology

There is one risk-neutral principal ("she") and one risk-neutral agent ("he"). At the beginning of every period $t \in \{1, ..., T\}$, with $1 < T < \infty$, the principal makes an employment offer to the agent. If the agent accepts the offer, he chooses an effort level $e_t \geq 0$, which is associated with effort costs $c(e) = e^3/3$.[1] Furthermore, effort determines the probability with which a positive output – that is subsequently consumed by the principal – is realized. More precisely, the output is $y_t \in \{0, \theta\}$, with Prob$(y_t = \theta) = e_t$. Below, we will impose further assumptions to always guarantee an interior solution. If the agent rejects the offer, both players consume their exogenous outside options which for simplicity are set to zero.

2.1.2 Payments, Information & Contracts

The employment offer includes a prospective compensation package. It consists of a fixed wage w_t and discretionary bonus payments. An *output-based* bonus b_t is supposed to be paid if $y_t = \theta$ (it is without loss of generality to assume that no output-based bonus is paid if $y_t = 0$), an *effort-based* bonus B_t is supposed to be paid if the principal's requested effort level is chosen by the agent.

The output realization y_t is verifiable, and formal spot contracts can be used to enforce payment of b_t. Effort can be observed by both parties, however is not verifiable. Therefore, payment of B_t can only be enforced within a self-enforcing dynamic arrangement, a so-called relational contract. The agent is protected by limited liability, hence w_t, $b_t \geq 0$ (this assumption is not needed for most of our results).

Note that the agent's compensation, consisting of w_t, b_t, and B_t, does not only have to contain monetary components. It rather is a common perception in the literature on relational contracts (and beyond) that money is not the only source of motivation inside firms. Gibbons and Henderson (2012), for example, conceive of an individual's payoffs to include "everything that might affect an individual's experience of his or her

[1] We assume this specific functional form for analytical tractability. Other (convex) cost functions would deliver similar results.

job, including factors such as job assignment, degree of autonomy, status with the firm or work group, and other intangibles such as feelings of belonging or that one is making a difference" (Gibbons and Henderson (2012), p. 1353). In the following, though, we will for simplicity stick to the terms wage and bonus payments when referring to the agent's compensation.

2.1.3 Preferences and Equilibrium

Provided the agent has accepted the principal's employment offer at the beginning of a period t, and denoting the on-path effort level e_t^*, the principal's per-period profits on the equilibrium path are

$$\pi_t = e_t^* \left(\theta - b_t\right) - B_t - w_t.$$

The agent is also risk-neutral and in addition has preferences for reciprocity. Preferences for reciprocity are activated by any *non-contingent* payment the agent receives and thus seemingly by fixed wages. However, a relational contract can either use current payments (in the form of bonuses) or future rents to motivate current effort – and we rule out that the agent's preferences for reciprocity are triggered by wages paid as a reward for past effort. It turns out though, that in our setting it is without loss of generality to assume that only current bonus payments are used to incentivize the agent. Taking this into account, the agent's preferences for reciprocity are indeed activated by all fixed wage payments. Then, upon accepting the principal's offer, the agent's per-period utility on the equilibrium path is

$$u_t = e_t^* b_t + B_t + w_t - \frac{e_t^3}{3} + \eta w_t e_t^* \theta.$$

The parameter $\eta \in [0, \infty)$ captures the agent's inherent preferences for reciprocity and lets the principal's output (potentially) enter his utility. Note that the agent's preferences for reciprocity in period t are only activated by wage payments received in period t – and not by received past or expected future payments. Furthermore, η remains constant across periods, with one exception. If the principal has promised to pay a bonus B_t but reneges on that promise even though the agent has exerted the desired effort level, η drops to zero in all subsequent periods.

We discuss our assumptions concerning the agent's preferences for reciprocity in the following Section 2.1.4.

Finally, principal and agent agent share the discount factor $\delta \leq 1$, and we can use the following recursive formulations for players' discounted payoff streams:

$$\Pi_t = e_t^* (\theta - b_t) - B_t - w_t + \delta \Pi_{t+1}$$
$$U_t = e_t^* b_t + B_t + w_t - c(e_t^*) + \eta w_t e_t^* \theta + \delta U_{t+1}$$

We apply subgame-perfect equilibrium as the equilibrium concept. We are interested in a subgame-perfect equilibrium that maximizes the principal's profits at the beginning of the game, Π_1.

2.1.4 Discussion of Assumptions

Before deriving properties of a profit-maximizing subgame-perfect equilibrium, we want to discuss our assumptions regarding the agent's preferences for reciprocity.

Our approach yields a hybrid between outcome- and intention-based reciprocity. On the one hand, intentions are not formally considered. On the other hand, reciprocity is only triggered by non-contingent payments and disappears once the principal breaks a promise. A purely output-based formulation would not contain these two properties. Therefore, our approach can generally be compared to Falk and Fischbacher (2008), where an individual's reciprocal inclinations depend on outcomes, but also on the available options one's counterpart has at hand. This takes into account empirical evidence that individuals respond to outcomes, however that intentions often matter as well (see Fehr et al. (2009a), Falk et al. (2006), Camerer and Weber (2013)).

We also assume that reciprocity only enters the agent's stage-game payoffs. However, one might expect reciprocal inclinations to also depend on past events in the employment relationship. We capture this idea by letting η drop to zero after a deviation by the principal. This appears to be the simplest way to take a potential history-dependence into account.

Furthermore, reciprocal behavior is triggered by a positive fixed wage (or put differently, by a wage that is above a reservation wage which is set to zero), and not by the agent's actual or perceived rent. This assumption is driven by two aspects. First, there is evidence (in particular from the lab) that generous wages cause reciprocal behavior even in the absence of performance-based incentives (for surveys on field studies see Fehr et al. (2009b) or Charness and Kuhn (2011)). Second, in many instances incentives cannot be provided *without* granting the agent a rent (for example if the agent is protected by limited liability as in our case). We do not want reciprocal behavior being caused by rents that the agent collects in any case, but only by extra rents that the principal *chooses* to pay. Again, this relates to the idea that also intentions – and not only outcomes – are supposed to matter.[2]

The reciprocity term in the agent's utility function also contains θ, and hence the extent to which the principal benefits from the agent's effort. This follows evidence pointing out that an important factor for positive reciprocity is the agent's assessment of the value generated for the principal (Hennig-Schmidt et al. (2010), or Englmaier and Leider (2012b)).

Finally, we focus on positive reciprocity. In Section 5, we briefly discuss negative reciprocity.

2.2 Formal Spot Contracts

We first derive a profit-maximizing spot contract and hence omit time subscripts. There, in order to always guarantee an interior solution, we impose the technical assumptions $\theta < 3$ and $\frac{\eta\theta^2}{2} < 1$. Besides serving as a benchmark, such a contract will also be offered in period T, the last period of the game. In a spot contract, it is not possible to enforce a bonus based on non-verifiable effort, hence $B = 0$. Therefore, the only means to provide *direct* incentives is an output-based bonus b. Indirectly, though, the agent will also be incentivized by a positive fixed wage w. Because of his inherent preferences for reciprocity, a positive wage lets the output value also enter the agent's utility. Then, the agent's and principal's interests become partially aligned. Taking a slightly different perspective, one might also regard positive values of w and η as triggering a reduction of the agent's effective effort to $(e^*)^3/3 - \eta w e^* \theta$.

Given b and w, and presuming he decides to work for the principal, the agent chooses effort e^* in order to maximize his per-period utility $u = eb + w - e^3/3 + \eta w e \theta$. The conditions for using the first order approach hold, hence the agent's incentive compatibility (IC) constraint gives

$$e^* = \sqrt{b + \eta w \theta}. \tag{IC}$$

The principal sets b and w to maximize her expected per-period profits $\pi = e^*(\theta - b) - w$. However, she has to take into account that accepting the contract must be optimal for

[2]Note that we are not able to use an approach introduced by Englmaier and Leider (2012a). They assume that the principal requests an effort level from the agent, and that the associated rent triggers reciprocal behavior. Then, consistency between actual and requested effort is required in equilibrium. This consistency requirement could not be met in our setting because actual effort would always be higher than requested effort (it is feasible in Englmaier and Leider (2012a) since they assume that effort is binary).

the agent. This is captured by the agent's individual rationality (IR) constraint,

$$e^*b + w - \frac{(e^*)^3}{3} + \eta w e^* \theta \geq 0. \tag{IR}$$

Furthermore, because of limited liability, payments must be non-negative.

Concluding, the principal's problem is to

$$\max_{w,b} e^* (\theta - b) - w,$$

subject to (IR) and (IC) constraints, and $w,\ b \geq 0$.

As a first result, we show that either only wages or bonus payments are used, not a combination of both.

Lemma 1. *Either bonus or wage payments are used to give incentives in a profit-maximizing spot contract. More precisely, there exists a threshold $\overline{\eta} > 0$ such that $b > 0$ and $w = 0$ for $\eta < \overline{\eta}$, and $b = 0$ and $w > 0$ for $\eta \geq \overline{\eta}$.*

The proof of this Lemma, as well as all other omitted proofs, can be found in the Appendix.

Intuitively, bonus and wage payments are not used together because they are substitutes in the principal's profit function: For equilibrium effort $e^* = \sqrt{b + \eta w \theta}$, the cross-derivative of per-period profits π with respect to w and b is negative. Put differently, for any bonus level the marginal profitability of using a bonus is decreasing in the wage. Therefore, either a pure *bonus contract* ($b > 0$ and $w = 0$) or a pure *reciprocity contract* ($b = 0$ and $w > 0$) is implemented by the principal.[3] When a reciprocity contract is used, a higher value of η is associated with lower effective effort costs and consequently also larger profits. Since the profitability of a bonus contract with a zero-wage is naturally unaffected by the size of η, a reciprocity contract is optimal given that η is sufficiently high.

Finally, note that profits under the bonus contract ($\pi = \frac{2\theta}{3}\sqrt{\frac{\theta}{3}}$) are strictly positive. Therefore, the principal will in any case make an employment offer to the agent.

The positive relationship between intrinsic reciprocity η and outcomes in the reciprocity contract is summarized in the following Corollary:

Corollary 1. *Given $\eta \geq \overline{\eta}$ and hence a reciprocity contract is used, $\frac{de^*}{d\eta} > 0$, $\frac{d\pi}{d\eta} > 0$, $\frac{dw}{d\eta} > 0$, and $\frac{du}{d\eta} > 0$.*

[3] However, note that this result is subject to the specific functional form of the agent's effort cost function – with other functional forms, bonus and wage payments might very well be used together. Still, our further results would not be qualitatively affected in this cases.

Proof. Using a reciprocity contract, outcomes are $e^* = \eta\theta^2/2$, $\pi = \frac{\eta\theta^3}{4}$, $w = \eta\theta^3/4$ and $u = \frac{\eta\theta^3}{4} + \frac{\eta^3\theta^6}{12}$, which all are increasing in η. □

Finally, note that the agent always gets a rent, that is, $u > 0$ under both types of contracts. This is straightforward for the reciprocity, but also for the bonus contract because of the agent's limited liability constraint. However, note that even without a limited liability constraint (implying that when using a bonus contract, the principal could extract the whole rent), a reciprocity contract would eventually be optimal because of the associated reduction of effective effort costs. In this case, only the threshold $\overline{\eta}$ would be larger.

2.3 Relational Contracts

Now, we analyze how self-enforcing relational contracts based on effort can be used to motivate the agent. The principal would generally prefer an effort-based over an output-based contract because – as derived in the previous section – limited liability requires to grant the agent a rent in the latter case. Two aspects are of particular interest, namely the enforceability of relational contracts and whether and how they are affected by the agent's preferences for reciprocity. We will explore these aspects in the next subsections and furthermore derive the properties of a profit-maximizing relational contract.

2.3.1 Preliminaries

Relational contracts are self-enforcing implicit arrangements between economic agents. They work if the future surplus of continuing a cooperative relationship is sufficiently large compared to the future surplus without cooperation. Informally speaking, a relational contract in our setting involves a request from the principal to the agent to exert an effort level e_t^* (recall that effort can be observed by the principal), combined with a promise to pay the reward B_t in return. However, it must be in the principal's interest to pay the bonus when supposed to do so, which is specified by a dynamic enforcement (DE) constraint for every period t,

$$-B_t + \delta\Pi_{t+1} \geq \delta\tilde{\Pi}_{t+1}. \tag{DE}$$

Π_{t+1} describes the principal's on-path and $\tilde{\Pi}_{t+1}$ her off-path continuation profits. The (DE) constraint captures the requirement that future on-path profits must be sufficiently large compared to future off-path profits so that they offset today's costs of paying the bonus. Note that since the period-t output has already been realized and consumed, it is not included in the (DE) constraint and hence considered as sunk by the principal when making the decision whether or not to pay B_t. (DE) indicates that a bonus payment is only feasible if $\Pi_{t+1} > \tilde{\Pi}_{t+1}$, i.e., if future equilibrium play can be made contingent on the principal's current behavior.

Generally, relational contracts require a (potentially) infinite time horizon because of a standard unravelling argument that can be applied once a predetermined last period exists. Then, the equilibrium outcome in the last period is unique, implying the same for all subsequent periods. In our case, however, the situation is different if the spot reciprocity contract is (strictly) more profitable than the spot bonus contract, i.e., if $\eta > \overline{\eta}$. In this case, the principal's behavior in a period $t < T$ affects her future profits because A) the optimal spot contract is implemented (at least) in period T, and B) refusing to pay a promised bonus B_t lets η drop to zero. Therefore, the spot reciprocity contract is not feasible anymore once the principal reneged on a promise, and reneging is costly if $\eta > \overline{\eta}$.

In addition, relational contracts are not feasible anymore once the principal refused to pay a promised bonus (e.g., Abreu, 1988, shows that an observable deviation should be punished by a reversion to a player's minmax-payoff). Hence, after a deviation by the principal, spot bonus contracts are implemented in every subsequent period,[4] and off-path continuation profits are $\tilde{\Pi}_t = \sum_{\tau=t}^{T} \delta^{\tau-t} \frac{2\theta}{3}\sqrt{\frac{\theta}{3}} = \frac{1-\delta^{T-t+1}}{1-\delta}\frac{2\theta}{3}\sqrt{\frac{\theta}{3}}$.

For $\eta \leq \overline{\eta}$, equilibrium profits in period T are unique, hence no relational contracts are feasible, and the profit-maximizing spot bonus contract will be implemented in every period.[5] To keep the analysis interesting, we will from now on assume that

$$\eta > \overline{\eta}.$$

This assumption is backed by the data we use for our empirical analysis, where the variable measuring positive reciprocity is relatively high for most individuals. The assumption also implies that a relational contract does not involve an output-based bonus b_t because it is dominated by using a fixed wage. Therefore, incentives are potentially given by a non-discretionary fixed wage w_t and an effort-based bonus payment B_t.

[4]Because those are profitable, subgame perfection implies that the relationship is not terminated after a deviation.

[5]We assume that no formal long-term contracts based on output realizations are feasible. This can be endogenized by assuming that the principal is not able to commit to fire the agent. If she were able to do so, a long-term contract involving a positive termination probability following a number of low output realizations would yield higher profits than a series of spot contracts (see Ohlendorf and Schmitz (2012) or fai Fong and Li (2017)). Still, the possibility to write such a long-term contract would have no qualitative effect on our results, in particular with respect to the impact of the agent's reciprocal preferences on a profit-maximizing agreement.

As mentioned above, we also assume that in a given period t, the agent is only motivated by period-t payments. This assumption is without loss of generality, for the following reasons: Generally, incentives in relational contracts can be provided via contingent current or future payments. In a setting like ours, though, replacing contingent future payments with the equivalent and appropriately discounted current amount does neither affect today's profits nor any constraints. Furthermore, sticking to current discretionary payments simplifies our analysis because the agent's reciprocal preferences are triggered only by unconditional payments. If a future wage were paid as a compensation for previous effort, we would have to differentiate between wages that are paid as a compensation for past effort and those that are not (if *any* fixed-wage payment triggered reciprocal behavior, using wages would be effectively cheaper than bonus payments, making it optimal to backload wages as much as possible).

2.3.2 Incentive Compatibility

The relational contract specifies an effort level e_t^* that the agent is supposed to exert on the equilibrium path. He will do so if his (IC) constraint is satisfied. Before stating this constraint, we have to specify what happens if he deviates in a period t. First, he does not receive the period-t bonus B_t. Second, we assume that after a deviation by the agent, the reciprocity parameter is *not* reduced but remains at η, and third, that continuation play is not affected by the agent's behavior. The second assumption is not crucial for our results, but it seems more realistic to presume that the degree of the agent's reciprocal preferences only depends on the principal's behavior. It implies that if the agent deviates, he does not necessarily deviate to an effort level of zero. The third assumption, however, is important because the agent's rent under a sequence of (spot) reciprocity contracts might be higher than under a relational contract (see below). Therefore, if the agent's behavior affected continuation play, and in particular if a devation triggered a breakdown of the relational contract, the agent might be tempted to deviate in order to enjoy the higher rent of a sequence of reciprocity contracts in the future.

Concluding, for any off-path effort level $\tilde{e}_t$, the (IC) constraint equals

$$B_t + w_t - \frac{(e_t^*)^3}{3} + \eta w_t e_t^* \theta \geq w_t - \frac{(\tilde{e}_t)^3}{3} + \eta w_t \tilde{e}_t \theta.$$

Subgame perfection implies that if the agent deviates, he will select an effort level $\tilde{e}_t =$

argmax $\left(-e^3/3+\eta w_t e\theta\right)$, i.e., $\tilde{e}_t=\sqrt{\eta w_t\theta}$. Hence, the (IC) constraint becomes

$$B_t-\frac{(e_t^*)^3}{3}+\eta w_t e_t^*\theta\geq 2/3\left(\sqrt{\eta w_t\theta}\right)^3. \tag{IC}$$

This implies that an (IR) constraint for the agent is automatically satisfied because his per-period rent, $B_t+w_t-(e_t^*)^3/3+\eta w_t e_t^*\theta$, is non-negative given the (IC) constraint. Also note that $e_t^*\geq\tilde{e}_t$ (because $B_t\geq 0$).

2.3.3 The Complementarity of Relational and Reciprocity-Based Incentives

In this section, we will derive some first results and show that reciprocity-based incentives also improve the performance of the relational contract.

To simplify the principal's problem, note that the (IC) constraint must bind in any profit-maximizing equilibrium. If it did not bind, the bonus B_t could be slightly reduced, which would increase profits and relax the (DE) constraint without violating the (IC) constraint. This allows us to plug $B_t=(e_t^*)^3/3-\eta w_t e_t^*\theta+2/3\left(\sqrt{\eta w_t\theta}\right)^3$ into the (DE) constraint, which yields

$$\frac{(e_t^*)^3}{3}-\eta w_t\theta e_t^*\leq\delta\left(\Pi_{t+1}-\tilde{\Pi}_{t+1}\right)-\frac{2}{3}\left(\sqrt{\eta w_t\theta}\right)^3. \tag{DE}$$

The enforceability of relational contracts is generally determined by a comparison of today's effort costs with discounted future payoffs (compared to future deviation payoffs). Only if the latter are large enough, they are sufficient to cover today's costs of exerting effort. Here, two additional terms enter which are implied by the agent's preferences for reciprocity; first, reciprocal preferences reduce the necessary bonus payment to achieve a certain effort level e_t^*; second, if the agent deviates, he still selects a positive effort level given the wage is positive.

Concluding, for $\eta>\overline{\eta}$, the principal's problem is to maximize

$$\Pi_1=\sum_{t=1}^{T}\delta^{t-1}\pi_t,$$

subject to a (DE) constraint for every period t, and subject to $w_t\geq 0\forall t$.[6]

The equilibrium is sequentially efficient, hence the problem is equivalent to maximizing

[6] Note that in period T, the (DE) constraint equals $\frac{(e_T^*)^3}{3}-\eta w_T\theta e_T^*\leq-\frac{2}{3}\left(\sqrt{\eta w_T\theta}\right)^3$, which for $e_T^*=\sqrt{\eta w\theta}$ (the agent's effort in a spot reciprocity contract) is trivially satisfied.

$\pi_t = e_t\theta - B_t - w_t = e_t\theta - \left((e_t^*)^3/3 - \eta w_t e_t^*\theta + 2/3\left(\sqrt{\eta w_t\theta}\right)^3\right) - w_t$ in every period t, subject to the relevant constraints.

After generally addressing the enforceability of a relational contract, we will now analyze the relationship between reciprocal and effort-based incentives. To do so, we first abstract from issues of enforceability. Put differently, we assume that the (DE) constraint does not bind, i.e., is satisfied for the principal's preferred effort level and derive respective effort and wage levels. Note that this situation is equivalent to one where formal contracts based on effort would be feasible.

Lemma 2. *Assume the (DE) constraint does not bind in a period $t < T$. Then, setting a strictly positive wage is optimal.*

Lemma 2 implies that even if the principal is not restricted in setting her preferred effort-based bonus B_t, she still decides to pay a strictly positive fixed wage (which amounts to $w_t = \left(\eta^2\theta^3 - 1\right)^2/4\eta^3\theta^3$), and the agent receives a rent. This is because the agent's concern for reciprocity reduces his effective effort costs, *but only in combination with a strictly positive wage w_t*. The agent's effective effort costs are $(e^*)^3/3 - \eta w e^*\theta$, and implemented effort $e_t^* = \left(1 + \eta^2\theta^3\right)/2\eta\theta$ is also strictly larger than the "standard" first best without reciprocal preferences, $\sqrt{\theta}$.[7] In the following, we will refer to the implemented effort and wage levels for a non-binding (DE) constraint as *first-best* levels. At these first-best levels, the costs for the principal to implement one additional unit of effort are the same when using relational as when using reciprocity-based incentives, and those costs are equal to the principal's marginal benefits.

In a next step, we explicitly take the enforceability of relational contracts into account and assess how the agent's preferences for reciprocity affect outcomes with a *binding* (DE) constraint.

Lemma 3. *Assume the (DE) constraint binds in a period $t < T$. Compared to the situation with a non-binding (DE) constraint, the fixed wage is larger and implemented effort smaller.*

Besides reducing effective effort costs, a fixed wage also relaxes the principal's (DE) constraint – by reducing the bonus that must be paid to implement a given effort level. Therefore, if the (DE) constraint binds (i.e., it does not hold for first-best effort), the fixed wage is larger than when it does not bind.

All this implies that relational and reciprocity-based incentives are complements *at any given point in time.* Reciprocity-based incentives reduce effective effort costs. Further-

[7]The condition $\left(1 + \eta^2\theta^3\right)/2\eta\theta > \sqrt{\theta}$ is equivalent to $\left(1 - \sqrt{\eta^2\theta^3}\right)^2 > 0$, where the strict inequality holds since $\eta > \overline{\eta}$ also implies $\eta^2\theta^3 > 1$.

more, they relax the (DE) constraint and therefore allow to enforce more effort within the relational contract. In the following, we will explore how this interaction evolves over time.

2.3.4 Relational and Reciprocity-Based Incentives as Dynamic Substitutes

In this section, we derive conditions for when the (DE) constraint actually binds, and in particular how this relates to the tenure of the employment relationship. This allows us to characterize how the optimal use of relational and reciprocity-based incentives evolves over the course of the employment relationship.

Generally, the (DE) constraint might or might not bind in any period $t < T$, depending on discount factor δ, reciprocity parameter η and productivity θ. Furthermore, the (DE) constraint becomes tighter in later periods.

Lemma 4. *The principal's dynamic enforcement constraint might or might not bind in period $T-1$. More precisely, for any discount factor δ, the (DE) constraint holds for first-best effort and wage levels if η is sufficiently large. For any values η and θ, the (DE) constraint does not hold for first-best effort and wage levels if the discount factor is sufficiently small.*

Furthermore, $\Pi_{t-1} - \tilde{\Pi}_{t-1} > \Pi_t - \tilde{\Pi}_t$ for all $t \leq T$.

The principal's commitment in a relational contracts is given by what she has to lose given she deviates. If the discount factor is small, she cares less about a potential reduction of future profits and is therefore less willing to compensate the agent for his effort. Furthermore, a larger reciprocity parameter η increases future profits on the equilibrium path (by more than future off-path profits), and furthermore reduces today's effective effort costs (by more than first-best effort goes up). The second part of Lemma 4 states that the difference between on- and off-path continuation profits goes down over time. The intuition is driven by two aspects. First, the remaining time horizon and therefore the periods in which profits can be generated is reduced as time elapses. Second, this triggers a re-enforcing effect because implementable effort in a period is increasing in the difference between on- and off-path continuation profits. Since $\Pi_T - \tilde{\Pi}_T > 0$, the (DE) constraint allows to implement a larger effort level in period $T-1$ than in period T. Therefore, per-period on-path profits in period $T-1$ are larger than in period T (whereas per-period off-path profits are the same in every period), and implementable effort in period $T-2$ is even larger than in period $T-1$. Hence, the (DE) constraint in earlier periods is less tight than later on.

Lemma 4 implies that if the (DE) constraint *binds* in a given period $\tilde{t}$, it will also bind in all subsequent periods $t > \tilde{t}$. If it is *slack* in a given period $\hat{t}$, it will also be slack in all previous periods $t < \hat{t}$. This allows us to derive the following effort- and (fixed) wage-dynamics.

Proposition 1. *Equilibrium effort is weakly decreasing over time and equilibrium wage weakly increasing, i.e.,* $e_t^* \leq e_{t-1}^*$ *and* $w_t \geq w_{t-1}$*. Both inequalities hold strictly if and only if the (DE) constraint binds in period* t*.*

Furthermore, $e_t^* < e_{t-1}^*$ *and* $w_t > w_{t-1}$ *imply* $e_{t+1}^* < e_t^*$ *and* $w_{t+1} > w_t$*, whereas* $e_{t+1}^* = e_t^*$ *and* $w_{t+1} = w_t$ *imply* $e_t^* = e_{t-1}^*$ *and* $w_t = w_{t-1}$*.*

Proposition 1 states that the profit-maximizing equilibrium is characterized by a downward sloping effort and an upward sloping wage profile. As long as the future is sufficiently valuable for the (DE) constraint not to bind, both are time-invariant. Once the (DE) constraint binds, the principal cannot credibly promise her preferred bonus payment anymore. On the one hand, this reduces equilibrium effort. On the other hand, the principal responds with a wage increase which increases equilibrium effort – directly due to the agent's preferences for reciprocity, and indirectly because it relaxes the principal's (DE) constraint and allows her to request more effort from the agent. However, the effort increase caused by the higher wage does not fully compensate for the effort reduction caused by the binding (DE) constraint because the costs of implementing an additional unit of effort now are larger with reciprocity-based than with relational incentives. As time proceeds, the (DE) constraint becomes tighter and tighter (Lemma 4). Hence, relational incentives are gradually substituted by reciprocity-based incentives (fixed wage ↑), with the substitution however being incomplete (effort ↓).

3 Predictions

In the previous sections, we derived the properties of a profit-maximizing long-term arrangement for an agent with given reciprocal preferences. Now, we will explore to what extent the agent's preferences for reciprocity affect his effort choices over the course of his career. This allows us to generate several comparative statics and consequently a number of testable predictions.

3.1 Effort

First, we derive a general result concerning the effect of an individual's reciprocity on effort. Our model provides the general result that irrespective of an individual's career stage, the effect of a larger η on effort is unambiguously positive.

Prediction 1. *More reciprocal individuals exert more effort.*

Proof. This relationship holds in any period: For periods $t < T$ and $\eta > \overline{\eta}$, $\frac{\partial e_t^*}{\partial \eta} = \frac{\eta^2\theta^3(1+\lambda_{DEt})-1}{2\eta^2\theta(1+\lambda_{DEt})} > 0$. For period T and $\eta > \overline{\eta}$, $\frac{\partial e_T^*}{\partial \eta} = \frac{\theta^2}{2} > 0$. Finally, for $\eta \leq \overline{\eta}$, $\frac{\partial e_t^*}{\partial \eta} = 0$ in all periods t. □

This prediction follows from our result that reciprocal and relational incentives are complements at a given point in time. There, providing incentives becomes cheaper if η goes up, hence more effort will be implemented.

The next prediction picks up the results stated in Proposition 1 and refers to the dynamics with respect to effort.

Prediction 2. *Effort is lower in later stages of a career.*

Proof. This immediately follows from Lemma 1. □

Next, we explore how η affects incentive schemes and consequently outcomes at different stages of an individual's career. Prediction 3 yields the main result of this paper:

Prediction 3. *The positive effect of reciprocal preferences on effort becomes stronger over the course of the employment relationship.*

Proof. This follows from Lemma 4, where we show that λ_{DEt} increases over time, and $\frac{\partial e_t^*}{\partial \lambda_{DEt} \partial \eta} = \frac{1}{2\eta^2\theta(1+\lambda_{DEt})^2} > 0$. □

Prediction 3 follows from reciprocal and relational incentives being dynamic substitutes. When an individual approaches the end of his or her employment relationship, the incentive system puts more weight on reciprocal incentives, hence the role of η is intensified. Therefore, the reduction of incentive costs caused by a higher η is more pronounced and equilibrium effort reacts more strongly.

3.2 Utility

In the following, we derive predictions concerning the agent's utility. In the empirical section, we test these predictions using survey measures on an individual's job satisfaction. This section is also supposed to capture potential interactions between an individiual's inherent preferences for reciprocity and his or her compensation. Although the SOEP contains measures such as "montly wage" or "annual salary", those are incomplete if an individual's total compensation also contains non-monetary components, like career concerns, job assignment, status, feelings of belonging, that one is making a difference,[8] or discretion over decisions[9].

But all these aspects are supposed to increase an individual's satisfaction with his or her job, therefore the respective measure – and the agent's utility as the theoretical counterpart – seems better suited. [10]

Our predictions on job satisfaction are collected in the following prediction.

Prediction 4.

- *More reciprocal employees are more satisfied with their jobs.*
- *Job satisfaction increases over time.*
- *The positive effect of reciprocal preferences on satisfaction becomes stronger over the course of the employment relationship.*

The proof of Prediction 4 can be found in the Appendix.

Generally, the agent has a larger utility if one unit of effort is implemented with reciprocal than when it is implemented with relational incentives. The intuition for Prediction 4 then proceeds along the same lines as the intuition underlying Predictions 1-3: In any period t, reciprocity-based incentives are more important for larger values of η, therefore the agent also is better off in this case. Furthermore, because reciprocity-based incentives assume a larger role later on, the positive effect of η on an agent's utility becomes stronger over time.

4 Empirical Analysis

We use data from the German Socio-Economic Panel (SOEP). The SOEP is a yearly panel survey that is representative of the German population and goes back to 1984. It contains a wide range of questions on the personal and socioeconomic situation as

[8]See Gibbons and Henderson (2012), p. 1353.

[9]This has been observed by Cyert et al. (1963) and later taken up by Li et al. (2017), who state that "payments within organizations often take the form of promises about future decisions and decision making rather than monetary transfers" (p. 218).

[10]Note that Dohmen et al. (2009) also explore the interaction between reciprocity and satisfaction. They compare individuals who are satisfied with their jobs with individuals who are not, and find that the positive effect of reciprocity on effort is only observed for the former (a result we are able to replicate). Our model would also predict such an outcome if unsatisfied agents were regarded to have had a bad experience with their employer, and in particular perceive the latter to have reneged on the relational contract (after which η drops to zero). But our model also allows to go beyond this rather straightforward prediction, and assess the on-the-equilibrium-path implications of observing different satisfaction/utility levels.

well as labor market status and income of respondents. We use the same data set as Dohmen et al. (2009) and largely keep their empirical specification for the sake of comparability, however are particularly interested in exploring how the existence of intrinsic reciprocity affects dynamic incentive systems. Our focus on employment relationships lets us restrict our analysis to a subsample of all SOEP respondents and only consider employees. This excludes individuals who are unemployed, retired, self-employed, in compulsory military or community service, or in training and education. We further exclude employees below the age of 25 and above the age of 65 to avoid sample selection issues due to endogenous retirement decisions, leaving us with a sample of 9,221 individuals who participated in the 2005 wave of the survey. For our purposes, the 2005 wave is of particular interest as it contains a total of six questions that are designed to capture individual reciprocal inclinations. Note that this measure has also been included in the 2010 and 2015 waves of the SOEP; however, as those do not include other measures that we regard as important for the relation to our theoretical model, for example retirement propensity (see below), we decided to use these waves only for robustness exercises, which can be found in Section 4.2.3.

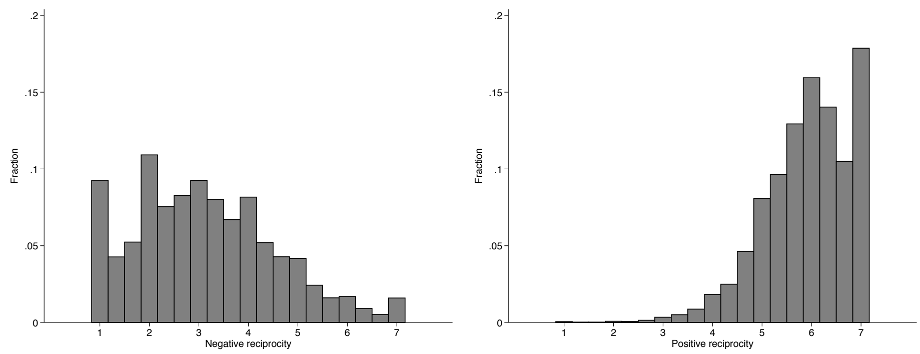
The reciprocity items developed by Perugini et al. (2003) capture what they define as a personal norm of reciprocity, that is, to what extent an individual has internalized the norm of reciprocal behavior. Participants are asked to rate how well six statements (three for positive, three for negative reciprocity) apply to themselves on a seven-point Likert scale.[11] The item average then determines each person's strength of reciprocity. Figure 2 shows the distribution of positive and negative reciprocity among survey participants, revealing that while there is quite some variation in negative reciprocity, positive reciprocity is strongly pronounced.

It is important to note that positive and negative reciprocity constitute different traits. This is supported by the observations that the correlation between the two is rather low (p=.052), that the traits have different determinants (Dohmen et al., 2008), and that the six items can be represented by two distinct orthogonal principal components (Dohmen et al., 2009). In our study, we focus on the effects of *positive* reciprocity and discuss this choice below, in Section 5.

To study the effect of positive reciprocity on (non-contractible) effort, we use over-

[11] Specifically, the items measuring positive reciprocity are "If someone does me a favor, I am prepared to return it", "I go out of my way to help somebody who has been kind to me before", and "I am ready to undergo personal costs to help somebody who helped me before", while the items "If I suffer a serious wrong, I will take revenge as soon as possible, no matter what the cost", "If somebody puts me in a difficult position, I will do the same to him/her", and "If somebody offends me, I will offend him/her back" are meant to capture negative reciprocity.

Figure 2: Distribution of negative and positive reciprocity in the SOEP population



Notes: The figure plots the distribution of negative and positive reciprocity for the 9,221 employee respondents of the 2005 SOEP wave who answered all six reciprocity questions. The individual inclination for negative and positive reciprocity are calculated by taking the average of the three questions that are targeted at the respective dimension.

time work as proxy for the latter (following Dohmen et al. (2009)). Overtime is a binary variable indicating whether the employee has worked overtime hours in the month preceding the interview or not. There, two aspects are important. First, this measure does *not* exclude the possibility that an employee is compensated for working overtime, which one might argue does not capture our notion of non-contractible effort. However, effort in our model does not only capture actual working time, but also other aspects that benefit the firm and are costly to the employee, such as flexibility in one's working arrangements. Therefore, even if overtime is compensated, it can very well include non-contractible aspects of effort. Moreover, in Section 4.2.1, we replicate our results using *unpaid* overtime as the dependent variable, as well as overtime that cannot be accumulated in a work-time account. Second, the overtime measure is binary, whereas one might argue that our predictions are better addressed by analyzing overtime hours (i.e., the intensive margin). This is taken care of in Section 4.2.2, where we explore the effect of reciprocal preferences on overtime hours. Finally, in Section 4.2.3, we rule out that our results are entirely driven by cohort effects. There, we include later waves of the survey that also include the reciprocity measure and conduct a panel analysis.

4.1 Main Results

4.1.1 Reciprocity and Effort

We first examine the effect of reciprocity on effort. We do so by estimating cross-sectional regressions and controlling for several other influence factors. Specifically, our controls include gender, age, years of education, full-time and part-time work experience, tenure in the recent position (all included in a Mincer-type fashion), a dummy variable for part-time employment, and indicator variables for industry sector, firm size, and occupational status. To estimate the effect of reciprocity on the propensity to work overtime, we employ a logit specification. Standard errors are clustered at the household level. Column (1) of Table 1 gives the results of a regression of the binary dependent variable indicating whether the employee has worked overtime in the month preceding the interview on reciprocity and the set of controls. Our results confirm Prediction 1 (and are similar to those of Dohmen et al., 2009) – the propensity to work overtime is increasing in the degree of positive reciprocity.

Next, we test Prediction 2 and explore how effort evolves over time. In particular, we examine the effect of age on the propensity to work overtime. Looking at the net relationship in the regression in column (1) of Table 1, the age coefficient in the effort regression is negative and significant, indicating that the propensity to work overtime is decreasing with employee age, confirming Prediction 2. Figure 3 further explores the relationship between employee age and effort by depicting a local polynomial regression of the residual variance of overtime on age, thus illustrating the adjusted, non-linear relationship between the two variables. It can be seen that the pattern largely overlaps with the linear regression line with a few small exceptions at the lower and upper end of the age continuum.

Having explored the impact of positive reciprocity and age on overtime, we now turn to our central question: how is the effect of positive reciprocity on effort changing over the course of an employment relationship? To approach this, we modify the estimation equation used so far by adding a term where we interact positive reciprocity with a dummy variable that indicates whether an individual is relatively close to the last periods of an employment relationship. In accordance with our model predictions, a positive interaction coefficient would indicate that reciprocity is indeed more important in later stages.

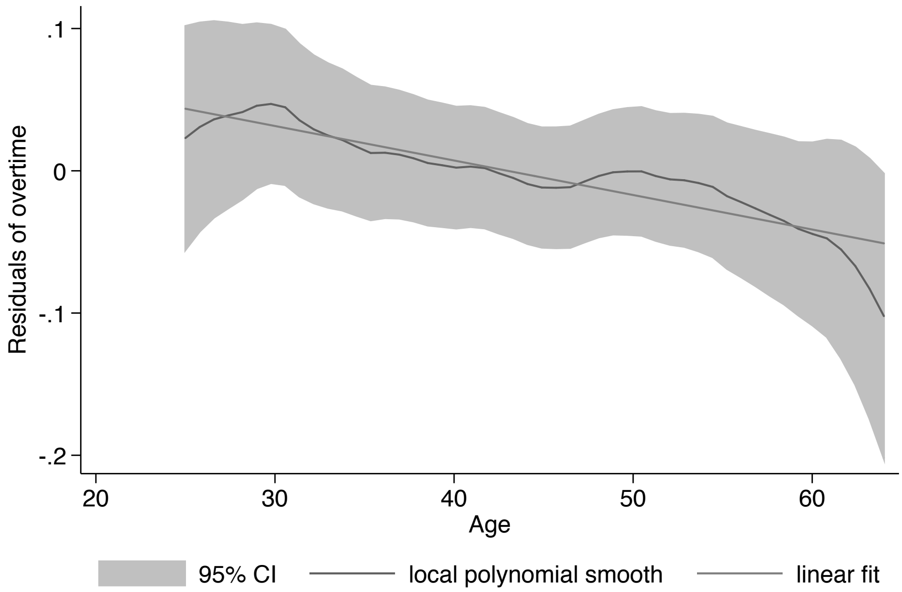
As a first approach, we create a dummy variable indicating whether an individual is at least 60 years old. We argue that this subgroup is sufficiently close to the last periods of their employment relationships such that an insufficient future surplus restricts the enforceability of the relational contract (or, in more technical terms, such that the (DE)

Table 1: Effect of reciprocity on effort by age and likelihood of retirement

DV: Overtime (Y/N)	(1) Overall	(2) Age cutoff	(3) Retirement propensity
Positive reciprocity	0.0176***	0.0184***	0.0175***
	(0.00641)	(0.00643)	(0.00642)
Age (in years)	-0.00785***		
	(0.00166)		
Age_cutoff = 1		-0.0812**	
		(0.0332)	
1.Age_cutoff # Positive reciprocity		0.0838***	
		(0.0317)	
retire = 1			-0.0690**
			(0.0291)
1.retire # Positive reciprocity			0.0551**
			(0.0278)
Pseudo R^2	0.0691	0.0679	0.0677
Observations	7,019	7,019	7,019

Notes: Estimations are based on the 2005 survey wave of the SOEP. Robust standard errors in parentheses clustered at household level. Table reports marginal effects at the mean calculated after logit regressions, with marginal effects for interactions reflecting the difference in slope for reciprocity between the groups. Reciprocity score standardized. Controls include years of education, gender, years of full time and part time work experience (linear and squared terms), a dummy for part-time employment, job tenure in current position (linear and squared), indicator variables for industry sector (services, agriculture, energy or mining, manufacturing, construction, trade, transport, bank or insurance) and firm size (less than 100, 100-199, 200-1999, more than 2000 employees), and an indicator variable for occupation status (white collar, blue collar, public sector). *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure 3: Local polynomial smooth of effort on age



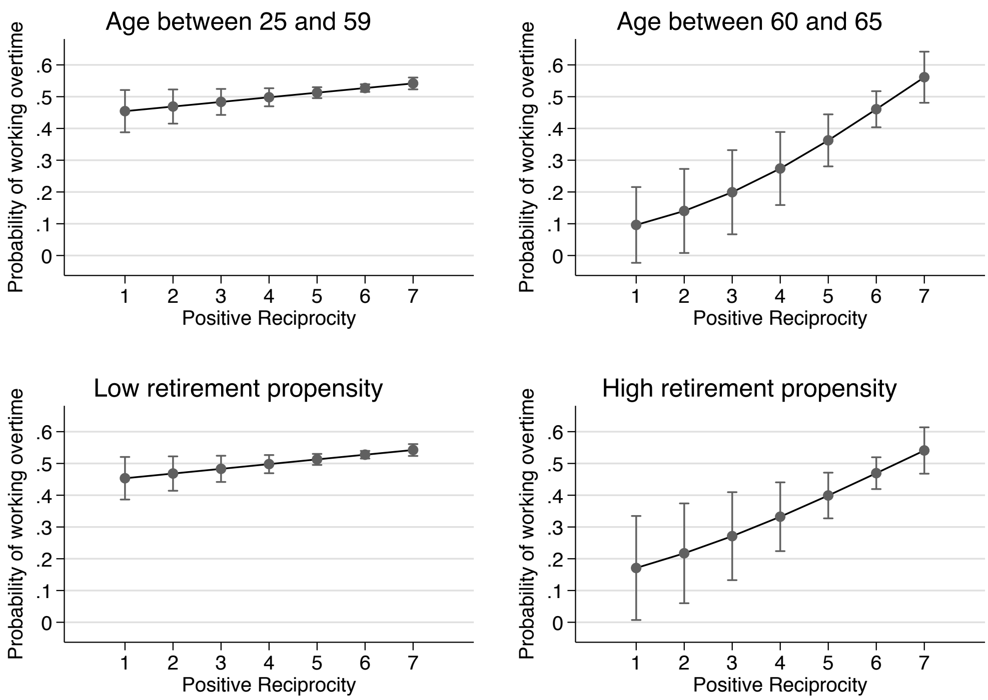
Notes: The figure plots a linear fit as well as a local polynomial smooth of the residual variance of the propensity to work overtime on age. Estimations are based on the 2005 survey wave of the SOEP.

constraint binds), thus making intrinsic reciprocity relatively more important. Estimation results are reported in column (2) of Table 1. It can be seen that while the influence of reciprocity on the propensity to work overtime is positive for all workers, the positive relationship is significantly more pronounced for workers above the age cutoff, as indicated by the positive marginal effect of the interaction. Thus, it seems like the positive effect of positive reciprocity on the probability of working overtime is mostly driven by older workers, confirming Prediction 3. Note that these results are qualitatively robust to choosing other age cutoffs. Figure 6 in the Appendix depicts the estimated interaction coefficients for varying cutoffs. It can be seen that the interaction coefficient is increasing in the cutoff value for age and that there is a jump at age 60, indicating that there is a more pronounced difference for this cutoff.[12]

[12]Of course, while we present results for one specific age cutoff throughout this section, we are aware of the fact that this constitutes a somewhat arbitrary choice, and keep other possible cutoffs and specifications in mind throughout. Generally, the overall pattern of interactions at different cutoffs is as expected from our model (i.e., while the influence of intrinsic reciprocity is always more pronounced for relatively older people, the difference between the groups becomes smaller in size when the division is made earlier).

To further illustrate this result, the upper panel of Figure 4 plots the predictive marginal effects of positive reciprocity on the propensity to work overtime (i.e., the expected propensity to work overtime depending on reciprocity score, holding all other influence factors constant) calculated separately for workers who are younger than 60 and those who are at least 60 years old. While the effect of reciprocity on the propensity to work overtime seems overall positive, it is substantially more pronounced for employees who are at least 60 years old. This further confirms the main intuition of our model, namely that intrinsic reciprocity mostly matters near the end of employment relationships.

Figure 4: Predictive marginal effects of positive reciprocity on effort by age cutoff and retirement propensity



Notes: The figure plots predicted marginal changes of the propensity to work overtime at different levels of positive reciprocity depending on age group (upper panel) and a high vs. low propensity to retire within the next two years (lower panel), holding all other factors constant. Estimations are based on the 2005 survey wave of the SOEP. Error bars indicate 95% confidence intervals.

However, even though there is an officially regulated age for retirement in Germany, there might still be differences in individual retirement ages, and thus age might only be a noisy proxy for the stage of employees' careers. To address this concern, we utilize an additional question from the SOEP that asks employees how likely it is that they are going to retire within the following two years. This results in a binary variable that takes on the value 1 if the respondent indicates that his/her probability of retiring within the following two years is at least 50 percent. We use this variable as an alternative dummy for the interaction with positive reciprocity. The estimation results can be found in column (3) in Table 1. It is evident that this alternative specification produces similar results to generating the dummy based on age: again, the marginal effect of positive reciprocity is significant, but the interaction is as well, indicating that the positive relationship between intrinsic reciprocity and effort is more pronounced among among employees who expect to retire within the following two years. Again, we further illustrate our finding by plotting the predictive marginal effects of positive reciprocity on effort separately for low and high retirement propensity in the lower panel of Figure 4. It can be seen clearly that while the slope of both curves is positive, the slope is much steeper for employees with a high likelihood of retirement.

To sum up, looking at influence factors on propensity to work overtime among our sample of German employees, we find that positive reciprocity is positively related to overtime (confirming Prediction 1). While the propensity to work overtime decreases with age (confirming Prediction 2), the positive effect of reciprocity on overtime is stronger for employees in the last stages of their employment relationships (confirming Prediction 3).

4.1.2 Reciprocity and Job Satisfaction

To explore the effect of reciprocity on an employee's job satisfaction as reflected in Prediction 4, we make use of a survey question asking employees to rate their overall job satisfaction.[13] We regress job satisfaction on reciprocity from the survey waves of 2006, controlling for age and our usual control variables. The reason for taking job satisfaction from the subsequent wave is to address concerns of reverse causality. Note that we do not control for an individual's (monetary) income because it constitutes a substantial part of the agent's utility (together with other, non-monetary, components of an employee's compensation package which we cannot observe).

The results shown in column (1) of Table 2 indicate that reciprocity indeed influences job satisfaction of employees as the marginal effect of positive reciprocity is positive and

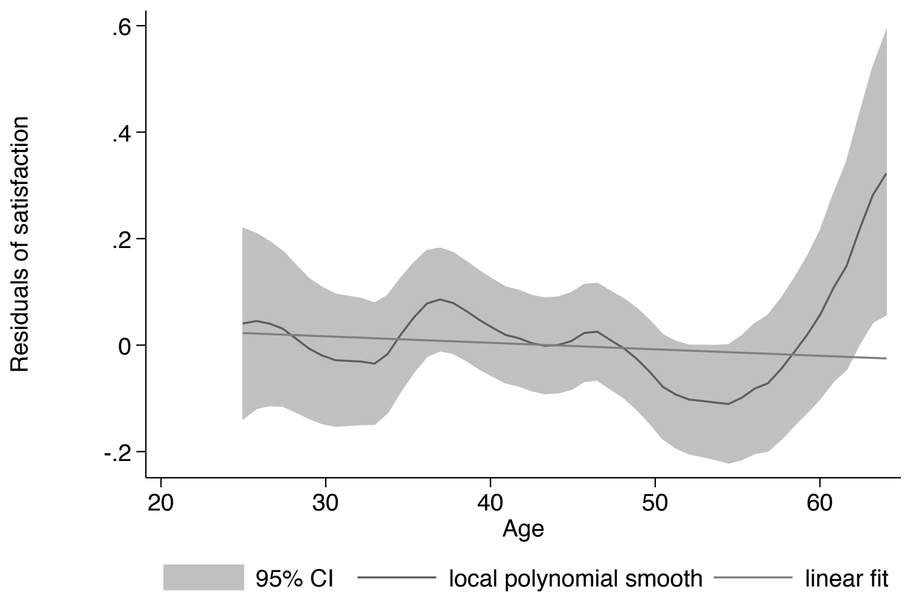
[13]The question employees are asked is "How satisfied are you with your job?" and is to be rated on a scale from 0 (totally unsatisfied) to 10 (totally satisfied).

Table 2: Effect of reciprocity on job satisfaction

DV: Job satisfaction	(1) Overall	(2) Age cutoff	(3) Retirement propensity
Positive reciprocity	0.176***	0.172***	0.165***
	(0.0269)	(0.0274)	(0.0271)
Age (in years)	-0.00748		
	(0.00657)		
Age_cutoff = 1		0.390***	
		(0.149)	
1.Age_cutoff # Reciprocity		0.122	
		(0.152)	
retire = 1			-0.267*
			(0.140)
1.retire # Reciprocity			0.205
			(0.145)
Observations	6,218	6,218	6,218
R^2	0.032	0.033	0.033

Notes: Estimations are based on the 2005 survey wave of the SOEP. Job satisfaction is taken from the 2006 wave. Robust standard errors reported in parentheses. Standard errors are clustered at household level. Table reports coefficients of OLS regressions. Reciprocity measure standardized. Controls include negative reciprocity, years of education, gender, years of full time and part time work experience (linear and squared terms), a dummy for part-time employment, job tenure in current position (linear and squared), indicator variables for industry sector (services, agriculture, energy or mining, manufacturing, construction, trade, transport, bank or insurance) and firm size (less than 100, 100-199, 200-1999, more than 2000 employees), and an indicator variable for occupation status (white collar, blue collar, public sector). *** p<0.01, ** p<0.05, * p<0.1.

Figure 5: Local polynomial smooth of job satisfaction on age



Notes: The figure plots a linear fit as well as a local polynomial smooth of the residual variance of job satisfaction on age. Estimations are based on the 2005 survey wave of the SOEP. Job satisfaction is taken from 2006.

significant.

Next, we explore the development of job satisfaction over time by examining the effect of age on job satisfaction. Analogous to the relationship between age and the propensity to work overtime, Figure 5 depicts a local polynomial regression of the residual variance of job satisfaction on age to illustrate the adjusted, non-linear relationship. Here, it is evident that while in our theoretical model, job satisfaction increases over time, the relationship between job satisfaction and age is not approximated very well by a linear relationship in the data. Indeed, it seems like job satisfaction is more or less the same for workers under the age of 50 to then first decrease and subsequently increase to its highest level.

Having explored the overall effect of positive reciprocity and age on job satisfaction, we now again add an interaction term between reciprocity and a dummy variable indicating that the individual is older than 60. Column (2) of Table 2 presents the results of this estimation. It can be seen that the marginal effect is positive but not significant. The same holds when we use retirement propensity as indicator variable for the interaction, as can be seen in column (3) of Table 2. But we also explore different cutoff values by depicting the interaction coefficients resulting from employing our specification and varying the age cutoff. As can be seen in Figure 7 in the Appendix, the marginal effects are positive and relatively constant in value for cutoffs above 53, but the confidence intervals become much wider as the cutoff approaches 60, which is probably why we are only able to qualitatively detect the pattern predicted by our model. However, when we set the age cutoff to 52, 53, 54, 55, or 56, for example, the interaction effect is significant. Therefore, provided job satisfaction is regarded as a proxy for the total utility an individual enjoys from his or her job, Prediction 4 is largely confirmed.

Recall that the results in this section are supposed to also capture the effect of reciprocity on an employee's compensation (which naturally assumes a large part of the utility stemming from employment). We do not include an analysis of the interaction between reciprocity and compensation because only monetary compensation – which captures just a limited part of an individual's total compensation – is observed in our data. Results on monetary compensation are available from the authors upon request. There, an individual's annual labor income is increasing in the degree of positive reciprocity as would be predicted by our theoretical model. Furthermore, also in line with our theoretical approach (which would predict total compensation, the sum of wage and bonus payments, to go down over time), an individual's annual labor income is decreasing with age and particularly low above the age threshold. The effects of reciprocity for individuals above the age cutoff and for those who expect to retire soon, however, are not significant.

4.2 Robustness

Having mostly confirmed our predictions, we now show that our empirical results concerning effort are robust to different specifications. We first apply different overtime specifications and show that our results still hold. Then, we make use of data from two subsequent SOEP survey waves that also include reciprocity measures to verify that our results are not driven by cohort effects.

4.2.1 Unpaid overtime as effort measure

Up to now, we have – for the sake of comparability – relied on the same overtime measure as Dohmen et al. (2009). Since this measure also includes compensated overtime, one might question whether it is a good proxy for non-contractible effort. Thus, we rerun our main analysis using only *unpaid* overtime as a dependent variable. Doing so, our results are even more pronounced: for both the age cutoff and retirement propensity interactions, the main effect of positive reciprocity is positive but insignificant while the interaction terms are significant, indicating that the positive relationship between reciprocity and unpaid overtime is driven by workers who are relatively close to retirement. In addition, we use an even more restrictive overtime measure that only accounts for overtime that is neither compensated monetarily or non-monetarily (e.g., through work-time accounts). While the coefficients are not significant, they still point into the right direction. In sum, the overall picture provides further evidence for our main result. The full regression table and the predicted margins of the interactions can be found in Table 3 and Figure 8 in the Appendix.

4.2.2 Overtime hours

So far, our analyses have focused on the extensive margin of effort, i.e., whether employees have worked overtime or not. To further explore the influence of reciprocity on effort, we look at the intensive margin of overtime work by exploring the number of total and unpaid hours of overtime worked. This implies that our empirical measure of effort now is not binary anymore and therefore even closer to the continuous specification used in our theoretical model. Here, we estimate negative binomial models to account for the fact that we are now utilizing overdispersed count data and otherwise stick to our empirical strategy of estimating the overall effect of reciprocity and age before including interactions with age group and retirement propensity. Overall, we find that the pattern predicted by the theoretical model is also visible when we account for additional time spent at work as all interactions are positive, indicating that reciprocity has a stronger positive influence on the amount of overtime hours for workers who are at later stages of their careers. The full regression results can be found in Table 4 in the Appendix.

4.2.3 Panel structure

While we have focused on the 2005 SOEP wave so far, the survey measures of reciprocity have been included in the SOEP questionnaire in the years of 2010 and 2015 as well. Note that, because there is some turnover among survey participants in every year, only 53% of the 2005 respondents participate in the 2010 wave, and 33% of them participate in the 2015 wave. Furthermore, in these additional survey years, not all variables that we use for our analysis have been included again, retirement propensity being one example. However, we are able to rerun our main analysis of the effect of positive reciprocity on overtime using data from all three waves.[14]

Theoretically, positive reciprocity is supposed to be a stable trait and any variation over time spurious. The SOEP data support this presumption as the ICC, a measure of consistency between more than two measurements, takes a value of 0.418, which can be interpreted as fair (Cicchetti, 1994) – in particular taking into account the time distance between the waves, and that the SOEP contains self-reported measures. In addition, when we evaluate changes in positive reciprocity between the waves, we see that about 77% of changes are smaller than 1, and that the mean of changes is not significantly different from zero.

We estimate a random effects regression and a pooled logit regression.[15] The results are shown in Table 5 in the Appendix. To account for cohort effects, we included birth year dummies in the panel estimations. First, if we stick to the age cutoff of 60, we find that we still see the expected patterns: positive reciprocity has a significantly positive influence on the propensity to work overtime, while age has a negative influence. The interaction between being above the age cutoff and positive reciprocity is positive, even though insignificant. If we change the age cutoff to 55, though, the interaction coefficient is positive and significant.

To further explore the available data, we finally estimate the arguably most general specification. There, we not only include all three waves, from 2005, 2010, and 2015, but also use overtime hours as introduced in the previous Section 4.2.2. The results can be found in Table 6 in the Appendix. Here, the interaction coefficients are positive and significant at the 1% level for total as well as for unpaid overtime hours. These patterns are robust for changing the age cutoff from 60 to 55.

To sum up, we are able to replicate our main result when focusing on unpaid overtime instead of overtime in general, using overtime hours instead of a binary measure, as well as including two additional waves of the SOEP. This indicates that our results are not due to cohort effects, but indeed driven by the optimal design of incentive systems for employees with reciprocal preferences.

[14]In contrast, we are not able to do the same for job satisfaction as the 2016 measures are not available yet. As we take job satisfaction from the subsequent year to avoid issues with reverse causality, we are not able to use the 2015 data.

[15]We refrain from estimating a fixed effects regression although it would enable us to isolate within-person effects. The reason is that we would need to focus on employees who switch age categories between 2005 and 2015 because only those have variation needed for using a fixed effects approach which gets rid of all stable effects. Furthermore, recall the turnover among survey participants in every year. Therefore, this procedure would only leave us with about 800 observations.

5 Discussion & Conclusion

We have shown that repeated-game incentives and preferences for positive reciprocity can interact in intricate ways. The two are dynamic substitutes but complements once a specific point in time is considered. We have provided strong empirical support for this notion. No matter which specification we apply, the effect of reciprocity is always positive, and this effect is more pronounced for individuals who are relatively close to retirement – only significance levels differ. We think that this outcome is remarkable given the self-reported nature of the survey data we use.

We have not pursued the question of how negative reciprocity affects an optimal dynamic incentive scheme, though, and did this for two reasons. First, positive and negative reciprocity seem to describe quite different personality traits (recall that the correlation between the two only equals .052). Second, while the general *positive* effect of positive reciprocity on outcomes is well established and also straightforward from a theoretical perspective, the same is not true for negative reciprocity. There, the interaction is rather ambiguous.

On the one hand, the effect of negative reciprocity on effort and profits is negative if we assume that it is triggered by a fixed wage that is below a given reference wage. For example, assume that we give up the limited liability constraint and set this reference wage to zero. Then, the optimal spot contract still takes the form of either a bonus or a reciprocity contract, only the threshold $\overline{\eta}$ is different than in our main analysis.[16] Negative reciprocity negatively affects the bonus contract, because the fixed wage is generally negative in this case in order to extract the agent's rent. The reciprocity contract and the relational contract contain a positive fixed wage and consequently are not affected by negative reciprocity – hence the impact of the latter on effort and profits is negative on average. This negative effect is the dominant presumption in the literature (for a theoretical investigation, see Netzer and Schmutzler (2014)), and can also be found in the data (see Dohmen et al. (2009)).

On the other hand, negative reciprocity might also *positively* affect a relational contract. Right now, η drops to zero after a deviation by the principal. Instead, we might assume that η does not necessarily drop to zero, but that the reduction is a function of the agent's negative reciprocity. If a larger degree of negative reciprocity implies a bigger reduction of η (following a deviation by the principal), it would actually allow to implement a higher effort level (and increase profits) – because the principal's out-

[16] Omitting the limited liability constraint rather increases $\overline{\eta}$ (because using a bonus contract does not make it necessary to grant the agent a rent anymore), whereas negative reciprocity reduces $\overline{\eta}$.

side option would go down accordingly, and consequently increase her commitment in the relational contract. This positive effect would now be more pronounced for *younger* employees where incentives are mostly provided via relational contracts.

We think that a thorough investigation of the effect of negative reciprocity on an optimal dynamic incentive scheme deserves more attention, but leave it for future research.

References

Abreu, D. (1988). On the theory of infinitely repeated games with discounting. *Econometrica*, 56(2):383–396.

Akerlof, G. A. (1982). Labor contracts as partial gift exchange. *Quarterly Journal of Economics*, 97(4):543–569.

Andreoni, J. and Miller, J. H. (1993). Rational cooperation in the finitely repeated prisoner's dilemma: Experimental evidence. *Economic Journal*, 103(418):570–85.

Bellemare, C. and Shearer, B. (2009). Gift giving and worker productivity: Evidence from a firm-level experiment. *Games and Economic Behavior*, 67:233–244.

Bellemare, C. and Shearer, B. (2011). On the relevance and composition of gifts within the firm: Evidence from field experiments. *International Economic Review*, 52(3):855–882.

Bull, C. (1987). The existence of self-enforcing implicit contracts. *The Quarterly Journal of Economics*, 102(1):147–159.

Cabral, L., Ozbay, E. Y., and Schotter, A. (2014). Intrinsic and instrumental reciprocity: An experimental study. *Games and Economic Behavior*, 87:100–121.

Camerer, C. and Weber, R. (2013). Experimental organizational economics. In Gibbons, R. and Roberts, J., editors, *The Handbook of Organizational Economics*, pages 213 – 262. Princeton University Press.

Charness, G. and Kuhn, P. (2011). Lab labor: What can labor economists learn from the lab? In Ashenfelter, O. and Card, D., editors, *Handbook of Labor Economics*, volume 4, pages 229–330. Elsevier.

Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment*, 6(4):284–290.

Contreras, O. F. and Zanarone, G. (2017). Managing social comparison costs in organizations. *Working Paper*.

Cyert, R. M., March, J. G., et al. (1963). *A behavioral theory of the firm*, volume 2. Prentice-Hall.

DellaVigna, S. (2009). Psychology and economics: Evidence from the field. *Journal of Economic Literature*, 47(2):315–372.

Dohmen, T., Falk, A., Huffman, D., and Sunde, U. (2008). Representative trust and reciprocity: Prevalence and determinants. *Economic Inquiry*, 46(1):84–90.

Dohmen, T., Falk, A., Huffman, D., and Sunde, U. (2009). Homo reciprocans: Survey evidence on behavioural outcomes. *Economic Journal*, 119(536):592–612.

Dreber, A., Fudenberg, D., and Rand, D. G. (2014). Who cooperates in repeated games: The role of altruism, inequity aversion, and demographics. *Journal of Economic Behavior & Organization*, 98:41–55.

Dufwenberg, M. and Kirchsteiger, G. (2004). A theory of sequential reciprocity. *Games and Economic Behavior*, 47(2):268 – 298.

Dur, R., Non, A., and Roelfsema, H. (2010). Reciprocity and incentive pay in the workplace. *Journal of Economic Psychology*, 31(4):676–686.

Dur, R. and Tichem, J. (2015). Altruism and relational incentives in the workplace. *Journal of Economics & Management Strategy*, 24(3):485–500.

Englmaier, F., Kolaska, T., and Leider, S. (2015). Reciprocity in organizations: Evidence from the wers. *CESifo Working Paper No. 5168*.

Englmaier, F. and Leider, S. (2012a). Contractual and organizational structure with reciprocal agents. *American Economic Journal: Microeconomics*, 4(2):146–183.

Englmaier, F. and Leider, S. (2012b). Gift exchange in the lab - it is not (only) how much you give ... *Working Paper*.

fai Fong, Y. and Li, J. (2017). Relational contracts, limited liability, and employment dynamics. *Journal of Economic Theory*, 169:270 – 293.

Falk, A., Fehr, E., and Fischbacher, U. (2006). Testing theories of fairness – intentions matter. *Games and Economic Behavior*, 62(1):287–303.

Falk, A. and Fischbacher, U. (2006). A theory of reciprocity. *Games and Economic Behavior*, 54(2):293–315.

Fehr, E., Brown, M., and Zehnder, C. (2009a). On reputation: A microfoundation of contract enforcement and price rigidity. *The Economic Journal*, 119(536):333–353.

Fehr, E., Goette, L., Zehnder, C., Fehr, E., Goette, L., and Zehnder, C. (2009b). A behavioral account of the labor market: The role of fairness concerns. *Annual Review of Economics*, 1(1):355–384.

Fehr, E., Kirchsteiger, G., and Riedl, A. (1993). Does fairness prevent market clearing? an experimental investigation. *The Quarterly Journal of Economics*, 108(2):437–459.

Fehr, E., Kirchsteiger, G., and Riedl, A. (1998). Gift exchange and reciprocity in competitive experimental markets. *European Economic Review*, 42(1):1–34.

Gibbons, R. and Henderson, R. (2012). Relational contracts and organizational capabilities. *Organization Science*, 23(5):1350–1364.

Gneezy, U., Güth, W., and Verboven, F. (2000). Presents of investments? an experimental analysis. *Journal of Economic Psychology*, 21:481–493.

Gächter, S. and Falk, A. (2002). Reputation and reciprocity: Consequences for the labour relation. *The Scandinavian Journal of Economics*, 104(1):1–26.

Hennig-Schmidt, H., Rockenbach, B., and Sadrieh, A. (2010). In search of workers' real effort reciprocity – a field and a laboratory experiment. *Journal of the European Economic Association*, 8(4):817–837.

Huang, F. and Cappelli, P. (2010). Applicant screening and performance-related outcomes. *American Economic Review*, 100(2):214–218.

Kreps, D., Milgrom, P., Roberts, J., and Wilson, R. (1982). Rational cooperation in the finitely repeated prisoners' dilemma. *Journal of Economic Theory*, 27(2):245–252.

Leuven, E., Oosterbeek, H., Sloof, R., and Van Klaveren, C. (2005). Worker reciprocity and employer investment in training. *Economica*, 72(285):137–149.

Levin, J. (2003). Relational incentive contracts. *American Economic Review*, 93(3):835–857.

Li, J., Matouschek, N., and Powell, M. (2017). Power dynamics in organizations. *American Economic Journal: Microeconomics*, 9(1):217–241.

MacLeod, W. B. and Malcomson, J. M. (1989). Implicit contracts, incentive compatibility, and involuntary unemployment. *Econometrica*, 57(2):447–480.

Mailath, G. J. and Samuelson, L. (2006). *Repeated games and reputations: long-run relationships*. Oxford University Press.

Malcomson, J. M. (2013). Relational incentive contracts. In Gibbons, R. and Roberts, J., editors, *The Handbook of Organizational Economics*, pages 1014 – 1065. Princeton University Press.

Netzer, N. and Schmutzler, A. (2014). Explaining gift-exchange—the limits of good intentions. *Journal of the European Economic Association*, 12(6):1586–1616.

Ohlendorf, S. and Schmitz, P. W. (2012). Repeated moral hazard and contracts with memory: The case of risk-neutrality*. *International Economic Review*, 53(2):433–452.

Perugini, M., Gallucci, M., Presaghi, F., and Ercolani, A. P. (2003). The personal norm of reciprocity. *European Journal of Personality*, 17(4):251–283.

Rabin, M. (1993). Incorporating fairness into game theory and economics. *The American Economic Review*, 83(5):1281–1302.

Rabin, M. and Charness, G. (2002). Understanding social preferences with simple tests. *Quarterly Journal of Economics*, 117(3):817–869.

Reuben, E. and Suetens, S. (2012). Revisiting strategic versus non-strategic cooperation. *Experimental Economics*, 15(1):24–43.

Sobel, J. (2005). Interdependent preferences and reciprocity. *Journal of Economic Literature*, 43(2):392–436.

Appendix

Omitted Proofs

Proof. [Proof of Lemma 1.] Plugging the agent's optimal effort choice, $e^* = \sqrt{b + \eta w \theta}$, into the principal's profits gives the Lagrange function $\mathcal{L} = \sqrt{b + \eta w \theta}\,(\theta - b) - w + \lambda_b b + \lambda_w w$ and first order conditions

$$\frac{\partial \mathcal{L}}{\partial b} = \frac{1}{2\sqrt{b + \eta w \theta}}(\theta - b) - \sqrt{b + \eta w \theta} + \lambda_b = 0$$
$$\frac{\partial \mathcal{L}}{\partial w} = \frac{\eta \theta}{2\sqrt{b + \eta w \theta}}(\theta - b) - 1 + \lambda_w = 0$$

We first show that bonus and wage payments are not used simultaneously. To the contrary, assume that this as the case, i.e. that $\lambda_b = \lambda_w = 0$. Then, first-order conditions are

$$\frac{1}{2\sqrt{b + \eta w \theta}}(\theta - b) - \sqrt{b + \eta w \theta} = 0$$
$$\frac{\eta \theta}{2\sqrt{b + \eta w \theta}}(\theta - b) - 1 = 0$$

Second-order conditions will not hold in this case, though: The Hessian matrix of second-order partial derivatives equals

$$\begin{pmatrix} -\frac{(b+\eta w\theta)^{-3/2}}{4}(\theta - b) - \frac{1}{\sqrt{b+\eta w \theta}} & -\frac{(b+\eta w\theta)^{-3/2}\eta\theta}{4}(\theta - b) - \frac{\eta\theta}{2\sqrt{b+\eta w \theta}} \\ -\frac{(b+\eta w\theta)^{-3/2}\eta\theta}{4}(\theta - b) - \frac{\eta\theta}{2\sqrt{b+\eta w \theta}} & -\frac{\eta^2\theta^2(b+\eta w\theta)^{-3/2}}{4}(\theta - b) \end{pmatrix},$$

yielding a determinant equal to $-\frac{3}{2}\eta\theta < 0$. Hence, either $w = 0$ or $b = 0$.

First, assume that $w = 0$ and $b > 0$, i.e., $\lambda_b = 0$ and $\lambda_w > 0$. Then, only the principal's first first-order condition is relevant and yields $b = \theta/3$. Furthermore, effort is $e^* = \sqrt{\theta/3}$, profits are $\pi = \frac{2\theta}{3}\sqrt{\frac{\theta}{3}}$, and the agent's utility equals $u = \frac{2\theta}{9}\sqrt{\frac{\theta}{3}} > 0$.

Now, assume that $w > 0$ and $b = 0$, i.e., $\lambda_b > 0$ and $\lambda_w = 0$. Then, only the principal's second first-order condition is relevant and yields $w = \eta\theta^3/4$. Furthermore, effort is $e^* = \eta\theta^2/2$, profits are $\pi = \frac{\eta\theta^3}{4}$, and the agent's utility equals $u = \frac{\eta\theta^3}{4} + \frac{\eta^3\theta^6}{12} > 0$.

Note that the second-order conditions hold in both cases.

Profits using a wage contract are higher than using a bonus contract, if $\eta^2\theta^3 \geq \frac{64}{27}$, hence the proclaimed threshold $\overline{\eta}$ exists, with $\overline{\eta} = \sqrt{\frac{64}{27\theta^3}}$. □

Proof. [Proof of Lemma 2.] If the (DE) constraint does not bind in a period t, the principal maximizes profits $\pi_t = e_t^*\theta - \left((e_t^*)^3/3 - \eta w_t e_t^* \theta + 2/3\left(\sqrt{\eta w_t \theta}\right)^3\right) - w_t$, subject to $w_t \geq 0$.

The Lagrange function equals $\mathcal{L}_t = e_t^*\theta - (e_t^*)^3/3 + \eta w_t e_t^* \theta - 2/3\left(\sqrt{\eta w_t \theta}\right)^3 - w_t + \lambda_{w_t} w_t$, where $\lambda_{wt} \geq 0$ represents the Lagrange parameter for the agent's limited liability constraint, giving first order conditions

$$\frac{\partial \mathcal{L}_t}{\partial e_t^*} = \theta - (e_t^*)^2 + \eta w_t \theta = 0$$
$$\frac{\partial \mathcal{L}_t}{\partial w_t} = \eta\theta \left(e_t^* - \sqrt{\eta w_t \theta}\right) - 1 + \lambda_{w_t} = 0$$

First, we show that $\lambda_{w_t} = 0$. To the contrary, assume that $\lambda_{w_t} > 0$ and hence $w_t = 0$. Then, $e_t^* = \sqrt{\theta}$ and $\pi_t = \frac{2}{3}\left(\sqrt{\theta}\right)^3$. In this case, a small increase of the wage would raise profits: $\frac{d\pi_t}{dw_t} \mid_{w_t=0} = \sqrt{\eta^2\theta^3} - 1 > 0$, since $\eta > \overline{\eta}$ implies that $\eta^2\theta^3 > 64/27 > 1$.

Since $\lambda_{w_t} = 0$, the first order conditions allow us to obtain the values for effort and wage, yielding $w_t = \frac{\left(\eta^2\theta^3 - 1\right)^2}{4\eta^3\theta^3}$ and $e_t^* = \frac{1+\eta^2\theta^3}{2\eta\theta}$. There, $w_t > 0$ because $\eta > \overline{\eta}$ implies $\eta^2\theta^3 > 1$. □

Proof. [Proof of Lemma 3.] Including the respective (DE) constraints, the Lagrange function of the principal's maximization problem in a period t becomes $\mathcal{L}_t = e_t^*\theta - (e_t^*)^3/3 + \eta w_t e_t^* \theta - 2/3\left(\sqrt{\eta w_t \theta}\right)^3 - w_t + \lambda_{DE_t}\left[\delta\left(\Pi_{t+1} - \tilde{\Pi}_{t+1}\right) - \frac{2}{3}\left(\sqrt{\eta w_t\theta}\right)^3 - (e_t^*)^3/3 + \eta w_t \theta e_t^*\right]$, where $\lambda_{DE_t} \geq 0$ represents the Lagrange parameter for the principal's dynamic enforcement constraint, and where we omit the agent's limited liability constraint and show ex-post that is satisfied.

First order conditions are

$$\frac{\partial \mathcal{L}}{\partial e_t^*} = \theta - (e_t^*)^2 + \eta w_t \theta + \lambda_{DE_t}\left[-(e_t^*)^2 + \eta w_t \theta\right] = 0$$
$$\frac{\partial \mathcal{L}}{\partial w_t} = \eta\theta e_t^* - \eta\theta\sqrt{\eta w_t \theta} - 1 + \lambda_{DE_t}\left[-\eta\theta\sqrt{\eta w_t\theta} + \eta\theta e_t^*\right] = 0,$$

yielding $w_t = \frac{\left(\eta^2\theta^3\left(1+\lambda_{DE_t}\right)-1\right)^2}{4\eta^3\theta^3\left(1+\lambda_{DE_t}\right)^2}$ and $e_t^* = \frac{1+\eta^2\theta^3\left(1+\lambda_{DE_t}\right)}{2\eta\theta\left(1+\lambda_{DE_t}\right)}$. There, $w_t > 0$ for $\lambda_{DE_t} \geq 0$ because $\eta > \overline{\eta}$ implies $\eta^2\theta^3 > 1$. Finally, it is straightforward to show that for $\lambda_{DE_t} > 0$, $\frac{\left(\eta^2\theta^3\left(1+\lambda_{DE_t}\right)-1\right)^2}{4\eta^3\theta^3\left(1+\lambda_{DE_t}\right)^2} > \frac{\left(\eta^2\theta^3-1\right)^2}{4\eta^3\theta^3}$ and $\frac{1+\eta^2\theta^3\left(1+\lambda_{DE_t}\right)}{2\eta\theta\left(1+\lambda_{DE_t}\right)} < \frac{1+\eta^2\theta^3}{2\eta\theta}$. □

Proof. [Proof of Lemma 4.] The (DE) constraint in period $T-1$ (where on- and off-path continuation profits are $\Pi_T = \eta\theta^3/4$ and $\tilde{\Pi}_T = \frac{2\theta}{3}\sqrt{\frac{\theta}{3}}$, respectively) equals $(e_t^*)^3/3 - \eta w_t \theta e_t^* \leq \delta\left(\frac{\eta\theta^3}{4} - \frac{2\theta}{3}\sqrt{\frac{\theta}{3}}\right) - \frac{2}{3}\left(\sqrt{\eta w_t \theta}\right)^3$. For first-best effort and wage levels $w_t = \frac{\left(\eta^2\theta^3-1\right)^2}{4\eta^3\theta^3}$ and $e_t^* = \frac{1+\eta^2\theta^3}{2\eta\theta}$, it becomes

$$\frac{3\eta^2\theta^3 - 1}{6\eta^3\theta^3} \leq \delta\left(\frac{\eta\theta^3}{4} - \frac{2\theta}{3}\sqrt{\frac{\theta}{3}}\right).$$

By assumption ($\eta > \overline{\eta}$), both left and right hand side are strictly positive. Therefore, the constraint is violated for first-best effort and wage levels if $\delta \to 0$.

To investigate the first part of the Lemma, rewriting the (DE) constraint gives $\frac{3-\frac{1}{\eta^2\theta^3}}{6\eta} \leq \delta\sqrt{\theta^3}\left(\frac{\eta}{4} - \sqrt{\frac{4}{27}}\right)$. Therefore, the left hand side is decreasing and the right hand side increasing in η and θ.

However, we have imposed the assumptions $\theta < 3$ and $\frac{\eta\theta^2}{2} < 1$ in order to guarantee an interior solution. This gives an upper bound for η, $\eta = \frac{2}{\theta^2}$. Plugging this upper bound into the constraint yields $\frac{12-\theta}{48}\theta \leq \delta\left(\frac{1}{2} - \frac{2}{3}\sqrt{\frac{\theta}{3}}\right)$. This is satisfied for any positive δ provided θ is sufficiently small. Finally, note that in this case, the condition $\eta > \overline{\eta}$ also holds for θ sufficiently small. Plugging the upper bound $\eta = \frac{2}{\theta^2}$ into this condition (i.e., $\eta > \sqrt{\frac{64}{27\theta^3}}$) yields $27 > 16\theta$

Concerning the second part, recall that the equilibrium is sequentially efficient, hence, the principal's maximization problem is equivalent to maximizing $\pi_t = e_t^*\theta - b_t^* - w_t$ in every period t, subject to the (DE) constraint $(e_t^*)^3/3 - \eta w_t\theta e_t^* \leq \delta\left(\Pi_{t+1} - \tilde{\Pi}_{t+1}\right) - \frac{2}{3}\left(\sqrt{\eta w_t\theta}\right)^3$. Defining $\Delta_t \equiv \Pi_t - \tilde{\Pi}_t$, implementable effort in period t is ceteris paribus strictly increasing in Δ_{t+1}, whereas per-period profits π_t are consequently weakly increasing in Δ_{t+1}. Furthermore, per-period profits in periods $t < T$ can solely be expressed as functions of Δ_{t+1}, i.e. $\pi_t(\Delta_{t+1})$, with $\pi_t' \geq 0$.

The profit-maximizing spot reciprocity contract is the principal's optimal choice in the last period T, hence $\pi_T = \Pi_T = \eta\theta^3/4$. In all previous periods, the principal still has the option to implement the spot reciprocity contract (by setting $b_t^* = 0$ and $w_t = \eta\theta^3/4$), therefore $\pi_t \geq \pi_T \,\forall t$. In addition, off-path profits are determined by a bonus spot contract, hence $\tilde{\pi} = \frac{2\theta}{3\sqrt{\frac{\theta}{3}}}$ in every period.

Now, we can apply proof by induction to verify that $\Delta_{t-1} > \Delta_t$. We start with the last periods in order to show that $\Delta_{T-1} > \Delta_T$:

$$\Delta_{T-1} = \pi_{T-1} - \tilde{\pi} + \delta\Delta_T \geq \pi_T - \tilde{\pi} + \delta\Delta_T = \Delta_T(1+\delta) > \Delta_T.$$

Now, assume that $\Delta_t > \Delta_{t+1}$. Since $\pi_t'(\Delta_{t+1}) \geq 0$, $\pi_{t-1} \geq \pi_t$. Therefore, $\Delta_{t-1} = \pi_{t-1} - \tilde{\pi} + \delta\Delta_t \geq \pi_t - \tilde{\pi} + \delta\Delta_t > \pi_t - \tilde{\pi} + \delta\Delta_{t+1} = \Delta_t$, which completes the proof. □

Proof. [Proof of Proposition 1.] In Lemmas 2 and 3, we established that $w_t = \frac{\left(\eta^2\theta^3\left(1+\lambda_{DE_t}\right)-1\right)^2}{4\eta^3\theta^3\left(1+\lambda_{DE_t}\right)^2}$ and $e_t^* = \frac{1+\eta^2\theta^3\left(1+\lambda_{DE_t}\right)}{2\eta\theta\left(1+\lambda_{DE_t}\right)}$, where λ_{DE_t} is the Lagrange parameter associated with the (DE) constraint in period t. Hence, $w_t = w_{t-1}$ and $e_t^* = e_{t-1}$ if $\lambda_{DE_t} = \lambda_{DE_{t-1}} = 0$. By Lemma 3, if $\lambda_{DE_{t-1}} = 0$ but $\lambda_{DE_t} > 0$, then $w_t > w_{t-1}$ and $e_t^* < e_{t-1}$. Finally, assume that $\lambda_{DE_{t-1}} > 0$. First, we show that in this case also $\lambda_{DE_t} > 0$: Plugging $w_{t-1} = \frac{\left(\eta^2\theta^3\left(1+\lambda_{DE_{t-1}}\right)-1\right)^2}{4\eta^3\theta^3\left(1+\lambda_{DE_{t-1}}\right)^2}$ and $e_{t-1}^* = \frac{1+\eta^2\theta^3\left(1+\lambda_{DE_{t-1}}\right)}{2\eta\theta\left(1+\lambda_{DE_{t-1}}\right)}$ into the binding (DE) constraint for period $t-1$ yields

$$\frac{3\eta^2\theta^3\left(1+\lambda_{DE_{t-1}}\right)-1}{6\eta^3\theta^3\left(1+\lambda_{DE_{t-1}}\right)^3}=\delta\left(\Pi_t-\tilde{\Pi}_t\right).$$

By the implicit function theorem, $\frac{d\lambda_{DE_{t-1}}}{d\left(\Pi_t-\tilde{\Pi}_t\right)}=\frac{2\delta\eta^3\theta^3\left(1+\lambda_{DE_{t-1}}\right)^4}{1-2\eta^2\theta^3\left(1+\lambda_{DE_{t-1}}\right)}<0$ (since $\eta>\overline{\eta}$ implies $\eta^2\theta^3>1$). Hence, Lemma 4 yields $\lambda_{DE_{t-1}}<\lambda_{DE_t}$, which implies $\lambda_{DE_{t-1}}>0\Rightarrow\lambda_{DE_t}>0$. Furthermore, if $\lambda_{DE_t}=0$ in a period t, this also holds for all previous periods.

The wage schedule is increasing in periods $t<T$ since $\frac{\partial w_t}{\partial\lambda_{DE_t}}=\frac{\left(\eta^2\theta^3\left(1+\lambda_{DE_t}\right)-1\right)}{2\eta^3\theta^3\left(1+\lambda_{DE_t}\right)^3}>0$, whereas the effort path is decreasing because of $\frac{\partial e_t^*}{\partial\lambda_{DE_t}}=\frac{-1}{2\eta\theta\left(1+\lambda_{DE_t}\right)^2}<0$. Finally, wage and effort in period T are $e_T^*=\frac{\eta\theta^2}{2}$ and $w_T=\frac{\eta\theta^3}{4}$, respectively. $e_T^*<e_t^*$ for all $t<T$ follows from $\frac{\eta\theta^2}{2}<\frac{1+\eta^2\theta^3\left(1+\lambda_{DE_t}\right)}{2\eta\theta\left(1+\lambda_{DE_t}\right)}$ $\left(\Leftrightarrow\eta^2\theta^3\left(1+\lambda_{DE_t}\right)<1+\eta^2\theta^3\left(1+\lambda_{DE_t}\right)\right)$. $w_T>w_t$ for all $t<T$ follows from $\frac{\eta\theta^3}{4}>\frac{\left(\eta^2\theta^3\left(1+\lambda_{DE_t}\right)-1\right)^2}{4\eta^3\theta^3\left(1+\lambda_{DE_t}\right)^2}$ $\left(\Leftrightarrow 2\eta^2\theta^3\left(1+\lambda_{DE_t}\right)>1\right)$, which completes the proof. □

Proof. [Proof of Prediction 4.]

An agent's utility in a period $t<T$ is

$$u_t=w_t+b_t-\frac{e_t^3}{3}+\eta w_t e_t^*\theta$$
$$=\frac{\left(2+\lambda_{DE_t}\right)+3\eta^4\theta^6\left(1+\lambda_{DE_t}\right)^3-3\eta^4\theta^6\left(1+\lambda_{DE_t}\right)^2+\eta^6\theta^9\left(1+\lambda_{DE_t}\right)^3-3\eta^2\theta^3\left(1+\lambda_{DE_t}\right)}{12\eta^3\theta^3\left(1+\lambda_{DE_t}\right)^3}$$

$\frac{\partial u_t}{\partial\eta}=\frac{3\eta^4\theta^6(1+\lambda_{DEt})^2\lambda_{DEt}+3\left(\eta^6\theta^9(1+\lambda_{DEt})^3-1\right)+3(1+\lambda_{DEt})\left(\eta^2\theta^3-1\right)}{12\eta^4\theta^3(1+\lambda_{DEt})^3}>0$ yields that more reciprocal agents are more satisfied with their jobs.

$\frac{\partial u_t}{\partial\lambda_{DEt}}=\frac{3\left(\eta^4\theta^6(1+\lambda_{DEt})^2-1\right)+2(1+\lambda_{DEt})\left(3\eta^2\theta^3-1\right)}{12\eta^3\theta^3(1+\lambda_{DEt})^4}>0$ (because $\eta>\overline{\eta}$ implies $\eta^2\theta^3>1$) yields that job satisfaction increases over time. Concerning the last period T, recall that in a spot reciprocity contract, $u=\frac{\eta\theta^3}{4}+\frac{\eta^3\theta^6}{12}$.

This is larger than the utility in previous periods if

$$\left(1+\lambda_{DEt}\right)\left(3\eta^2\theta^3-1\right)>1-3\eta^4\theta^6\left(1+\lambda_{DEt}\right)^2$$

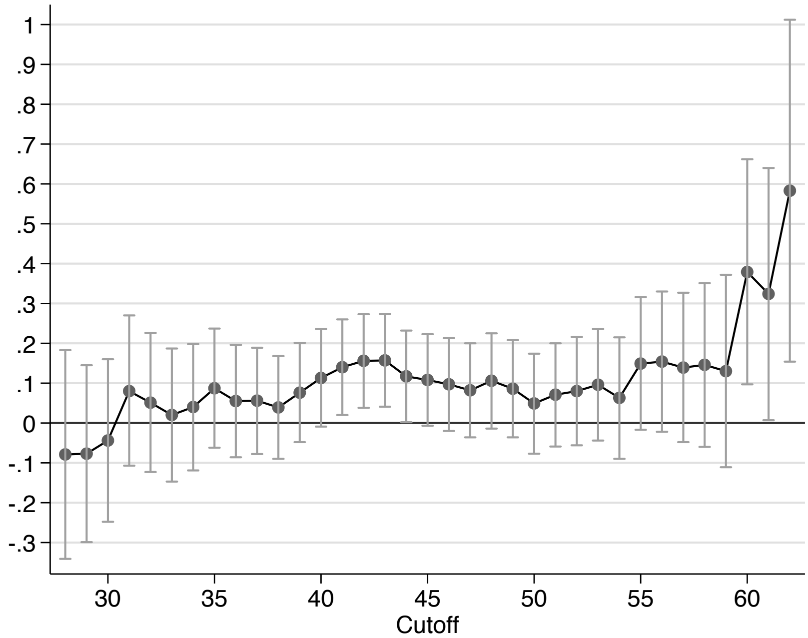
which always holds.

$\frac{\partial^2 u_t}{\partial\lambda_{DEt}\partial\eta}=\frac{(1+\lambda_{DEt})\left(\eta^2\theta^3-1\right)^2+\eta^4\theta^6(1+\lambda_{DEt})\lambda_{DEt}+(4+\lambda_{DEt})}{4\eta^4\theta^3(1+\lambda_{DEt})^4}>0$ yields that the positive effect of reciprocity on job satisfaction increases over time.

□

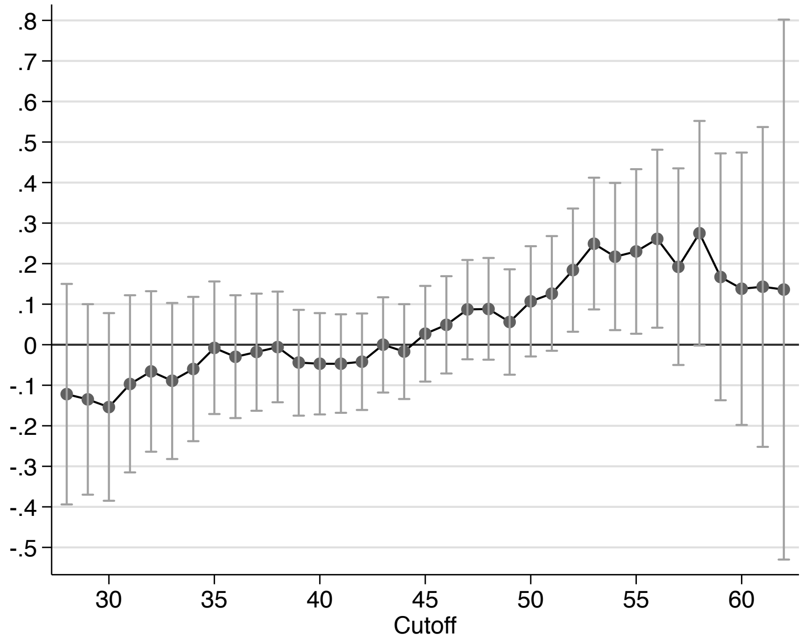
Figures and Tables

Figure 6: Interaction coefficients in overtime regressions for varying age cutoffs



Notes: The figure plots coefficient estimates of the interaction between positive reciprocity and being at least the threshold value of years old. Error bars indicate 95% confidence intervals.

Figure 7: Interaction coefficients in satisfaction regressions for varying age cutoffs



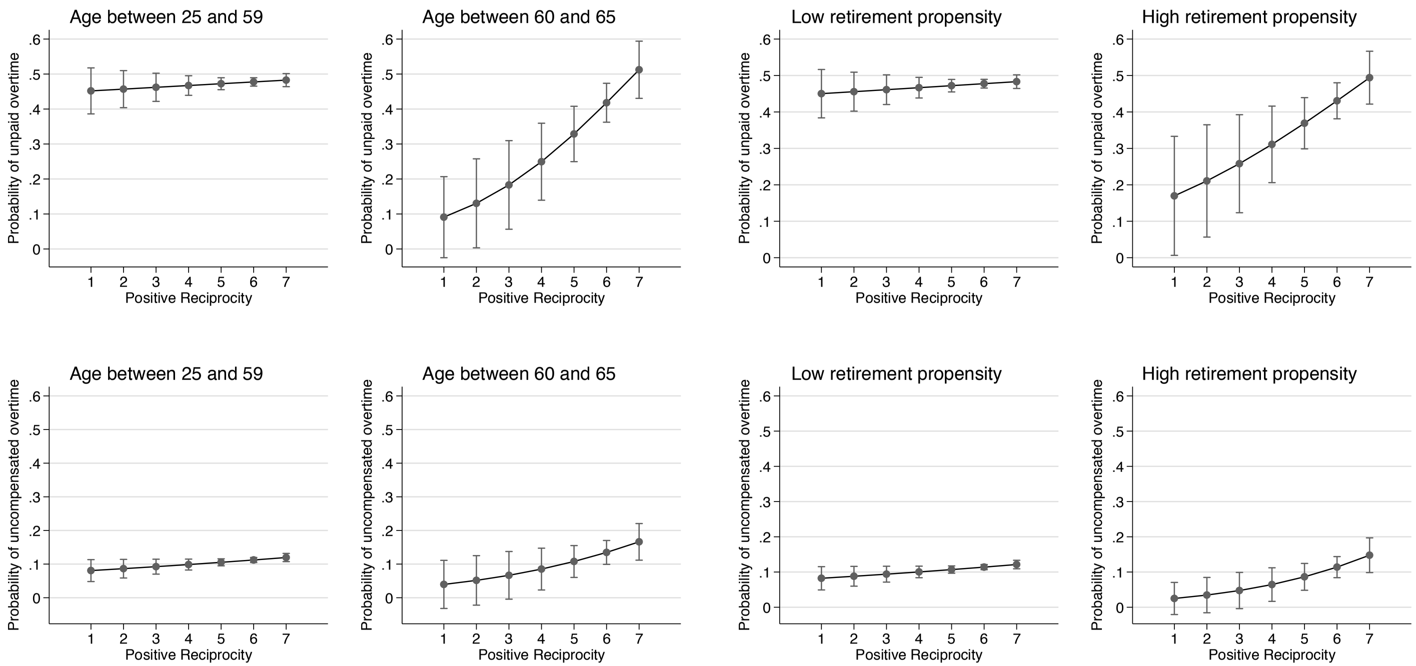
Notes: The figure plots coefficient estimates of the interaction between positive reciprocity and being at least the threshold value of years old. Error bars indicate 95% confidence intervals.

Table 3: Effect of reciprocity on unpaid overtime by age and likelihood of retirement

	DV: Unpaid Overtime			DV: Uncompensated Overtime		
	(1)	(2)	(3)	(4)	(5)	(6)
	Overall	Age cutoff	Retirement propensity	Overall	Age cutoff	Retirement propensity
Positive reciprocity	0.00879	0.00973	0.00883	0.00507**	0.00494*	0.00504**
	(0.00652)	(0.00653)	(0.00652)	(0.00246)	(0.00253)	(0.00246)
Age (in years)	-0.00744***			0.000507		
	(0.00171)			(0.000712)		
Age_cutoff = 1		-0.0749**			0.0145	
		(0.0328)			(0.0142)	
1.Age_cutoff # Reciprocity		0.0861***			0.0144	
		(0.0316)			(0.0122)	
Retire = 1			-0.0580**			-0.0348
			(0.0292)			(0.188)
1.Retire # Reciprocity			0.0566**			0.00137
			(0.0276)			(0.0104)
Pseudo R^2	0.0794	0.0786	0.0782	0.1824	0.1829	0.1826
Observations	7,019	7,019	7,019	7,019	7,019	7,019

Notes: Estimations are based on the 2005 survey wave of the SOEP. Robust standard errors in parentheses clustered at household level. Table reports marginal effects at means after logit regressions with marginal effects for interactions reflecting the difference in slope for reciprocity between the groups. Reciprocity measure standardized. Controls include years of education, gender, years of full time and part time work experience (linear and squared terms), a dummy for part-time employment, job tenure in current position (linear and squared), indicator variables for industry sector (services, agriculture, energy or mining, manufacturing, construction, trade, transport, bank or insurance) and firm size (less than 100, 100-199, 200-1999, more than 2000 employees), and an indicator variable for occupation status (white collar, blue collar, public sector). *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure 8: Predicted marginal effects for unpaid and uncompensated overtime



Notes: The figure plots predicted average marginal changes of the propensity to work unpaid (upper panel) and uncompensated overtime (lower panel) at different levels of positive reciprocity depending on age group and a high vs. low propensity to retire within the next two years. Estimations are based on the 2005 survey wave of the SOEP. Error bars indicate 95% confidence intervals.

Table 4: Effect of reciprocity on overtime hours by age and likelihood of retirement

	DV: Total Hours			DV: Unpaid Hours		
	(1)	(2)	(3)	(4)	(5)	(6)
	Overall	Age cutoff	Retirement propensity	Overall	Age cutoff	Retirement propensity
Positive reciprocity	0.0973***	0.0871***	0.0898***	0.0637**	0.0536**	0.0553**
	(0.0205)	(0.0207)	(0.0206)	(0.0248)	(0.0252)	(0.0252)
Age (in years)	-0.0178***			-0.0188***		
	(0.00568)			(0.00695)		
Age_cutoff = 1		-0.245**			–0.327**	
		(0.116)			(0.130)	
1.Age_cutoff # Reciprocity		0.283**			0.306**	
		(0.119)			(0.125)	
Retire = 1			-0.246**			-0.281**
			(0.107)			(0.116)
1.Retire # Reciprocity			0.157			0.224*
			(0.106)			(0.115)
Pseudo R^2	0.0111	0.0110	0.0110	0.0132	0.0133	0.0133
Observations	6,976	6,976	6,976	6,864	6,864	6,864

Notes: Estimations are based on the 2005 survey wave of the SOEP. Robust standard errors in parentheses clustered at household level. Table reports coefficients of negative binomial regressions. Reciprocity measure standardized. Controls include years of education, gender, years of full time and part time work experience (linear and squared terms), a dummy for part-time employment, job tenure in current position (linear and squared), indicator variables for industry sector (services, agriculture, energy or mining, manufacturing, construction, trade, transport, bank or insurance) and firm size (less than 100, 100-199, 200-1999, more than 2000 employees), and an indicator variable for occupation status (white collar, blue collar, public sector). *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Effect of reciprocity on overtime by age and likelihood of retirement (2005, 2010, and 2015)

DV: Overtime (Y/N)	(1) Overall	(2) Age cutoff = 60	(3) Age cutoff = 55	(4) RE: Overall	(5) RE: Age cutoff = 60	(6) RE: Age cutoff = 55
Positive reciprocity	0.00852**	0.00850**	0.00859**	0.00802**	0.00794**	0.00812**
	(0.00348)	(0.00349)	(0.00349)	(0.00330)	(0.00330)	(0.00330)
Age (in years)	-0.00284***			-0.00267**		
	(0.00108)			(0.00105)		
age_cutoff = 1		-0.0808***	-0.0219		-0.0776***	-0.0184
		(0.0178)	(0.0137)		(0.0175)	(0.0134)
1.age_cutoff#c.posrec		0.0149	0.0156*		0.00821	0.0108
		(0.0136)	(0.00870)		(0.0130)	(0.00824)
Observations	25,653	25,653	25,653	25,653	25,653	25,653
Groups				18,128	18,128	18,128

Notes: Estimations are based on the 2005, 2010, and 2015 survey waves of the SOEP. Robust standard errors in parentheses clustered at household level. Table reports marginal effects at the mean of pooled logit regressions in columns (1) and (2) and coefficents of RE logit estimations in columns (3) and (4). Controls include years of education, gender, years of full time and part time work experience (linear and squared terms), a dummy for part-time employment, job tenure in current position (linear and squared), indicator variables for industry sector (services, agriculture, energy or mining, manufacturing, construction, trade, transport, bank or insurance) and firm size (less than 100, 100-199, 200-1999, more than 2000 employees), an indicator variable for occupation status (white collar, blue collar, public sector), and indicator variables for birth years. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 6: Effect of reciprocity on overtime hours by age and likelihood of retirement (2005, 2010, and 2015)

	DV: Total Hours			DV: Unpaid Hours		
	(1)	(2)	(3)	(4)	(5)	(6)
	Overall	Age cutoff = 60	Age cutoff = 55	Overall	Age cutoff = 60	Age cutoff = 55
Positive reciprocity	0.147***	0.136***	0.122***	0.110***	0.0986***	0.0797**
	(0.0248)	(0.0249)	(0.0264)	(0.0297)	(0.0300)	(0.0323)
Age (in years)	-0.0515***			-0.0530***		
	(0.00706)			(0.00855)		
Age_cutoff = 1		-0.645***	-0.542***		-0.739***	-0.507***
		(0.130)	(0.0974)		(0.142)	(0.110)
1.Age_cutoff # Reciprocity		0.359***	0.188***		0.404***	0.218***
		(0.128)	(0.0701)		(0.133)	(0.0764)
Pseudo R^2	0.0149	0.0143	0.0143	0.0170	0.0165	0.0164
Observations	15,883	15,883	15,883	15,771	15,771	15,771

Notes: Estimations are based on the 2005, 2010, and 2015 survey waves of the SOEP. Robust standard errors in parentheses clustered at household level. Table reports coefficients of negative binomial regressions. Reciprocity measure standardized. Controls include years of education, gender, years of full time and part time work experience (linear and squared terms), a dummy for part-time employment, job tenure in current position (linear and squared), indicator variables for industry sector (services, agriculture, energy or mining, manufacturing, construction, trade, transport, bank or insurance) and firm size (less than 100, 100-199, 200-1999, more than 2000 employees), and an indicator variable for occupation status (white collar, blue collar, public sector). *** p<0.01, ** p<0.05, * p<0.1.