Output, Welfare, and Incentives in Economies with Other-Regarding Preferences

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Abstract

We analyze a model economy populated by workers who care about their own income and wealth but also regard their position relative to the economy’s average values of these variables. Furthermore, these workers differ in their initial wealth. Poor workers are inferiority-averse while rich workers may be superiority-averse or -seeking. We investigate the role of these features on incentive contracts, welfare, and output. Unlike former agency models with inequity aversion, we find that increasing inferiority aversion tends to raise effort and reduce wage costs. The same holds also for superiority seeking workers. By contrast, raising superiority aversion lowers effort and increases wage costs. A parameterized version of the model which roughly mimics some key features of the industrialized world shows that, even under inequality aversion, increased initial wealth differences lead to higher average output, entail distributional utility losses, and result in a worse income distribution.

JEL Classifications: D31, D50, D63, D82, M52, M54

Keywords: other-regarding preferences, inequality, inequality aversion, superiority seeking, general equilibrium, incentives

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1 Introduction

The publications of Piketty (2014) and the Handbook of Income Distribution by Atkinson and Bourguignon (2015) have generated enormous interest in issues related to wealth and income distribution.\(^1\) Beyond the social unrest and political consequences that are naturally associated with increasing inequality, there is also concern about the negative impact inequality may have on aggregate economic outcomes (see, e.g., Atkinson and Bourguignon (2015) or Cingano (2014)). A related aspect concerns the dependence of individual wellbeing on income and wealth distributions and on a person’s relative position within these distributions (see, e.g., Clark, Frijters, and Shields (2008) and Clark and D’Ambrosio (2015)). While the existing macroeconomic literature typically analyzes the dynamics of income inequality through the lens of skill-biased technological change,\(^2\) the current paper focuses solely on the presence of societal considerations in individual preferences and their possible impact on economic performance.

For this purpose, we develop a static single-good general equilibrium model. In the economy, profit-maximizing firms operate a technology requiring only labor as an input, where employment relationships are subject to moral hazard. The economy is populated by workers who differ only in their initial wealth. These workers care about their own income and wealth but also regard their position relative to the economy’s average values of these variables (see, e.g., Clark and D’Ambrosio (2015)). Specifically, workers whose income and wealth fall short of the economy’s average are inferiority averse, i.e., they incur disutility due to envy. However, workers who are above average may be either superiority averse or superiority seeking.\(^3\) In the first case, they too incur disutility due to empathy, in which case they are “inequality averse”. By contrast, when they are superiority seeking and enjoy their advantage, they are “competitive”. In line with the literature on agency relationships with other-regarding preferences (see, e.g., Fehr and Schmidt (1999)), the attitude towards inequality is asymmetric. Specifically, a given income difference has a stronger utility effect on workers below the societal average (the “poor”) than on those above that average (the “rich”). It is important to note that, in our model, workers consider their standing in the societal income and wealth distribution regardless of their employment status. This adds an additional behavioral aspect to becoming unemployed.

The moral-hazard environment implies that, in addition a fixed wage, employment contracts stipulate an incentive payment when an effort-related signal is detected by the employer. Due to the aforementioned structure of the preferences, these contracts depend on the economy’s average income, which in turn is generated by the very same contracts. In equilibrium, both must coincide.

We derive some theoretical results that characterize the optimal incentive contracts and partial-equilibrium impacts of variations in the intensity and type of the other-regarding preference on these contracts. For instance, we find that, in addition to the well-established impact of

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\(^1\)See also the World Inequality Report 2018 at https://wir2018.wid.world.

\(^2\)See, e.g., Bental and Demougin (2018) and the literature therein.

\(^3\)Evidence indicates that people have a distaste for earning less than others whereas the results concerning earning more are inconclusive and context-dependent (see, e.g., Loewenstein, Thompson, and Bazerman (1989), Lu and Scheve (2016), and Card, Mas, Moretti, and Saez (2012)). In our study, we hence allow for both attitudes towards advantageous inequality and investigate whether these attitudes lead to significantly different results.
the incentive pay, also the fixed wage affects effort. This result follows, because the standing of
an individual relative to the societal average depends on both the fixed and the incentive part
of his wage, thereby affecting the other-regarding part of the preferences. However, due to the
model’s complexity, the general equilibrium is analyzed using a parameterized environment. The
parameters are chosen to roughly mimic some key features of industrialized economies regarding
the labor share, wealth distribution, and the ratio between wealth and income. We conduct
numerical experiments in which we vary the wealth distribution. We also vary the intensity and
type of the workers’ other-regarding preference given the evidence that societies may differ in
their attitudes towards inequality (see, e.g., Lü and Scheve (2016), Osberg and Smeeding (2006),
and the Figures in Appendix B summarizing relevant findings of the European Social Survey
(2016)).

We find that envy strengthens incentives while empathy reduces them, which is in line with
former agency models with inequity aversion. In our model, these effects manifest themselves
when comparing an economy with an equitable initial wealth distribution to one with an ine-
quitable distribution with the same average wealth. It turns out that inequality in the initial
wealth distribution makes it easier (cheaper) to incentivize the poor workers. In fact, because
of the disadvantageous social standing, they are induced to exert more effort than that induced
under equitable wealth distribution for a lower bonus. By contrast, the rich inequality averse
workers reduce their effort relative to that of the equitable economy, but nevertheless obtain
a higher bonus. As a result, the expected wage income of the rich is higher than that of the
poor. Thus, despite the empathy arising from the preference structure, ex post the wealth and
income distribution becomes even less equitable. On the other hand, since the number of the
poor outweighs that of the rich, output in the inequitable economy is higher than that of the
equitable one. Naturally, net of wealth, wealth inequality causes both the poor and the rich to
incur utility losses. However, for the rich these are not sufficient to outweigh the direct utility
obtained from their higher wealth. It worth noting that, in our model, inequality aversion may
be beneficial for the firm when the initial wealth distribution is inequitable. This is in contrast to
most of the agency literature, where employing inequality averse workers typically raises agency
costs and hence lowers expected profits.\footnote{Compare the literature cited below. Exceptions are settings with relational contracts (e.g., Kragl and Schmid
(2009)) or with limited liability on the agents’ side (Demougin and Fluet (2003)), where the incentive effect of envy may lead to overall reduced agency cost.}

In the competitive case, compared to the equitable wealth distribution both the poor and the
rich increase effort despite their lower expected wage, and consequently the economy’s output
increases. In this case too the rich earn more than the poor and moreover they also enjoy
the inequitable wealth distribution per se. Nevertheless, in a utilitarian sense, raising wealth
inequality reduces welfare. For both economies populated by inequality averse or competitive
workers, as expected, increasing the intensity of the other-regarding preference increases the
foregoing effects. Surprisingly, the difference between the equilibrium wages of the rich and
the poor is larger with inequality aversion compared to competitive preferences. That is, in
our model, the presence of societal other-regarding preferences does not entail a more even
This paper is related to the literature on agency relationships with other-regarding preferences. That literature provides empirical evidence from the lab and the field suggesting that workers not only care about their absolute but also about their relative economic position (see, e.g., Goranson and Berkowitz (1966), Berg, Dickhaut, and McCabe (1995), Fehr, Kirchsteiger, and Riedl (1998), Fehr and Schmidt (1999), or Charness and Rabin (2002)). The foregoing studies have clear implications for standard incentive theory, since incentive pay is an important source of inequality. Much of the ensuing work has focused on envy among co-workers or inequity aversion as proposed by Fehr and Schmidt (1999). In these environments, the workers’ social preferences generally come at a cost for the principal because workers need to be compensated for the expected disutility from payoff inequity. Typically, the focus is on agency relationships within firms, where workers compare their income with that of co-workers or their boss. In contrast, we investigate the effect of other-regarding preferences at the societal rather than the firm context. While maintaining the well-known assumption that envy is the stronger emotion compared to empathy, in our preference specification, that asymmetry arises endogenously. In our context, this assumption also reflects the idea that a given income difference has a larger impact on a person whose wealth is low than it has on his rich peer. Another distinguishing feature of our model stems from the assumption that workers consider their social standing also regarding their outside option when unemployed. Intuitively, the workers’ reference point is always the societal average. This differs from the foregoing literature, where the peer’s pay is relevant only when working in the firm while the outside option is usually assumed to be fully exogenous.

The structure of the paper is as follows. Section 2 presents the various features of the model. Section 3 discusses the optimization problems of the players, defines the equilibrium, and discusses some general comparative-statics results. The parametric specification of the model and graphical presentations of its implications are the subject of section 4. Section 5 presents our numerical experiments and their results while Section 6 discusses the results and concludes.

## 2 The Model

We consider a static economy which is populated by a measure-one continuum of workers (agents) with identical preferences and an infinite countable number of firms. While all firms are identical, ex ante there are two types of workers, “rich” and “poor” denoted respectively by \( i = R, P \).

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5See Akerlof and Yellen (1990) for an overview of the extensive literature on the effects of relative pay comparisons that already existed by the early 1990s. A later overview of the experimental literature on other-regarding preferences is provided by, e.g., Camerer (2003) or Fehr and Schmidt (2006).


7In the remainder, we will use the male pronoun for the workers. Moreover, lower-case letters denote variables related to the principal-agent problem whereas upper-case letters stand for variables that are exogenous from the individual’s point of view and societal averages when no index is assigned.
who differ only in their initial, commonly known, wealth $W_i$, where $w_R > w_P$. The rich and the poor constitute, respectively, a fraction $\lambda_R$ and $\lambda_P$ of the worker population (where $\lambda_R + \lambda_P = 1$). Accordingly, the weighted average wealth is given by:\(^8\)

$$ W = \sum_{i=R,P} \lambda_i w_i $$ (1)

Workers are randomly matched with firms so that the composition of the workforce employed by every firm is representative. Ownership over the firms is uniformly distributed among all workers.

### 2.1 Preferences

All parties are risk neutral. Firms care only about expected profit while workers maximize their personal expected utility as explained in the following.

Workers may be either employed or unemployed. Employed workers incur an increasing and convex cost $c(e)$ of exerting non-verifiable work effort $e$ with $c(0) = 0$ and receive a wage income $y$. Unemployed workers obtain a benefit $u$. In addition, all workers get the average (per-worker) profit $\Pi$. Let $\omega(y, u) = y + u + w + \Pi$ denote a generic worker’s total ex-post wealth (with $y = 0$ for the unemployed and $u = 0$ for the employed). In addition, workers observe the average ex-ante societal wealth $W$ and wage income $Y$. We denote by $\Omega = Y + W + \Pi$ the societal average ex-post wealth.

Workers’ utility depends not only on their own income and wealth but also on their relative position in the respective societal distribution. In particular, they care about economic inequality by taking into account deviations of $\omega$ from the societal mean $\Omega$.\(^9\) Notice that the foregoing holds regardless of whether a worker is employed or unemployed. Altogether, the ex-post utility of a generic worker is given by:

$$ U(e, \omega, \Omega) = \begin{cases} 
\omega(0, u) - \gamma f(\omega(0, u), \Omega) & \text{if unemployed} \\
\omega(y, 0) - c(e) - \gamma f(\omega(y, 0), \Omega) & \text{if employed} 
\end{cases} $$ (2)

where $\gamma \geq 0$ measures the weight of the worker’s valuation of his relative position in the societal ex-post wealth distribution, henceforth the “intensity parameter”.

There are two types of possible states of inequality. We speak of advantageous inequality when, ex post, a worker’s total wealth exceeds the societal average wealth and of disadvantageous inequality when his total wealth falls short of the societal average wealth.

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\(^8\)In the sequel, we will use the term "average" for all expression of the form:

$$ X = \sum_{i=R,P} \lambda_i x_i $$

\(^9\)A common terminology in the literature refers to “inequity aversion” (Fehr and Schmidt (1999)). Mostly, in these settings, (income) inequity accords with inequality. However, since our workers are heterogenous in terms of wealth, the two notions do not necessarily coincide. Accordingly, in the sequel, we use the terms “inequality” and “inequality aversion".
It is worth noting that, also when unemployed, over and beyond the monetary benefit $u$, the workers are affected by a utility loss due to their social preference. Notice that this differs from most well-known agency models where the outside option is exogenously given. While the latter assumption is natural with purely self-regarding preferences, with other-regarding preferences, it implies that wage comparisons apply within the firm but become irrelevant when the worker is unemployed.

The inequality preference function $f(\cdot, \cdot)$ is defined over $\mathbb{R}^2_+$ and is assumed to be twice continuously differentiable. It may represent two different types of other-regarding preferences; (i) inequality aversion and (ii) what we call “competitiveness”. In case (i), workers dislike any deviation from the societal mean and hence suffer from both advantageous and disadvantageous inequality. Accordingly, these workers feel either envy or empathy. In case (ii), workers also suffer from disadvantageous inequality by feeling envy but derive positive utility from outperforming the average.\(^{10}\) In the sequel, wherever appropriate, we refer to workers who fall behind as inequality averse while workers who outperform are superiority averse in case (i) and superiority seeking in case (ii).\(^{11}\) Furthermore, we assume that, for a given deviation from the societal average, the absolute utility impact of falling behind exceeds that of forging ahead. Notice that, for case (i), the foregoing corresponds with the assumption in Fehr and Schmidt (1999) and subsequent work where envy is the stronger emotion as compared to empathy. Finally, we assume that, regardless of the attitudes towards inequality, the workers’ utility is strictly increasing in wage income and wealth.\(^{12}\)

For illustration, in the figure below we plot both types of inequality preference for the specification introduced in Section 4. Panel (a) represents case (i), hence inequality aversion, and panel (b) case (ii) of competitiveness.\(^{13}\) Each panel shows the disutility function $\gamma \cdot f(\cdot, \Omega)$ as a function of total income and wealth (henceforth, for simplicity, referred to only as ‘income’), $\omega$, and for two intensity parameters $\gamma$, where the higher value in red naturally implies a stronger impact of inequality.

Panel (a) shows that any deviation from the societal average wealth $\Omega$ (here at 12.5) leads to a utility loss and that an upward deviation of $\omega$ is less harmful than an equivalent downward deviation. While this endogenous feature is similar to the exogenous parametrization used by Fehr and Schmidt (1999), we differ by imposing a non-linear formulation. In particular, the figure shows that, for a given deviation, the marginal effect of reducing individual income is larger for the inferiority averse ($\omega < \Omega$) than that of increasing income of the superiority averse ($\omega > \Omega$). Moreover, workers feel envy at an increasing rate as they move further from the

\(^{10}\) That is, case (i) is similar to the preferences proposed by Fehr and Schmidt (1999). In the Fehr and Schmidt (1999)-model, case (ii) would necessitate specifying a positive propensity for envy ($\alpha > 0$) and a negative empathy parameter ($\beta < 0$).

\(^{11}\) We rule out $\gamma < 0$ for the following reasons. The inequality averse case (i) would then turn around, whereby people are both inferiority and superiority seeking. The competitive case (ii) would imply that people are inferiority seeking but superiority averse, i.e., become “ascetic” or “altruistic”. We do not believe that, at the societal level, either type of preference is relevant.

\(^{12}\) That is, we implicitly assume $\gamma$ to be sufficiently small to guarantee that superiority averse workers are not better off by simply burning money.

\(^{13}\) For the functional form and the parameters, see equation (10).
societal average and are initially increasingly empathetic. However, as income becomes very high, the marginal impact of empathy starts decreasing. Technically, the disutility function thus possesses an inflection point to the right of $\Omega$ (see Appendix A2).

For the competitive case in panel (b), people whose income falls short of the societal average incur a utility loss due to envy while those above the average are increasingly happier. At the societal average $\Omega$, the disutility function has a saddle point. Accordingly, competitive individuals become increasingly happy when outperforming the societal average. These attitudes mollify when total income becomes sufficiently large and their marginal utility from becoming even richer starts decreasing. That is, at some point (not shown), the disutility function has another inflection point.

Formally, in general, we formalize case (i) by Assumption 1.

**Assumption 1** To represent inequality aversion, the function $\gamma \cdot f(\omega, \Omega)$ for any $\omega \neq \Omega$; (ii) for $\omega \in (0, \Omega)$, $f_\omega (\omega, \Omega) < 0$ and $f_{\omega \omega} (\omega, \Omega) > 0$; (iii) for $\omega \in (\Omega, \infty)$, $f_\omega (\omega, \Omega) > 0$, and (iv) $f(\Omega - d, \Omega) > f(\Omega + d, \Omega)$ for any $d \in (0, \Omega)$.

**Remark 1** Under Assumption 1, it must be the case that $f(\Omega, \Omega) = f_\omega (\Omega, \Omega) = 0$. Furthermore, there must exist an $\hat{\omega} \in (\Omega, \infty)$ such that $f_{\omega \omega} (\omega, \Omega) > 0$ for any $\omega \in (\Omega, \hat{\omega})$.

In case (ii), the function $f(\cdot, \cdot)$ is assumed to have the following properties.

**Assumption 2** Competitive attitudes are captured when (i) $f(\omega, \Omega) > 0$ for $\omega < \Omega$ and $f(\omega, \Omega) < 0$ for $\omega > \Omega$; (ii) for $\omega \in (0, \infty)$ $f_\omega (\omega, \Omega) < 0$; (iii) for $\omega \in (0, \Omega)$, $f_{\omega \omega} (\omega, \Omega) > 0$.

**Remark 2** Under Assumption 2, it must be the case that $f(\Omega, \Omega) = f_\omega (\Omega, \Omega) = 0$. Furthermore, there must exist an $\hat{\omega} \in (\Omega, \infty)$ such that $f_{\omega \omega} (\omega, \Omega) < 0$ for any $\omega \in (\Omega, \hat{\omega})$.

According to Assumption 2, Formally, we assume that if $\hat{\omega}$ is finite, $f_{\omega \omega} (\omega, \Omega) > 0$ for $\omega > \hat{\omega}$. This feature too is present in our specification below.

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Recall that the inequality term enters the workers’ utility function with a negative sign.
2.2 Production, Contracts, and Timing

Provided a worker becomes employed and exerts effort $e$, he produces output $v(e)$ with $v'(\cdot) > 0$, $v''(\cdot) < 0$. Both effort and the individual worker’s contribution to the firm’s output are non-verifiable. However, the worker’s effort stochastically determines a verifiable signal $\delta \in \{0, 1\}$ with $\Pr[\delta = 1|e] = p(e)$, where $p(e) \in [0, 1)$, $p(0) = 0$, $p'(\cdot) > 0$ and $p''(\cdot) \leq 0$. This signal is used by the employer to align incentives.

The timing is as follows. (i) Workers are randomly matched with firms. (ii) Each firm observes every worker’s type $i = R, P$ and offers a corresponding take-it-or-leave-it employment contract $(s_i, b_i)$, whereby $s_i$ is a fixed salary and $b_i$ a bonus to be paid if $\delta_i = 1$. (iii) The worker decides whether to accept the contract or reject it. (iv) If the worker accepts, he chooses effort $e_i$. (v) The performance signal $\delta_i$ is realized, and payments are made. Specifically, the worker obtains wage income $y_i = s_i + \delta_i b_i$ and the firm gains the worker’s net contribution to profit $\pi_i = v(e_i) - y_i$. (vi) Finally, total profits are evenly distributed among all workers (including the unemployed).

3 Optimization Problems and Equilibrium

In this section, we present the workers’ and the firms’ optimization problems, generating the optimal type-dependent contracts, the corresponding effort levels and firm profits. Then we define the equilibrium arising from the interaction between the workers’ and the firms’ decisions and the economy-wide characteristics they generate.

3.1 The Workers’ Problem

Provided that the worker has accepted the contract $(s_i, b_i)$ and for given average levels of income, wealth and profits $(Y, W, \Pi)$, an employed worker of type $i$ chooses effort $e_i$ to maximize his expected utility:

$$ e_i = \arg \max_{\hat{e}_i} \left\{ \begin{array}{l} s_i + p(\hat{e}_i) b_i + \Pi + W_i - c(\hat{e}_i) \\ - \gamma [p(\hat{e}_i) f (s_i + b_i + \Pi, Y + W + \Pi)] \\ - \gamma [(1 - p(\hat{e}_i)) f (s_i + W_i + \Pi, Y + W + \Pi)] \end{array} \right\} $$

(3)

The first line of equation (3) represents the contribution to expected utility associated with wage income, profit share, and initial wealth net of effort costs. The next two lines, in the sequel called “inequality term”, show that, in evaluating the (dis)utility from inequality, the worker considers both possible ex-post relative wealth positions ($\delta = 0, 1$). In particular, the second line represents the case when a bonus is paid whereas, in the third line, no bonus is paid. Assuming that the worker calculates the expected value of the (dis)utilities, he weighs the two cases by the associated probabilities.
The incentive constraint is given by:

\[ 0 = p'(e_i)b_i - c'(e_i) - \gamma p'(e_i)f (s_i + b_i + W_i + \Pi, Y + W + \Pi) + \gamma p'(e_i)f (s_i + W_i + \Pi, Y + W + \Pi) \]  

\( (IC) \)

The first line in equation \((IC)\) coincides with the incentive constraint in moral-hazard settings with purely selfish preferences. The next two lines emerge from the worker’s other-regarding preferences. Notice that the fixed salary \(s_i\) appears in the worker’s marginal inequality premium. This implies that, apart from the bonus, also the fixed pay has an impact on the worker’s optimal effort choice. However, the total effect of the marginal inequality premium on the constraint is generally ambiguous; for all inferiority averse workers, the terms in the second and third lines have opposite signs. The only unambiguous case arises for superiority seeking workers, where the marginal inequality term has negative effect on the constraint.

Formally, holding effort fixed, condition \((IC)\) also implies that, for \(\gamma > 0\), \(\frac{\partial s_i}{\partial b_i}\) is never nil (see Lemma A1 in the Appendix). Moreover, the combination of \(\{b_i, s_i\}\) needed to induce a given level of effort depends on the workers’ intensity parameter \(\gamma\), as indicated by \(\frac{\partial s_i}{\partial \gamma}, \frac{\partial b_i}{\partial \gamma} \neq 0\) (see Lemmata A2 - A3 in the Appendix). We will further elaborate on the consequences of these features using our specification in Section 4.3.

The participation constraint guarantees that a worker chooses to become employed:

\[ s_i + p(\hat{e}_i)b_i - c(\hat{e}_i) - \gamma[p(\hat{e}_i)f (s_i + b_i + W_i + \Pi, Y + W + \Pi)] - \gamma((1 - p(\hat{e}_i))f (s_i + W_i + \Pi, Y + W + \Pi)] \geq u - \gamma f (u + W_i + \Pi, Y + W + \Pi) \]  

\( (PC) \)

The above condition ensures that the worker is at least as well off by accepting the contract compared to rejecting it obtaining his outside option when becoming unemployed (fourth line). As mentioned above, whether employed or unemployed, the worker incurs an inequality premium. We denote by \(I_i\) the worker’s expected inequality premium when employed, hence the expected value of the inequality preference function (second and third lines). Note that we do not impose any financial constraints on workers. However, as argued in the next subsection, this becomes innocuous because condition \((PC)\) turns out to be binding.

Given the foregoing remark, the variables \((s_i, b_i, \gamma)\) are interdependent also in the \((PC)\) for a given level of effort. In particular, Lemma A4 in the Appendix shows the impact of the marginal inequality premium on \(\frac{\partial s_i}{\partial b_i}\). Moreover, similar to condition \((IC)\), both wage components \(b_i, s_i\) needed to induce participation depend on the workers’ intensity parameter \(\gamma\)

\[ 15 \text{ This arises because workers take the reference point as given. Consequently, the individual fixed payment cannot cancel out.} \]

\[ 16 \text{ Table 3 in the Appendix summarizes the results of Lemmas A1 - A10 in the corresponding order of the lemmas.} \]

\[ 17 \text{ Notice that the term } \Pi + W_i \text{ appears on both sides of the inequality and is hence not shown.} \]
(see Lemmas A5 - A6 in the Appendix). These lemmas also show that the impact of $\gamma$ depends on the interrelationship between $\gamma$ and the benefit $u$ due to their opposite effects on the workers’ outside option. These effects will also be further discussed in Section 4.3.

### 3.2 The Firms’ Problem

Firms also take $(Y, W, II)$ as given. For each worker of type $i = R, P$, they design a take-it-or-leave-it employment contract $(s_i, b_i)$ so as to maximize expected profit

$$
\pi_i = \max_{s_i, b_i, e_i} v(e_i) - s_i - p(e_i)b_i
$$

s.t. $(PC)$,

where $e_i$ satisfies the workers’ incentive constraint $(IC)$. Denote by $(s_i^*, b_i^*, e_i^*)$ the optimal incentive contracts that solves the firms’ problem in (4). At that contract, the participation constraint is always satisfied and the contract is accepted by the worker.\(^{18}\)

The solution of (4) obviously depends on whether condition $(PC)$ is binding. To elaborate on this, notice that, in the participation constraint, the fixed payment $s_i$ has the usual direct positive effect on the worker’s expected utility but, as noted above, also impacts the expected inequality premium. For the inferiority averse and the superiority seeking, increasing the fixed payment lowers that premium, thereby reinforcing the direct effect of $s_i$. By contrast, for the superiority averse, these two effects go in opposite directions, yet by Footnote 12, the direct effect outweighs the inequality consideration.

The foregoing impact of the fixed payment on the participation constraint is true for setups with purely selfish agents as well as for commonly used models with other-regarding preferences (see, e.g., Demougin and Fluet (2003), Grund and Sliwka (2005), Dur and Glazer (2008), Enghmaier and Wambach (2010), Krägel and Schmid (2009)). In all these models, the participation constraint obviously binds because the fixed salary constitutes only a cost to the firm. Notice however that, in our setup, this is not obvious.

To understand the intuition, note that the mechanism that determines the optimal incentive contracts in our model differs from that found in most principal-agent models. In these models, there typically is a recursive relationship between the optimal incentive pay and the optimal fixed wage. Specifically, given effort, the optimal incentive payment is determined by the incentive constraint while the corresponding fixed pay then follows from the participation constraint. By contrast, as explained in the foregoing subsection, the fixed salary affects both conditions $(IC)$ and $(PC)$. Consequently, whether the participation constraint is binding, depends on the interaction of $(IC)$ and $(PC)$ via the worker’s optimal effort choice.

As a first step, the following lemma proven in the Appendix analyzes the impact of the fixed salary on that effort along the $(IC)$.

\(^{18}\)In principle, profits may become negative in which case the firm would close shop and the worker would become unemployed. We ignore this case because, in our numerical experiments below, profits are always positive.
Lemma 1  Along the incentive constraint (IC), $\frac{\partial e}{\partial s} < 0$ for all persons with $\omega(s+b,0) < \Omega$, superiority averse persons with $\omega(s+b,0) < \hat{\omega}$, and superiority seeking persons with $\omega(s,0) > \hat{\omega}$. Further, $\frac{\partial e}{\partial s} > 0$ for superiority averse persons with $\omega(s,0) > \hat{\omega}$ and superiority seeking persons with $\omega(s+b,0) < \hat{\omega}$.

Intuitively, low-income workers suffer from envy and try to mitigate it by raising effort and earning the bonus. This is known as the incentive effect of envy and will be discussed in greater detail in Section 4.3. Accordingly, raising $s$ reduces such workers’ disutility under any circumstance, thereby lowering their incentive to exert effort. The same logic applies to all other cases where the inequity premium is convex, i.e., the superiority seeking with very high income and the superiority seeking with moderate income. In the remaining cases, the opposite is true.

The implication of Lemma 1 for the participation constraint follows immediately.

Proposition 1  For all workers with $\omega(s+b,0) < \Omega$, superiority averse workers with $\omega(s+b,0) < \hat{\omega}$ and superiority seeking workers with $\omega(s,0) > \hat{\omega}$, the participation constraint (PC) is binding.

This result obtains as, in the listed cases, the firm finds it beneficial to decrease the fixed salary both for its direct cost-saving effect and its incentive effect. The latter effect is not present for superiority seeking workers with intermediate levels of income as well as superiority averse workers with very high income. However, it is highly plausible that the participation constraint will also bind in these cases, as the marginal impact of the fixed wage on effort is likely to be too small to overturn its direct impact. This is also what we find in our numerical exercises below.

In the sequel, we hence focus on situations where the participation constraint binds.

The above is likely to have an important impact on the firm’s expected wage cost (and hence also the optimal contract). Given effort, to keep the participation constraint binding, the firm adjusts the worker’s expected wage according to the difference between the inequality premia when employed and unemployed. Specifically, provided that the unemployment benefit $u$ is sufficiently low, the firm benefits from the inferiority averse workers’ fear of being unemployed and the associated low societal standing. Similarly, superiority seeking workers experience an extra joy of being employed and hence also want to avoid unemployment, allowing the firm to reduce wage cost. These effects naturally become larger as the importance of the other-regarding preferences increases. The only exception are superiority averse workers who suffer relatively less from compassion when unemployed. The following summarizes this result.

Proposition 2  For sufficiently low levels of $u$, given a level of effort, an increased $\gamma$ reduces both the fixed wage and the bonus required to satisfy the participation constraint.

Proof. See Lemmata A5 and A6 in the Appendix.

Remark 3  The bound on $u$ listed in the Appendix is sufficient to yield the result. In our numerical experiment, $u$ has to implausibly exceed the expected wage in order to overturn it.

Note that the foregoing strongly differs from well-known agency models. There, as inequality aversion increases, workers become ever more expensive to employ because employers are forced
to compensate them for the increased inequity premium. Under reasonable circumstances, this is not true in our specification because the other-regarding preference is relevant also for assessing the disutility associated with the outside option.

Subject to Proposition 1, in the current setup, the optimal levels of incentive pay and fixed salary are jointly determined by the incentive and participation constraints. This implies that, in contrast to the literature cited above, the cost of inducing effort cannot be inferred solely from the participation constraint. Furthermore, the optimal effort is affected not only by the incentive pay but also by the fixed salary. We further discuss the optimal contract and its cost in conjunction with the graphical illustrations presented in Subsection 4.3 below, generated by a tractable model specification introduced in Section 4. In fact, it turns out that, in our specification, employing inferiority averse and superiority seeking workers is cheaper for the firm than hiring purely selfish workers.

3.3 Equilibrium

The various steps described above generate a feedback between the economy-wide characteristics that are taken as given by workers and firms and the underlying variables that both depend on and form these characteristics. In equilibrium, we require these relationships to be consistent. Formally, an equilibrium is thus defined as follows.

**Definition 3** Given \( W_R, W_P, \) and the corresponding \( W, \) a rational-expectations equilibrium consists of a tuple \((e_i, s_i, b_i, \pi_i, i = R, P)\) and a pair \((Y, \Pi)\) such that:

(i) Given \((Y, \Pi)\) and \((s_i, b_i)\), workers choose \(e_i\) by solving \((IC)\).

(ii) Given \((Y, \Pi)\), profit \(\pi_i\) obtains from \((4)\).

(iii) Average income is:

\[
Y = \sum_{i=R,P} \lambda_i (s_i + p(e_i)b_i)
\]

(iv) Per-worker profit is:

\[
\Pi = \sum_{i=R,P} \lambda_i \pi_i
\]

4 Model Specification

In this section, we specify a parametric environment in line with the underlying assumptions introduced above. This specification will be used in the numerical analysis presented in Section 5 below.
4.1 Production, Effort Costs, and Signal Generation

We assume that effort is restricted to the unit interval \((e \in [0, 1])\). Given effort \(e\), a worker’s individual contribution to output is:

\[
v(e) = \theta(e)^{\beta}, \quad \beta \in (0, 1), \theta > 0
\]  

(7)

A worker’s cost of effort is assumed to be:

\[
c(e) = -\ln(1 - e) - e
\]  

(8)

Note that the cost function is non-negative for any \(e > 0\) with \(\lim_{e \to 1} c(e) = \infty\) and an associated marginal effort cost of \(c'(e) = \frac{e}{1 - e}\).

Given effort \(e\), the probability that the firm detects a favorable signal is specified to be:

\[
Pr[\delta = 1|e] = e
\]  

(9)

4.2 Inequality Preferences

As explained above, workers care about their own income and wealth but also regard their economic standing relative to others. Well-known agency models with other-regarding preferences use absolute income differences to represent workers’ interpersonal comparisons. Since we are interested in the impact of other-regarding preferences in the context of an entire economy, we find it more plausible to assume that workers consider the societal income and wealth averages as reference points. Moreover, rather than a difference, they use as a measure of inequality the ratio between their own income and wealth and the corresponding societal averages (see Clark, Frijters, and Shields (2008)).

We implement Assumptions 1 and 2 by the following inequality preference function:

\[
f(\omega; \Omega) = \left(1 - \frac{\omega}{\Omega}\right)^{\alpha}, \quad \alpha \in \mathbb{N}
\]  

(10)

In Section 2.1, we discuss the disutility function \(\gamma \cdot f(\omega, \Omega)\). Figure 1 plots that function for \(\Omega = 12.5\) and \(\gamma = 2\). In equation (10), the exponent \(\alpha\) captures the type of preference, whereby an even \(\alpha\) reflects inequality aversion while an odd \(\alpha\) represents competitive preferences. In the figure, panel (a) shows the case \(\alpha = 2\) and panel (b) sets \(\alpha = 3\). As in Figure 1, all subsequent figures represent the cases \(\gamma = 2\) and \(\gamma = 5\) by green and red curves, respectively.

Recall that, in our model, there are two types of workers, rich and poor, \(i = R, P\), who differ in their initial wealth \(W_i\). Clearly, the rich possess above-average and the poor below-average wealth. Consequently, by construction, for an identical wealth-and-income deviation from the societal mean, the inequality averse rich suffer from empathy less than the poor from envy.

\(^{19}\)The average societal initial wealth \(\Omega\) reflects the numerical results reported below. For a further formal discussion of the function’s properties, see the Appendix.
4.3 Incentive Contracts

As explained above in Subsection 3.2, in our setting, the optimal levels of incentive pay and fixed wage are jointly determined by the incentive and the participation constraints. Given the complexity of the model, we now use a graphical approach to gain an intuition on the contract-setting mechanism. Furthermore, the figures below illustrate the impact of the intensity parameter $\gamma$ on the two constraints, holding effort fixed. The results serve to indicate how variations in the workers’ other-regarding preference affect the ensuing contracts. These illustrations elaborate on the comparative-statics results shown in Table 3 above.

The Figures 2 and 3 show the cases of inequality aversion ($\alpha = 2$) and competitiveness ($\alpha = 3$), respectively. Both panels in these figures show $(s, b)$ - combinations that satisfy the incentive and participation constraints, i.e., conditions $(IC)$ and $(PC)$, for two values of the intensity parameter $\gamma = 2, 5$. To isolate the impact of $\gamma$, all graphs hold effort fixed at its equilibrium value for $\gamma = 5$ derived in Section 5.3 below for $u = 1.2$. Moreover, the economy’s average profit and income also correspond to that equilibrium. It is important to note, however, that by changing $\gamma$ the outside option changes as well, reflecting the person’s welfare when unemployed that is associated with the corresponding attitude towards inequality. Thus, the intersection of the constraints for $\gamma = 5$ correctly reflects the equilibrium for that intensity parameter which is not the case for $\gamma = 2$ since the economy-wide endogenous variables are not allowed to adjust. In both figures, panel (a) shows the case of the poor with initial wealth $W_P = 2.5$ and panel (b) represents the rich with $W_R = 40$. The solid curves show the participation constraint while the dashed ones represent the incentive constraint. In the following, we discuss these figures and thereby refer to the formal comparative-statics results shown in Table 3 in the Appendix.

As it turns out, all figures correspond to the lower ranges of the intensity parameter $\gamma$ and the unemployment compensation $u$.

---

*Figure 2: Incentive and Participation Constraints for Inequality Averse Workers*

---

20 The choice of these values is explained below in Section 5.
Turning first to the inequality averse poor in Figure 2(a), the incentive constraints are upwards sloping. That is, both instruments can be used for inducing the worker to exert effort. Intuitively, raising $b$ increases the inferiority averse worker’s utility directly as well as indirectly by lowering the envy felt in the state in which he obtains the bonus ($\delta = 1$). Ceteris paribus, this makes it less costly to incentivize him. To counteract this positive effect on effort, $s$ needs to be raised. In contrast to raising the bonus, an increase in the fixed payment $s$ has no direct effort-related effect on the worker’s wage. Nevertheless, it reduces the envy-related disutility for both realizations of the signal but more so for the case when no bonus is paid. Therefore, the worker’s incentive to avoid the unfavorable outcome ($\delta = 0$) by exerting effort is lowered. Clearly, to hold effort fixed, the bonus needs to be raised so that, altogether, the two wage components are complements. Notice that this result is different from that usually found in the literature where variations in the fixed wage typically do not affect effort incentives. The latter is not only true for agency models with purely selfish workers but also for well-known models using other-regarding preferences.

Turning to the impact of the intensity parameter $\gamma$, note that increasing it shifts the incentive constraint to the left. In this case, in line with the common literature on inequity aversion, there is an incentive effect of envy. Intuitively, for a given contract $(s, b)$, a poor worker who becomes more inequality averse would want to exert a relatively higher level of effort in order to lower the expected disutility from envy. To hold effort constant, either $b$ or $s$ needs to be reduced. Notice that, for any given effort, the fixed wage depends also on $\gamma$ in the incentive constraint. Hence, this is another manifestation of the difference between our preference specification and those commonly used in the aforementioned literature. Both features of the fixed wage in the incentive constraint, i.e., that it affects effort and is affected by the intensity parameter, are common to all combinations of wealth and preference types in our environment and thus hold true for all figures below.

By contrast, the both participation constraints in Figure 2(a) are downwards sloping so that the fixed wage $s$ and the bonus $b$ become substitutes. Beyond the direct monetary substitutability of the two payment modes, both a higher bonus and a higher fixed pay raise a poor worker’s utility also indirectly via the inequality term. Consequently, both wage components become even stronger substitutes than they would have been with purely selfish workers.

An increase in the intensity parameter $\gamma$ shifts the participation constraint downwards. Intuitively, increasing inferiority aversion, ceteris paribus, raises the worker’s disutility due to envy both when employed and unemployed. However, due to the low fixed wage, when the worker does not obtain the bonus, his situation becomes even worse compared to being unemployed, making him try even harder to avoid this outcome. Therefore, to induce the same effort, the firm can reduce compensation either in terms of a higher bonus or fixed wage. This result seems a little surprising since it means that it is easier to make more inequality averse workers participate, which is in contrast to existing agency models with inequity aversion.\footnote{As noted in Table 3, this result reverses for sufficiently large values $u$.}

In principle, increasing the intensity parameter seems to have countervailing effects on the optimal contract. For a given bonus, a higher value of $\gamma$ increases the wage payment required to...
induce a given effort but reduces the wage required to make the worker participate. As shown in the Figure, the impact on the incentive constraint dominates so that the optimal contract implies a higher fixed wage but a lower bonus for $\gamma = 5$ relative to the $\gamma = 2$-case, which turns out to be generally true (see Lemmas A7, A8 in Appendix A1). Similarly, variations in $\gamma$ have countervailing effects on the firm’s expected total wage costs to induce effort $e$. We discuss this point further below (see Figure 4).

Now consider Figure 2(b) that represents the constraints for the inequality averse rich, i.e., the superiority averse. The very large slope of the incentive constraints implies that it is mainly the bonus that can be used as an instrument to induce the worker to exert effort, as the high initial wealth of the rich in our example very much reduces the indirect incentive effect of income. Note that this observation resembles the case of purely selfish workers, where the incentive constraint would be a vertical line.

In contrast to the case of poor workers, the incentive constraint (slightly) shifts to the right when the intensity parameter $\gamma$ increases. Thus, in our case, the results are in line with the common literature on inequity aversion, where there is a disincentive effect of empathy. Intuitively, for a given contract $(s,b)$, a rich worker who becomes more superiority averse would want to exert a relatively lower level of effort in order to reduce the expected disutility from compassion. To outweigh this intrinsic effect, the bonus needs to be raised (as the fixed wage has a negligible impact).

The participation constraints in panel (b) are also downwards sloping as in panel (a). This is not obvious because, for the rich, there is a trade-off between the direct and indirect impact of the two wage components (compare Lemmas A7, A8 in Appendix A1). On the one hand, the superiority averse rich workers directly enjoy a higher pay. On the other hand, they dislike the greater inequality due their compassion. Again the high initial wealth of the rich renders the latter effect negligible. Consequently, the direct substitution effect outweighs the indirect complementarity arising from the other-regarding part of the preferences.

An increase in the intensity parameter $\gamma$ shifts the participation constraint slightly upwards. Similar to the discussion of panel (a), an increase in the intensity parameter seems to have an ambiguous impact on the optimal contract also for the rich. A higher value of $\gamma$ increases the bonus required to induce a given effort. Whether this allows a reduction in the wage along the participation constraint depends on the extent to which this constraint moves up. As it turns out, in our case that movement is very small, resulting in a reduction of the wage.

Figure 3 shows the case of $\alpha = 3$ for the poor (a) and the rich (b) with the same initial wealth values used for $\alpha = 2$. Note that poor competitive workers are inferiority averse which is analogous to their inequality averse peers. Consequently, qualitatively, all the features of panel (a) coincide with the equivalent case of $\alpha = 2$. By contrast, the rich competitive are superiority seeking, i.e., enjoy their advantageous position in the societal wealth distribution. Nevertheless, the participation constraints in Figure 3(b) are also downwards sloping. Here the rich enjoy both the direct and the indirect impact of the two wage components. Consequently, the latter are unambiguously substitutes. As noted above, the impact of $s$ is very small due to the high initial wealth. Therefore, the incentive constraint of the superiority seeking is very steep similar
However, when increasing $\gamma$, the participation and incentive constraints of the superiority seeking workers move in the opposite direction to that of the superiority averse workers. Intuitively, due to their joy of outperforming others, it becomes easier to make the former participate. Moreover, it is also easier to incentivize them. Nevertheless, the figure indicates that, at the optimal contract, the bonus decreases and the fixed wage increases. We show in the Appendix that this is always true. It is worth noting that, the competitive workers are easier to incentivize regardless of their initial wealth. Altogether, there hence is an incentive effect of competitiveness.

While the above discussion held the effort level fixed, the impact of $\gamma$ on the cost of inducing different effort levels is also of interest. That cost too depends on the workers’ inequality preference and wealth type. Figure 4 depicts the firm’s wage costs, where the payments $(s, b)$ satisfy the incentive and the participation constraints for any given level of $e$. That is, the graph shows $s^*(e) + e \cdot b^*(e)$ for two values each of $\alpha, \gamma$ and $W_i$, which are replicating those underlying Figures 2 and 3.\textsuperscript{22}

The structure of the firm’s expected wage costs naturally affects its optimization problem. In particular, while the marginal benefit of effort is independent of the workers’ characteristics, the figures show that both the level and the marginal wage costs do differ across workers. As a result, the optimal effort the firm will choose to induce and the ensuing profits will depend on the worker’s type.

In all panels above, the wage costs are increasing in $e$.\textsuperscript{23} For the poor, increasing the sensitivity to inequality clearly reduces their cost, implying that, at each effort level, the direct cost-reduction impact of the lower bonus exceeds that of the higher fixed wage. This dominance

\textsuperscript{22}For ease of notation, in the graphs, we drop the asterisks.

\textsuperscript{23}Note that, in principle, for the inequality averse rich workers, a counterintuitive effect on the wage costs may be at play. For them, exerting effort increases their disutility due to compassion. In our example, the direct effort cost dominate those due to the other-regarding preferences.
Figure 4: Expected Wage Cost for (a,b) Inequality Averse and (c,d) Competitive Workers

is also true for both types of the rich. Similar to the inferiority averse poor, the superiority seeking rich also need less of an incentivization when the utility of their advantageous position increases. Consequently, they too become cheaper to employ. In contrast, a rich person who becomes more superiority averse requires a larger bonus to induce any given level of effort and increases the resulting employment costs.

Notice that Figures 4(b) and 4(d) are in line with existent agency models; empathy raises a firm’s motivational costs while competitiveness lowers them (both in the incentive and participation constraint and thus also in total). By contrast, the results implied by Figures 4(a) and (c) differ from existent models with inequality averse or envious workers (e.g., Grund and Sliwka (2005), Kragl and Schmid (2009)). In these models, typically there is a trade-off; envy lowers the bonus required to induce some given effort but the firm needs to compensate workers for the expected disutility due to envy. In total, the latter effect outweighs the former so that employing envious or inequality averse workers always comes at a cost to the firm. As mentioned above at the end of Section 3.2, in our specification, the results show the opposite. In particular, as $\gamma$ increases, the firm exploits such workers’ increased disutility associated with being unemployed.

5 Numerical Experiments

In this section, we compare various economic environments and their sensitivity to the type and intensity of other-regarding preferences and the wealth distribution. As there is no analytical closed-form solution to our model, we turn to numerical experimentation. In the following, we explain the solution method, the parameter choice and experiments and describe the numerical results.
5.1 Technique

We use Mathematica to numerically generate relevant equilibrium outcomes and test how they depend on the societal wealth distribution, the preference type, and the magnitude of the intensity parameter $\gamma$.

In the computational process, we follow the structure of Definition 3 to calculate the equilibrium. Specifically, we choose values of $W_R, W_P$, the fraction of the poor in the population $\lambda_P$, which together determine the corresponding societal average wealth $W$. Next, we turn to the agency problem between firms and workers as stated in problem (4). In order to find the type-dependent equilibrium contracts $(s_i^*, b_i^*)$ and effort levels $e_i^*$, we need to take into account the recursive relationship between the optimal contracts and the societal average wage income and profits. In practice, we specify arbitrary initial values for $(Y, \Pi)$ and solve for the optimal contracts. Given the result, we update these values and derive the new optimal contracts. This process is repeated until the difference between the initial and resulting values converge. To sum, we are numerically solving a fixed-point problem, whereby the model maps $(Y, \Pi)$-pairs into themselves.\footnote{Given the underlying features of the model, we believe that the equilibrium is unique. However, since we rely on numerical solutions, we do not find it necessary to prove existence nor uniqueness.}

5.2 Parameter Choice and Experiments

In general, by our parameter choice, we try to roughly mimic some actual key features of a major industrial economy. For that purpose, we chose Germany for which reliable relevant data are available.

As a starting point, we arbitrarily chose values for $\theta = 3$ and $\beta = 0.5$ and held them fixed throughout. We set $\lambda_P = 0.8$ and the individual wealth of every “poor” worker at $2/8$ of the average societal wealth whereas that of the rich at $8/2$, implying that every “rich” worker possesses 16 times as much wealth as a “poor” one. This roughly corresponds to the wealth distribution found for Germany, whereby the top 20 % of the population own about 80 % of the total wealth. Moreover, we chose an average wealth of $W = 10$. In our experiments, this exogenous choice generates an income (wages and profits) of about 2.5, thereby mincing the ratio between average wealth and average income of 4 observed in Germany.\footnote{See Sachverständigenrat (2014) for the German data. Note that the ratio between average wealth and average income in the U.S. has reached a level of 6.5 (see https://www.bloomberg.com/news/articles/2017-03-10/u-s-household-wealth-to-income-ratio-jumps-to-a-record-chart). See also Bauluz (2010), Figure 22. Bauluz claims that Germany’s relative low ratio is still due to the equalizing effect of WWII.}

In accordance with the illustrations above, we use $\alpha = 2$ to represent the case of inequality aversion and $\alpha = 3$ for the case of competitive preferences. Moreover, we chose two values of the intensity parameter $\gamma$. The first is set at a moderate level of 5, which also serves to characterize our benchmark economy. The second value is set at a high level of 50, chosen in order to emphasize the impact of the population’s other-regarding preferences on the variables of interest. Notice however that, even at the higher of these values, the marginal utility of income
remains positive.\footnote{That is, in line with other models of other-regarding preferences, we ensure that workers have no interest in destroying resources just because of their inequality aversion.} Finally, the value of $u = 1.2$ is chosen to generate an empirically plausible value for the labor share of at about $2/3$ for the benchmark case, i.e., the average expected wage amounts to $2/3$ of the average per-worker output. Moreover, this value turns out to be smaller than $\bar{u}$ as defined for the inferiority averse in the Appendix, thereby satisfying Proposition 2.

Altogether, we present seven scenarios that illustrate the impact of the preference type and intensity as well as the wealth distribution. As a reference point, we show the purely self-regarding case with $\gamma = 0$. The other-regarding cases are examined for both values of $\alpha$. For each, we vary $\gamma$ as explained above and the wealth distribution. Specifically, holding average wealth fixed, we consider an economy in which wealth is perfectly evenly distributed as well as an unequal economy where, in line with the aforementioned characterization, $W_P = 2.5$ and $W_R = 40$. The latter comparison enables us to investigate the effect of a frictionless extreme hypothetical wealth redistribution.

### 5.3 Results

Tables 1 and 2 below focus each on inequality averse and competitive workers, respectively. In every table we report the results for: (i) purely self-regarding workers as a benchmark ($\gamma = 0$), (ii) other-regarding workers with a moderate intensity parameter ($\gamma = 5$), and (iii) other-regarding workers with a high intensity parameter ($\gamma = 50$). In case (i), the wealth distribution is immaterial and hence not taken into account. In all other cases, we present two initial wealth distributions; (a) perfect equality and (b) an uneven distribution with the same total (and therefore also average) initial wealth as in (a). This structure allows us to highlight the impact of the other-regarding preference \textit{per se} (the respective rows (a)) in isolation from that of wealth differences (rows (bP) and (bR)), showing the results for the poor and the rich, respectively.

At the individual level, for $i = P, R$, we present the workers’ equilibrium values of productive effort $e_i^*$, fixed wage $s_i^*$, bonus $b_i^*$ and the expected wage, $E[y_i^*] = s_i^* + e_i^*b_i^*$.\footnote{Notice that all our experiments yield positive fixed wages so that imposing limited liability on the workers would be inconsequential.} Further, we report the expected individual welfare excluding initial wealth:

$$W_i = s_i^* + e_i^*b_i^* + \bar{\Pi}^* - c(e_i^*) - I_i^*$$  \hspace{1cm} (11)

Given the fact that there are no rents, welfare measures the difference between the workers’ total expected income (including the average profit $\bar{\Pi}^*$) minus effort costs and the expected (dis)utility arising from the other-regarding preference. The latter is captured by the inequality premium $I_i^*$ (see condition (PC)), which we also report separately. Note that a positive inequality premium indicates a utility loss and a negative one a gain. We further report the profits, $\pi_i$, obtained when a firm employs a worker of type $i$. Finally, we report the economy-wide average output, $\bar{v}^*$, appropriately weighted as in Footnote 8.
<table>
<thead>
<tr>
<th></th>
<th>$e^*_i$</th>
<th>$s^*_i$</th>
<th>$b^*_i$</th>
<th>$E[y^*_i]$</th>
<th>$W_i$</th>
<th>$T^*_i$</th>
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<td><strong>(i) Self-Regarding</strong></td>
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<tr>
<td>(a) $W_P = W_R = 10$</td>
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<td>1.60</td>
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<tr>
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Table 1: Results of Numerical Experiments for Inequality Averse Workers ($\alpha = 2$)

When there are no wealth differences, Table 1 shows that, for the inequality averse workers, the effort of the moderately inequality averse (row ii(a)) is essentially the same as that of the self-regarding workers (row i) despite a lower equilibrium bonus.\(^{28}\) Intuitively, ex post all inequality averse workers experience either envy or compassion, since nobody ends up earning exactly the average wage. This leads to an expected utility loss as manifested by the emergence of a small inequality premium and hence reduced welfare. However, falling behind the societal average is more painful than forging ahead. Accordingly, workers try to avoid the former and ceteris paribus are willing to exert higher effort, which makes them cheaper to employ. With a moderate inequality aversion, the disutility is not sufficiently large to have much of an effect on the equilibrium optimal effort. Nevertheless, the structure of the optimal contract changes compared to that of the self-regarding case: the bonus is lower but the fixed payment higher. When raising the sensitivity to inequality without affecting the wealth distribution (row iii(a)), the results are much more pronounced. Here equilibrium effort is clearly reduced relative to that of the self-regarding workers. Moreover, the fixed part of the wage structure is much higher than in the other two cases, and the bonus lower. In this case, the workers’ aversion towards inequality is so high, that they actually try to reduce its incidence. Specifically, the lower bonus combined with the reduced probability of obtaining it reduces the variability of the wage payment. Consequently, the workers’ expected loss due to inequality aversion is mitigated.

When workers differ in their initial wealth, the equilibrium optimal contract induces poor inferiority averse workers to increase their effort beyond that of the self-regarding case despite a substantially lower bonus (rows ii(b$P$) and iii(b$P$) in Table 1). This is consistent with Proposition 2 and the subsequent discussion as well as the finding shown in Figure 4(a), whereby more inferiority averse workers become cheaper to employ at any effort level. As a matter of fact, the above table shows that, in equilibrium, these workers exert higher effort (which is also in

\(^{28}\) The table reports the results rounded to two digits after the decimal point. In fact, as is reflected by the slightly lower output in the inequality aversion case, effort is also somewhat lower.
contrast to the literature) and are nevertheless cheaper to employ.

This equilibrium result stems from three different forces. On the one hand, in line with the literature, there is an incentive effect of envy: at any given bonus, workers exert a higher level of effort in order to reduce the probability of ending up with a fixed payment alone. On the other hand, the higher inequality aversion increases per se the poor workers’ disutility caused by their disadvantageous societal status. In line with the literature, this, ceteris paribus, raises the total compensation needed to induce participation. In most existent studies, the second effect outweighs the first, causing firms in the final analysis to induce lower effort. By contrast, in our setting, the opposite happens. Recall that, in our model, the outside option too reflects the workers’ other-regarding preferences. Since being unemployed is the worst possible outcome in terms of the workers’ societal standing, this additional effect relaxes the participation constraint. As it turns out, the first and the last effects dominate the second one, so that increasingly inferiority averse workers become cheaper to employ. As a result, equilibrium effort increases while the bonus is reduced.

With moderate inequality aversion, the fixed wage paid to the poor workers is higher compared to the equitable wealth distribution case. This is again a reflection of the increased dislike of falling behind. However, when the sensitivity towards inequality rises even further, this effect seems to be overwhelmed by the even worse prospect of becoming unemployed, which further relaxes the participation constraint, allowing the firms to substantially reduce the fixed wage relative to the case with an equitable wealth distribution (rows iii(a) and iii(b) in Table 1). In either case, the firms “exploit” the inferiority aversion of the poor workers to substantially increase their profits.

Under an inequitable wealth distribution, we saw in 4(b) that, at each effort level, the rich become more expensive to employ. Taking this observation into account, a comparison of rows iii(a) and iii(b) in Table 1 reveals equilibrium effects that are opposite to those of the poor: their effort is slightly lower while the associated bonus is substantially higher, combined with a fixed pay that is a bit lower. These results reflect the disincentive effect of empathy. When becoming rich, these workers incur a disutility associated with their initial wealth exceeding the societal average. Due this distaste, earning a bonus is less desirable, and hence it becomes more costly to incentivize the rich to exert effort. Consequently, firms pay a large equilibrium bonus, hence lowering the firms’ profits compared to the case with an equitable wealth distribution. Despite the lower probability of obtaining the bonus and the lower fixed wage, the expected wage of the rich is still slightly larger than that of the poor. Thus, notwithstanding the aversion towards inequality, in our example an initial inequitable wealth distribution tends to generate even more inequality. On the other hand, due to the overwhelming majority of the poor, output is highest in an economy populated by inequality averse workers with an inequitable wealth distribution.

As is the case for the poor, most of the above effects are accentuated when we increase the intensity of the inequality aversion (row iii(bR)). As a matter of fact, in this case, due to the disincentive effect of empathy, the rich exert considerably lower effort but obtain a substantially higher bonus compared to the case with equitable wealth. With moderate inequality aversion,
the large bonus implies that the firms can afford to reduce the optimal fixed pay to the rich. However, the fixed wage needs to be raised when the intensity parameter is large. Note that, for the rich, in both cases the dislike of forging ahead reduces the advantage of being employed compared to being unemployed. This tightens the participation constraint ceteris paribus. As a result, when the intensity parameter becomes sufficiently large, inducing participation eventually requires *increasing* the fixed wage despite the high bonus. Despite their lower effort, the expected wage gap between the rich and the poor is tilted even further towards the former. Finally, at the aggregate level, the high effort of the poor results in large output gains.

To sum the experiments shown in Table 2 up, we find that, under inequality aversion, in an economy where wealth inequality is higher the poor to exert more effort but not the rich. Since the share of the former outweighs the share of the latter, output increases but welfare of both the poor and the rich is lower. Finally, we discuss workers’ attitudes towards a redistribution of wealth. To simplify, we consider an extreme case whereby the state costlessly imposes an ex-ante tax of 30 units of wealth on every rich worker and evenly distributes the revenues among the poor, yielding an equitable ex-ante wealth distribution. Such a redistribution would clearly be favored by the poor because they not only gain initial wealth but also avoid the loss due to wealth inequality in the society. Notice however that, despite their aversion towards inequality, the rich clearly oppose redistribution. While, under an even wealth distribution (rows (a)), their welfare net of wealth compared to an inequitable distribution (rows (b)) would rise by 1.39 for $\gamma = 5$, or even by 14.17 for $\gamma = 50$, the direct loss involved in redistributing their wealth to the poor would entail 30, summing up to a loss of 28.61 in the first case and 15.83 in the second. Clearly, this reflects the fact that, in our model, the direct welfare effect of wealth exceeds the loss associated with inequality aversion for the rich. On the other hand, every poor person would gain 8.48 (comprised of 0.98 due to the reduced inequality and 7.5 units of wealth) if $\gamma = 5$, and 16.99 (9.49 + 7.5) if $\gamma = 50$. Thus, for a utilitarian social welfare function, it is obvious that for $\gamma = 50$ redistribution is welfare-enhancing with a total gain of 10.43. This is also the case for $\gamma = 5$ where the total gain is still positive at 1.06, since the weight of the poor (0.8) is sufficiently high to outweigh that of the rich.

In Table 2 we turn to an economy populated by competitive workers ($\alpha = 3$). Remember that, for competitive preferences, the poor are still inferiority averse whereas the rich are superiority seeking. As a result, both the poor and the rich become cheaper to employ (see panels (c) and (d) of Figure 4). This manifests itself in the equilibrium results of Table 2, where those for the poor resemble the case of inequality aversion while the results for the rich are reversed.

We observe that, when initial wealth is equitable, raising the intensity parameter barely affects the equilibrium. In this case, the ex-ante disutility for those who do not obtain the bonus and fall behind the societal average is basically neutralized by the prospect of forging ahead and enjoying the higher than average income when the bonus is obtained. When initial wealth is not equal however, both the poor and the rich increase their effort relative to the equitable economy.
Table 2: Results of Numerical Experiments for Competitive Workers ($\alpha = 3$)

(rows (b\textsubscript{P}) and (b\textsubscript{R})), despite the lower boni they receive. As for the poor, the reasons have already been elaborated upon above. For the rich, there is an incentive effect of competitiveness; they have an additional incentive to exert effort due to their joy of outperforming the societal average. This allows the firms to reduce the equilibrium bonus also for the rich. The fixed wage too becomes smaller in equilibrium as the intensity parameter increases. This reflects the fact that, similar to the poor, also the rich dislike being unemployed, thereby relaxing the participation constraint and leading to reduced employment costs. All of the above implies that the firms’ equilibrium profits increase for both types of workers. In a very competitive economy, all foregoing effects are even stronger. Not surprisingly, the expected wage payment of the rich exceeds that of the poor, leading to an even more inequitable wealth distribution ex post, as was the case for inequality aversion. Clearly, in these environments the rich enjoy a substantial welfare gain (due to their negative inequality premium) and will obviously object to any redistribution policy. A welfare calculation reveals that, under the same redistribution program discussed above, every rich person loses 30.85 if $\gamma = 5$ and 38.19 if $\gamma = 50$. Each of the poor would gain 7.95 in the first case and 11.61 in the second. The total welfare gain of the poor is also in this case greater than the total loss of the rich, at 6.36 compared to 6.17 for the low intensity parameter, and 8.93 versus 7.64 for the high intensity parameter.

6 Discussion and Conclusion

This paper focuses on the impact of other-regarding preferences on economic performance at the macroeconomic level. For this purpose, it presents a static general-equilibrium framework where labor relations are affected by moral hazard. While workers’ other-regarding preferences are self-centered, they do care about societal income and wealth distribution. In particular, they are either inequality averse or competitive, where their reference point is the average economy-wide income and wealth. The utility of inequality averse workers is negatively affected
when their societal position either exceeds or falls below that reference point. Competitive workers who are below the societal average also suffer utility losses, but the welfare of those who are above that average increases. Conducting several numerical experiments, we find that in economies with high initial wealth differences those below average (the “poor”) increase effort. Notably, this happens although they obtain a lower bonus than they would in an economy with equitable wealth distribution. The same holds also when the distaste for inequality is reduced. In contrast, analogous comparisons reveal that those above average (the “rich”) obtain a higher bonus but exert lower effort in more inequitable economies or when the inequality preference is less pronounced. Under both inequality aversion and competitiveness, the expected wage of the rich exceeds that of the poor, indicating a worsening of subsequent wealth and income distributions. Intuitively, firms exploit the poor workers’ distaste of low earnings by inducing high effort at a relatively low incentive pay. Similarly, though less pronounced, superiority seeking rich workers enjoy their advantage and therefore become less costly to incentivize. In contrast, superiority averse rich workers try to avoid becoming even richer and hence require more incentivization. Consequently, under increased income and wealth inequality, both the poor and the inequality averse rich suffer utility losses whereas the utility of the competitive rich increases.

Altogether, in our environment social attitudes towards inequality do not, in and by themselves, create any mechanism that reduces inequality. This is particularly surprising where inequality aversion is concerned. As a matter of fact, increasing inequality aversion contributes towards higher inequality. Finally, regardless of the aforementioned welfare consequences, the work incentives created by wealth inequality or high intensity of the other-regarding preference result in higher productivity and output.

Due to our focus, the model abstracts from many important aspects. Specifically, technology, human capital, and skills play no role. Accordingly, by assuming that all workers are inherently identical except for their initial wealth, the model cannot account for the full extent of income differences as observed in reality. Introducing ability and skill differences into our framework would increase income differences as implied by the extensive literature on the effects of skill-biased technological change on inequality (Helpman (2018)). Moreover, Cingano (2014) finds a positive relationship between wealth and education. In our model, the foregoing would imply that the wages of the rich would increase even further due to their ability to acquire higher skills than the poor. That, in turn, would further increase the income gap, thereby reinforcing our main finding.

At this stage, we allowed for only two types of workers, “rich” and “poor”. An extended environment might include a more realistic wealth distribution. More importantly, the reference points and the outside options may include a broader set. For example, rather than comparing to the societal average, poor workers may compare themselves to the rich and the rich may look at the poor. Finally, a model of this type may be embedded in a dynamic growth framework in order to explicitly study the dynamics of wealth and income distributions and their interaction with economic growth.
Appendix

A1 Comparative Statics

In this appendix, we explore the properties of the incentive and participation constraints, equations \((IC)\) and \((PC)\) respectively. In addition, we conduct a comparative analysis exercise on the optimal contract \((s^*, b^*)\), for a given level of effort.

A1.1 The Properties of the Function \(f(\cdot, \cdot)\)

To simplify notation, we let:

\[
f_\omega \equiv \frac{\partial}{\partial \omega} f(\omega, \Omega), \quad f_{\omega \omega} \equiv \frac{\partial^2}{\partial \omega^2} f(\omega, \Omega)
\]  

(A1)

To simplify notation (and with some abuse), in the sequel we define \(\omega = s + W + \Pi\), and \(\Omega = Y + W + \Pi\). Furthermore, we focus throughout on cases where \(b > 0\) and one of the following situations holds (i) \(\omega + b < \Omega\), (ii) \(\Omega < \omega < \omega + b < \hat{\omega}\), (iii) \(\hat{\omega} < \omega\). In other words, either a person remains “poor” even if he receives a bonus, or, if he is “rich”, receiving a bonus keeps him to the left of the inflection point, or he was to right of that point even without a bonus. All other cases, where obtaining a bonus may “swing” a person beyond either critical point \(\Omega\) or \(\hat{\omega}\), are ruled out as they may entail ambiguous outcomes. In this context, we have the following implications:

Implications: Given Assumptions 1 and 2; (i) for a person with \(\omega + b < \Omega\), \(0 < f(s + b) < f(s)\) (ii) for a superiority person with \(\Omega < \omega\), \(0 < f(\omega, \Omega) < f(\omega + b, \Omega)\), (iii) for a superiority seeking person with \(\Omega < \omega\), \(f(\omega + b, \Omega) < f(\omega, \Omega) < 0\), (iii) for \(\omega + b < \Omega\), \(f_\omega(\omega, \Omega) < f_\omega(\omega + b, \Omega) < 0\), (iv) for a superiority averse person with \(\Omega < \omega < \omega + b < \hat{\omega}\), \(0 < f_\omega(\omega, \Omega) < f_\omega(\omega + b, \Omega)\), (v) for a superiority averse person with \(\hat{\omega} < \omega\), \(0 < f_\omega(\omega + b, \Omega) < f_\omega(\omega, \Omega)\), (vi) for a superiority seeking person with \(\Omega < \omega < \omega + b < \hat{\omega}\), \(f_\omega(\omega + b, \Omega) < f_\omega(\omega, \Omega) < 0\), and (vii) for a superiority seeking person with \(\hat{\omega} < \omega\), \(f_\omega(\omega, \Omega) < 0\).

These observations are used below to conduct a number of comparative statics analyses.

A1.2 The Incentive Constraint

Starting with the incentive condition, we rewrite it, omitting arguments, as:

\[
p'b - c' - \gamma p' [f(\omega + b, \Omega) - f(\omega, \Omega)] = 0
\]  

(A2)

From the implications of Assumption A1 we obtain the following results.
Proof of Lemma 1

Along (A2) we obtain:

\[
\frac{\partial e}{\partial s} = -\frac{\gamma p'}{p''b - c''} - \gamma p' [f(\omega + b, \Omega) - f(\omega, \Omega)] - \gamma p' f(\omega, \Omega) - f(\omega + b, \Omega) - f(\omega, \Omega)] \tag{A3}
\]

The denominator of (A3) is negative by SOC. For persons with \( \omega + b < \Omega \), superiority averse persons with \( \Omega < \omega + b < \hat{\omega} \) and superiority seeking persons with \( \hat{\omega} < \omega \) the numerator is positive, leading to \( \frac{\partial e}{\partial s} < 0 \). For superiority averse persons with \( \hat{\omega} < \omega \) and superiority seeking persons with \( \Omega < \omega + b < \hat{\omega} \) the numerator is negative, leading to \( \frac{\partial e}{\partial s} > 0 \).

**Slope**

Holding effort and \( \gamma \) fixed, along the incentive constraint the relationship between the fixed payment and the bonus is:

\[
\frac{\partial s}{\partial b} = \frac{1 - \gamma f_\omega(\omega + b, \Omega)}{\gamma (f_\omega(\omega + b, \Omega) - f_\omega(\omega, \Omega))}. \tag{A4}
\]

**Lemma A1**: Holding effort fixed, along the incentive condition we obtain: (i) \( \frac{\partial s}{\partial b} > 0 \) for \( \omega + b < \Omega \). (ii) For an superiority averse person with \( \Omega < \omega + b < \hat{\omega} \) and \( \gamma < \frac{1}{f_\omega(\omega + b, \Omega)} \), \( \frac{\partial s}{\partial b} > 0 \) and \( \frac{\partial s}{\partial b} < 0 \) if \( \gamma > \frac{1}{f_\omega(\omega + b, \Omega)} \). If \( \omega > \hat{\omega} \), \( \frac{\partial s}{\partial b} < 0 \) for \( \gamma < \frac{1}{f_\omega(\omega + b, \Omega)} \) with the reverse holding for \( \gamma > \frac{1}{f_\omega(\omega + b, \Omega)} \). (iii) For a superiority seeking person with \( \Omega < \omega + b < \hat{\omega} \), \( \frac{\partial s}{\partial b} < 0 \), and if \( \omega > \hat{\omega} \), \( \frac{\partial s}{\partial b} > 0 \).

**Impact of \( \gamma \)**

For a given bonus and \( \gamma \), the impact of a change in \( \gamma \) on \( s \) is:

\[
\frac{\partial s}{\partial \gamma} = -\frac{f(\omega + b, \Omega) - f(\omega, \Omega)}{\gamma (f_\omega(\omega + b, \Omega) - f_\omega(\omega, \Omega))}. \tag{A5}
\]

**Lemma A2**: Along the incentive constraint, holding effort fixed we have: (i) for \( \omega + b < \Omega \), \( \frac{\partial s}{\partial \gamma} > 0 \), (ii) for the superiority averse person with \( \Omega < \omega + b < \hat{\omega} \), \( \frac{\partial s}{\partial \gamma} < 0 \) and \( \frac{\partial s}{\partial \gamma} > 0 \) if \( \omega > \hat{\omega} \), (iii) the reverse holds for the superiority seeking person with \( \Omega < \omega \).

Next, we hold \( s \) constant and analyze the impact of \( \gamma \) on \( b \):

\[
\frac{\partial b}{\partial \gamma} = \frac{f(\omega + b, \Omega) - f(\omega, \Omega)}{1 - \gamma f_\omega(\omega + b, \Omega)} \tag{A6}
\]

**Lemma A3**: Along the incentive constraint, for a fixed effort level the following holds:
(i) for $\omega + b < \Omega$, $\frac{\partial b}{\partial \gamma} < 0$, (ii) For the superiority averse person with $\Omega < \omega$, $\frac{\partial b}{\partial \gamma} > 0$ if $\gamma < \frac{1}{f_\omega(\omega + b, \Omega)}$, $\frac{\partial b}{\partial \gamma} < 0$ if $\gamma > \frac{1}{f_\omega(\omega + b, \Omega)}$, and (iii) for the superiority seeking persons with $\Omega < \omega$, $\frac{\partial b}{\partial \gamma} < 0$.

A1.3 The Participation Constraint

Using the same notation, the participation constraint can be rewritten as:

$$s + pb - c - \gamma [pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega)] \geq u - \gamma f(u, \Omega)$$  \hspace{1cm} \text{(A7)}

Slope

Similar to the exercise above, we start by holding $\gamma$ fixed to assess the relationship between $s$ and $b$ along the participation constraint:

$$\frac{\partial s}{\partial b} = - \frac{p (1 - \gamma f_\omega(\omega + b, \Omega))}{1 - \gamma [pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega)]}. \hspace{1cm} \text{(A8)}$$

**Lemma A4**: Along the participation constraint, holding effort fixed we have: (i) $\frac{\partial s}{\partial b} < 0$ for $\omega + b < \Omega$, (ii) for the superiority averse person with $\Omega < \omega$ and $\gamma < \frac{1}{\max[f_\omega(\omega + b, \Omega), f_s(\omega, b)]}$ or $\gamma > \frac{1}{\min[f_\omega(\omega + b, \Omega), f_s(\omega, b)]}$, $\frac{\partial s}{\partial b} < 0$. (iii) for the superiority seeking person with $\Omega < \omega$, $\frac{\partial s}{\partial b} < 0$.

**Impact of $\gamma$**

We start by analyzing the impact of $\gamma$ on the participation constraint when $b$ and $e$ are fixed:

$$\frac{\partial s}{\partial \gamma} = \frac{pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega) - f(u, \Omega)}{1 - \gamma [pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega)]}. \hspace{1cm} \text{(A9)}$$

**Remark A1**: To provide incentives, $u$ must satisfy $s < u < s + b$. Define $\overline{\pi}$ and $\overline{\gamma}$ by $pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega) - f(\overline{\pi}, \Omega) = 0$ and $\overline{\gamma} = (1 - p) s + p (s + b)$. Consequently we have: (i) for $\omega + b < \Omega$, the convexity of $f(\cdot, \Omega)$ implies $\overline{\pi} < \overline{\gamma}$ and $pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega) - f(\overline{\pi}, \Omega) < 0$ if $u < \overline{\pi}$, and positive if $u > \overline{\pi}$. (ii) For the superiority averse with $\Omega < \omega < \omega + b < \widehat{\omega}$ we have $\overline{\pi} > \overline{\gamma}$ and $pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega) - f(\overline{\pi}, \Omega) > 0$ for $u < \overline{\pi}$, and negative if $u > \overline{\pi}$. (iii) The same holds for the superiority averse with $\widehat{\omega} < \omega$ except that now $\overline{\pi} < \overline{\gamma}$. (iv) For the superiority seeking with $\Omega < \omega < \omega + b < \widehat{\omega}$ we have $\overline{\pi} > \overline{\gamma}$ and $pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega) - f(\overline{\pi}, \Omega) < 0$ for $u < \overline{\pi}$ and positive if $u > \overline{\pi}$. (v) The same holds for the superiority seeking with $\widehat{\omega} < \omega$ but now $\overline{\pi} < \overline{\gamma}$.

**Lemma A5**: Taking Remark A1 into account, along the participation constraint and holding effort fixed the following obtain: (i) $\frac{\partial s}{\partial \gamma} < 0$ for $\omega + b < \Omega$ and $u < \overline{\pi}$, positive for $u > \overline{\pi}$. (ii)
For the superiority averse persons with \( u < \bar{u} \), if \( \Omega < \omega < \omega + b < \bar{\omega} \) or \( \bar{\omega} < \omega \), \( \frac{\partial s}{\partial \gamma} > 0 \) for \( \gamma < \frac{1}{f_\omega(\omega + b, \Omega)} \), respectively \( \gamma < \frac{1}{f_\omega(\omega, \Omega)} \), and \( \frac{\partial s}{\partial \gamma} < 0 \) if \( \gamma > \frac{1}{f_\omega(\omega + b, \Omega)} \), respectively \( \gamma > \frac{1}{f_\omega(\omega + b, \Omega)} \). The reverse relationships hold for the same types of individuals if \( u > \bar{u} \).

Next, we investigate the impact of changing \( \gamma \) on \( b \) when \( s \) is held fixed:

\[
\frac{\partial b}{\partial \gamma} = \frac{pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega) - f(u, \Omega)}{p (1 - \gamma f_\omega(\omega + b, \Omega))} \tag{A10}
\]

**Lemma A6**: Considering Remark 1, along the participation constraint, for a given effort we observe: (i) \( \frac{\partial b}{\partial \gamma} < 0 \) for \( \omega + b < \Omega \) and and \( u < \bar{u} \), positive for \( u > \bar{u} \). (ii) For the superiority averse person with \( \Omega < \omega < \omega + b < \bar{\omega} \) or \( \bar{\omega} < \omega \) and \( u < \bar{u} \), \( \frac{\partial b}{\partial \gamma} > 0 \) if \( \gamma < \frac{1}{f_\omega(\omega + b, \Omega)} \), and \( \frac{\partial b}{\partial \gamma} < 0 \) if \( \gamma > \frac{1}{f_\omega(\omega + b, \Omega)} \). The reverse relationships hold for the same types of individuals if \( u > \bar{u} \). (iii) \( \frac{\partial b}{\partial \gamma} < 0 \) for the superiority seeking person with \( \Omega < \omega < \omega + b < \bar{\omega} \) or \( \bar{\omega} < \omega \) and \( u < \bar{u} \), \( \frac{\partial b}{\partial \gamma} < 0 \) if \( \gamma > \frac{1}{f_\omega(\omega + b, \Omega)} \). The reverse holds if \( u > \bar{u} \).

**Optimal Contract**

We start by investigating the impact of \( \gamma \) on \((s^*, b^*)\) holding \( e \) fixed. Conducting the comparative statics analysis simultaneously on equations (A2) and (A7) yields:

\[
A \begin{bmatrix} ds^* \\ db^* \end{bmatrix} = Bd\gamma \tag{A11}
\]

where

\[
A = \begin{bmatrix}
-\gamma p' [f_\omega(\omega + b, \Omega) - f_\omega(\omega, \Omega)] & p' [1 - \gamma f_\omega(\omega + b, \Omega)] \\
1 - \gamma [p f_\omega(\omega + b, \Omega) + (1 - p) f_\omega(\omega, \Omega)] & p [1 - \gamma f_\omega(\omega + b, \Omega)]
\end{bmatrix} \tag{A12}
\]

and

\[
B = \begin{bmatrix}
p' [f(\omega + b, \Omega) - f(\omega, \Omega)] \\
p f(\omega + b, \Omega) + (1 - p) f(\omega, \Omega) - f(u, \Omega)
\end{bmatrix} \tag{A13}
\]

From here:

\[
\text{det} \ A = -p' (1 - \gamma f_\omega(\omega + b, \Omega)) (1 - \gamma f_\omega(\omega, \Omega)) \tag{A14}
\]

Accordingly:

\[
\begin{bmatrix} ds^* \\ db^* \end{bmatrix} = A^{-1} \begin{bmatrix}
p' [f(\omega + b, \Omega) - f(\omega, \Omega)] \\
p f(\omega + b, \Omega) + (1 - p) f(\omega, \Omega) - f(u, \Omega)
\end{bmatrix} d\gamma \tag{A15}
\]
We can summarize the analysis by the following:

**Lemma A7:** For a given level of effort, an increase in \( \gamma \) would: (i) increase the optimal wage \( s^* \) for a person with \( \omega + b < \Omega \), (ii) decrease the wage for the superiority averse person with \( \Omega < \omega \) if \( \gamma < \frac{1}{f_\omega(\omega, \Omega)} \) and increase it otherwise (iii) increase the wage of the superiority seeking person with \( \Omega < \omega \).

**Proof:** For this case

\[
\frac{\partial s^*}{\partial \gamma} = \frac{(f(u, \Omega) - f(\omega, \Omega))}{(1 - \gamma f_\omega(\omega, \Omega))}
\]  

(A17)

Notice that when \( \omega + b < \Omega \), we have \( (f(u, \Omega) - f(\omega, \Omega)) < 0 \), leading to the result. For the superiority averse person with \( \Omega < \omega \), \( (f(u, \Omega) - f(\omega, \Omega)) > 0 \). Therefore the optimal wage decreases if \( \gamma < \frac{1}{f_\omega(\omega, \Omega)} \) and increases if the reverse holds. For a superiority seeking individual with \( \Omega < \omega \), \( (f(u, \Omega) - f(\omega, \Omega)) < 0 \) and the denominator of A17 is positive.

**Lemma A8:** For a given level of effort, the impact of increasing \( \gamma \) would: (i) decrease the optimal bonus \( b^* \) for \( \omega + b < \Omega \). (ii) increase the optimal bonus for the superiority averse with \( \Omega < \omega \) provided \( \gamma \) is sufficiently small and decrease it if \( \gamma \) is sufficiently large (iii) decrease the optimal bonus for a superiority seeking person with \( \Omega < \omega \).

**Proof:** Here we have

\[
\frac{\partial b^*}{\partial \gamma} = \frac{f(\omega + b, \Omega) - f(\omega, \Omega) - \gamma \left[ (f(\omega + b, \Omega) - f(u, \Omega)) f_\omega(\omega, \Omega) + (f(u, \Omega) - f(\omega, \Omega)) f_\omega(\omega + b, \Omega) \right]}{(1 - \gamma f_\omega(\omega + b, \Omega))(1 - \gamma f_\omega(\omega, \Omega))}
\]  

(A18)

Notice that \( f(\omega + b, \Omega) - f(\omega, \Omega) \), \( f(\omega + b, \Omega) - f(u, \Omega) \) and \( f(u, \Omega) - f(\omega, \Omega) \) all have the same pattern, comparing higher to lower income levels. Therefore they all have the same sign: negative for persons with \( \omega + b < \Omega \), and for individuals with \( \Omega < \omega \) they are positive for the superiority averse and again negative for the superiority seeking types. For persons with \( \omega + b < \Omega \) and the superiority seeking rich the slope of \( f(\cdot, \Omega) \) is negative, yielding the respective result, but for the superiority averse rich the sign of both the numerator and the denominator of \( \frac{\partial b^*}{\partial \gamma} \) depends on the size of \( \gamma \). If \( \gamma \) is sufficiently small both the numerator and the denominator are negative, resulting in a positive outcome.

Finally, we look at the changes in \( s^* \) and \( b^* \) required to induce more effort, holding \( \gamma \) fixed. In this case we obtain:

\[
A \begin{bmatrix} ds^* \\ db^* \end{bmatrix} = C \begin{bmatrix} de \end{bmatrix}
\]

(A19)

with

\[
C = - \begin{bmatrix} SOC \\ 0 \end{bmatrix} \begin{bmatrix} de \end{bmatrix}
\]

(A20)
where $SOC$ stands for the derivative of $(A2)$, which by the second-order conditions must be negative. The second entry in $C$ is the derivative of $(A7)$, which is just $(A2)$, and equals 0 at the optimum. Accordingly,

$$
\begin{bmatrix}
    ds^* \\
    db^*
\end{bmatrix} = -\frac{1}{\det A} \begin{bmatrix}
    p[1 - \gamma f_\omega(\omega + b, \Omega)] \cdot SOC \\
    -[1 - \gamma (pf_\omega(\omega + b, \Omega) + (1 - p) f_\omega(\omega, \Omega))] \cdot SOC
\end{bmatrix} de
$$

Form all of the above, we obtain:

**Lemma A9**: For a given $\gamma$, an increase in $e$: (i) decreases $s^*$ for persons with $\omega + b < \Omega$, (ii) decreases $s^*$ for superiority averse persons with $\Omega < \omega$ and $\gamma < \frac{1}{f_\omega(\omega, \Omega)}$, and increases $s^*$ if $\gamma > \frac{1}{f_\omega(\omega, \Omega)}$, (iii) decreases $s^*$ for the superiority seeking persons with $\Omega < \omega$.

**Lemma A10**: For a given $\gamma$, increasing $e$ causes: (i) $b^*$ to increase for the persons with $\omega + b < \Omega$, (ii) $b^*$ to increase for the superiority averse persons with $\Omega < \omega$ and $\gamma < \frac{1}{f_\omega(\omega + b, \Omega)}$, and decrease if $\gamma > \frac{1}{f_\omega(\omega, \Omega)}$, (iii) $b^*$ to increase for the superiority seeking persons with $\Omega < \omega$.

Table 3 below provides a summary of the results of Lemmas A1-A10. In the table, we distinguish between poor workers for whom $s + b + \Pi + W_P < \Omega$, and the rich ones. Clearly, the former are inferiority averse under both inequity aversion and competitiveness whereas the latter are superiority averse in the first case but superiority seeking in the second. We differentiate between (moderately) rich workers with $\Omega < s + \Pi + W_R < s + b + \Pi + W_R < \tilde{\omega}$ and the very rich with $\tilde{\omega} < s + \Pi + W_R$, where, as defined above, $\tilde{\omega}$ denotes the inflection point in $f(\cdot, \Omega)$. We focus on unambiguous results and present them in a simplified manner. Specifically, the terms “small” and “large” are shorthand for “sufficiently small” and “sufficiently large”, where the particular thresholds are specified in the respective Lemma.
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<td></td>
<td>$&lt; 0$ if $\gamma$ large</td>
<td>$&lt; 0$ if $\gamma$ small</td>
</tr>
<tr>
<td>(A2) $\frac{\partial s}{\partial \gamma}$</td>
<td>$&gt; 0$</td>
<td>$&lt; 0$</td>
</tr>
<tr>
<td>(A3) $\frac{\partial b}{\partial \gamma}$</td>
<td>$&lt; 0$</td>
<td>$&gt; 0$ if $\gamma$ small</td>
</tr>
<tr>
<td></td>
<td>$&lt; 0$ if $\gamma$ large</td>
<td>$&lt; 0$ if $\gamma$ small</td>
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<table>
<thead>
<tr>
<th>Participation Constraint</th>
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<tbody>
<tr>
<td>(A4) $\frac{\partial s}{\partial b}$</td>
</tr>
<tr>
<td>(A5) $\frac{\partial s}{\partial \gamma}$</td>
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<tr>
<td></td>
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<tr>
<td>(A6) $\frac{\partial b}{\partial \gamma}$</td>
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<th>Optimal Contract (for given $e$)</th>
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<tr>
<td>(A7) $\frac{\partial s^\ast (e)}{\partial \gamma}$</td>
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<tr>
<td>(A8) $\frac{\partial b^\ast (e)}{\partial \gamma}$</td>
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<tr>
<td>(A9) $\frac{\partial s^\ast (e)}{\partial e}$</td>
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<tr>
<td>(A10) $\frac{\partial b^\ast (e)}{\partial e}$</td>
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Table 3: Comparative Statics (see Lemmata A1 - A10)
A2 Model Specification: Properties of the Function $f(\cdot, \cdot)$

In the following, we explore the properties of the utility associated with inequality for the specification introduced in Section 4. We discuss inequality aversion with $\alpha = 2$ and competitiveness with $\alpha = 3$.

A2.1 Inequality Aversion

We investigate a somewhat more general specification of (10):

$$f(\omega, \Omega) = \left( \frac{1 - \frac{\omega}{\Omega}}{1 + \mu \frac{\omega}{\Omega}} \right)^2, \ 0 < \mu \tag{A22}$$

Here a reduction in $\gamma$ but also an increase in $\mu$ lower the splay of the disutility function. Moreover, the function’s inflection point (see below) is shifted to the left, thereby reducing mainly the sensitivity people with an above-mean income-and-wealth combination to deviations from the mean.

**Property 1:** $f_\omega < 0$ for $\omega < \Omega$ and $f_\omega > 0$ for $\omega > \Omega$.

**Proof:** Obvious.

**Property 2:** Under (A22), $f(\omega, \Omega)$ is concave for $0 < \omega < \Omega$, convex for $\Omega < \omega < \tilde{\omega}$ and concave for $\tilde{\omega} < \omega$ where

$$\tilde{\omega} = \frac{1 + 3\mu}{2\mu} \Omega \tag{A23}$$

**Proof:** Immediate from the second derivative of $f(\omega, \Omega)$ with respect to $\omega$.

**Property 3:** Let $0 < d < \Omega$. Then $f(\Omega - d, \Omega) > f(\Omega + d, \Omega)$.

**Proof:** Under (A22),

$$\left( \frac{1 - \frac{\Omega - d}{\Omega}}{1 + \mu \frac{\Omega - d}{\Omega}} \right)^2 - \left( \frac{1 - \frac{\Omega + d}{\Omega}}{1 + \mu \frac{\Omega + d}{\Omega}} \right)^2 = \left( \frac{d}{(1 + \mu)\Omega - d} \right)^2 - \left( \frac{-d}{(1 + \mu)\Omega + d} \right)^2 > 0 \tag{A24}$$

A2.2 Competitiveness

Now we explore:

$$f(\omega, \Omega) = \left( \frac{1 - \frac{\omega}{\Omega}}{1 + \mu \frac{\omega}{\Omega}} \right)^3 \tag{A25}$$

**Property 4:** In the competitive case $f_\omega < 0$ for $\omega < \Omega$ and for $\omega > \Omega$ with $f_\omega(\Omega, \Omega) = 0$.

**Proof:** Immediate from the derivative of $f(\omega, \Omega)$ under (A25).

**Property 5:** Under (A25), $f$ is concave for $0 < \omega < \tilde{\omega}_1$, convex for $\tilde{\omega}_1 < \omega < \tilde{\omega}_2$ and concave for $\tilde{\omega}_2 < \omega$ where
\[ \hat{\omega}_1 = \Omega \]
\[ \hat{\omega}_2 = \frac{1 + 2\mu}{\mu} \Omega \]  

**Proof:** Obtained by taking the second derivative of \( f(\omega, \Omega) \) and finding the inflection points \( \hat{\omega}_1 \) and \( \hat{\omega}_2 \).

**B European Social Survey (2016)**

The following two figures present average attitudes towards incentivization and income differences across European countries. The underlying data was taken from the European Social Survey (2016). The histograms indicate the percentage of those who agree or disagree with the statement presented above the panels. Specifically, “agree” sums those who answer either “agree strongly” or “agree” while “disagree” combines those who reply “disagree” and “disagree strongly”. Those who answer “neither agree nor disagree” are omitted. Notice that the questions are formulated as mirror-images of one another. “Agreeing” with the statement that large income differences are acceptable is likely to entail “disagreeing” with the idea that differences in income should be small. Accordingly, the red (blue) columns represent attitudes (dis)favouring equality. The correlation between the blue columns in the two graphs as well as that of the red columns is surprisingly identical, at 0.66, thereby indicating that they capture similar values.

Figure 5: Attitudes towards Incentivization
"For a fair society, differences in standard of living should be small."

Figure 6: Attitudes towards Income Differences

References


Charness, G. and M. Rabin (2002). Understanding social preferences with simple tests. The


European Social Survey (2016). ESS Round 8 Data. Data file edition 2.0. NSD - Norwegian Centre for Research Data, Norway, Data Archive and distributor of ESS data for ESS ERIC.


