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Other-Regarding Preferences and Incentives in the Societal Context*

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Abstract

The article is concerned with understanding the impact of social preferences and wealth inequality on aggregate economic outcomes. We investigate how different manifestations of other-regarding preferences affect incentive contracts at the microeconomic level and how these in turn translate into macroeconomic outcomes. Increasing the workers' sensitivity to inequality raises effort and reduces wage costs for poor but not necessarily for rich workers. A parameterized version of the model roughly mimicking relevant key features of the industrialized world shows that, at the general equilibrium, increased initial wealth differences raise aggregate profit and output but entail distributional utility losses and increased inequality.

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

Keywords: other-regarding preferences, incentives, general equilibrium, inequality, wealth, income, inequality aversion, competitiveness

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1 Introduction

There is plenty of evidence that people care not only about their own material well-being, but consider also interactions with fellow human beings and tend to compare themselves to others. The microeconomic literature has long recognized this fact and studied the impact of social preferences on labor relations particularly in the context of income comparisons within firms (see the literature discussion below). Most of this literature indicates that the presence of envy and inequity aversion raises the workers' responsiveness to incentive pay. However, typically it also tends to raise labor costs and hence, under the optimal contracts, reduces effort, output, and welfare. Our paper reconsiders these results in the societal context, where other-regarding preferences are manifested by an individual's relative position within the *aggregate* income and wealth distributions (see, e.g., Clark et al. (2008), Clark and D'Ambrosio (2015)). In the macroeconomic context, incentives implied by such social preferences depend also on an individual's employment status. We investigate whether this additional channel fundamentally affects the aforementioned results.

Empirically the extent to which people care about inequality differs across societies and income levels (see, e.g., Lü and Scheve (2016), Osberg and Smeeding (2006) as well as our analysis related to the European Social Survey (2016) in Appendix B). Reflecting this evidence and combining micro- and macroeconomic perspectives, we therefore investigate how different manifestations of societal other-regarding preferences affect incentive contracts at the microeconomic level (partial equilibrium) and how these in turn translate into *aggregate* outcomes such as output, welfare, and income distribution (general equilibrium). Our main findings imply that the aforementioned results found at the microeconomic level do not generalize to the societal level. In the presence of initial wealth differences, other-regarding preferences tend to reduce labor costs and increase equilibrium effort, thereby raising aggregate profit and output. While our main focus is on positive rather than normative implications, we nevertheless comment that the aforementioned findings come at the expense of a welfare loss.

Our analysis is carried out within a static single-good general-equilibrium model. Consistent with the extensive evidence provided, among others, by Piketty (2014), our model economy is populated by individuals who differ in their initial wealth. To single out the role of other-regarding preferences, we assume that otherwise these individuals are inherently identical. Specifically, they are self-centered, caring 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)).¹

We consider economies that are either populated by *inequality averse* or *competitive* individuals.² In both cases, those whose income and wealth fall short of the economy's average incur disutility (e.g., due to envy) and are hence referred to as *inferiority averse*. If the population is inequality averse, individuals with above-average income and wealth too incur disutility (e.g., due to empathy) and are therefore *superiority averse*. However, in a competitive population,

¹The definition of the poverty line in terms of the median income reflects a similar notion.

²We prefer the term "inequality" to "inequity" because the former does not entail a value judgement. In addition, we find that the notion of "competitiveness" captures best the preferences we describe in the sequel.

above-average income individuals enjoy their advantage and are *superiority seeking*. This classification reflects the consensus that, at the personal level, people tend to have a distaste for earning less than others (for early evidence see, e.g., Mui (1995) and Vecchio (2000)). However, the empirical results regarding advantageous inequality are inconclusive (see, e.g., Loewenstein et al. (1989), Lü and Scheve (2016), and Card et al. (2012)), hence we allow for both attitudes. In the spirit of Corneo (2001) and Alesina et al. (2004), an inequality averse society might reflect the respective social attitudes typically found in European countries whereas the alternative case may be associated with the “competitive” American society.³ Further, we endogenize the asymmetry typically attributed to inequality aversion, whereby falling behind is worse than forging ahead (see, e.g., Fehr and Schmidt (1999)). Specifically, a given income difference turns out to have a larger impact on an individual whose wealth and income is below the societal average than it has on his ‘rich’ peer. This feature is also consistent with our findings based on the European Social Survey (2016), which indicate that the tolerance towards income inequality is rising in income (see Table 5 in Appendix B).

Our preference structure implies that, in the context of the labor market, workers consider their standing in the societal income and wealth distribution under any employment status. Consequently, the income loss associated with becoming unemployed affects an individual’s wellbeing not only directly but also through the associated deterioration in societal standing, thereby endogenizing the outside option. This feature differs from the approach to the outside option in studies investigating social comparisons within firms. There, such comparisons are relevant only as long as workers are employed and hence the outside option is typically assumed exogenous. Consequently, in our model, the well-known *inequality premium* incurred by employers due to their workers’ other-regarding preferences tends to turn into a discount on wage costs.

Labor relations in our setup are subject to moral hazard and emerge from the interaction between a profit-maximizing firm operating a technology that requires only labor as an input.⁴ Due to the presence of moral hazard, incentives are aligned using an effort-related signal. Under the given preference structure, the aforementioned incentive contracts depend on the economy’s average income, which is in turn generated by the very same contracts. In the general equilibrium, both must coincide.

The analysis follows several steps. We begin by setting up the economic environment. We then characterize the optimal incentive contracts and derive the partial-equilibrium impact of variations in the intensity and type of the other-regarding preference on them. For instance, unlike former agency models, we find that, the fixed payment affects the other-regarding part of an individual’s preferences through his societal standing. As a result, in addition to the well-established incentive effect of variable pay, the fixed wage also impacts effort. In particular, it turns out to always have a disincentive effect for individuals with below-average income and wealth while the effect may go in either direction for those above average.

³Bénabou and Tirole (2006) invoke a similar illustration for their model economies’ equilibria. In their case, the “American” equilibrium is obtained when people believe that effort and rewards are strongly linked whereas the “European” equilibrium emerges when people are more pessimistic.

⁴For simplification and in order to solely focus on the impact of wealth inequality, we abstract from the existence of capital and consequently also from the distinction between owners of capital and labor. For further discussion, see Section 7.

Next, we introduce functional specifications of the economic environment used in the sequel for a numerical analysis of the general equilibrium. This enables us to gain further intuition on the contract-setting mechanism. Specifically, we illustrate that, at the partial-equilibrium level, inducing any given level of effort becomes less costly, the more inferiority averse or superiority seeking workers are.

We then perform numerical analyses of the economies' general equilibrium under the respective functional specifications. It turns out that the results obtained are closely affined to those derived at the partial-equilibrium level for the general setup. This suggests that the conclusions drawn from the numerical analyses are applicable to a broader set of specifications. The numerical experiments allow us to identify how the aforementioned feedback effects between individual decisions and economy-wide values manifest themselves in the equilibrium income distribution.

The specific parameter values used in the numerical analyses are chosen to roughly mimic some key features of industrialized economies regarding wealth distribution, the ratio between wealth and income, and the labor share. Using these parameters, we study how varying the wealth distribution, the intensity of the workers' other-regarding preference as well as its type affect the economic outcomes.

In the presence of inequality averse individuals but absent initial wealth differences, our model results basically resemble those obtained in the microeconomic literature, whereby envy causes wage costs to increase and, as a result, aggregate profit and output to decrease. However, introducing wealth differences changes the picture dramatically. While the basic mechanisms at the micro level are still similar, the aggregate outcomes turn around. Specifically, at the partial-equilibrium level, the presence of envy strengthens incentives for the poor while empathy reduces incentives for the rich. At the general-equilibrium level however, inequality in the initial wealth distribution *reduces* wage costs of the poor workers. In fact, because of their disadvantageous social standing, in equilibrium 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, the expected inequality in the wealth and income distribution is exacerbated. On the other hand, since the number of the poor outweighs that of the rich, aggregate output and profit in the inequitable economy are higher than that of the equitable one. However, the presence of wealth inequality causes both the poor and the rich to incur utility losses.

In an economy populated by competitive individuals, when initial wealth is not evenly distributed, both the poor and the rich earn lower expected wages but nevertheless exert higher effort levels compared to the analogous outcomes with equitable initial wealth. Consequently, in this case too larger wealth inequality entails higher aggregate output and profit. Not surprisingly, with competitive preferences, in expectation the rich earn more than the poor. The latter again incur utility losses whereas the rich enjoy the inequitable wealth distribution *per se*. Finally, we find that increasing the workers' sensitivity to inequality increases all of the foregoing effects in both economies. Altogether, in our model, the presence of societal other-regarding preferences entails *more* inequality.

The structure of the paper is as follows. The next section discusses related literature. Section 3 presents the various features of the model. Section 4 introduces the optimization problems of the players, defines the equilibrium, and discusses some comparative-statics results at the partial-equilibrium level. The functional specification of the model and graphical presentations of its implications are the subject of Section 5. Section 6 focuses on the general equilibrium by presenting numerical experiments and their implications while Section 7 discusses the results and concludes.

2 Related Literature

Our analysis extends the literature on other-regarding preferences and that on the macroeconomic effects of income inequality. In the following, we briefly review some of the contributions that are of particular relevance to our paper.

By now, it is well established that individuals' actions and behaviour are not independent of those of their fellow human beings. In particular, people care about their relative income position and tend to compare themselves to others. This has been demonstrated empirically as well as by lab and field experiments in social and work settings (see, e.g., Camerer (2003) or Fehr and Schmidt (2006) for broad overviews of experimental evidence and Breza et al. (2017) for a recent workplace study).⁵ These findings have also their theoretical counterparts. Typically, models of other-regarding preferences retain the assumption that people are self-centered. That is, individuals are assumed to be interested in their own material payoff also in relation to that of others but do not care *per se* about inequity. In this vein, Goranson and Berkowitz (1966), Rabin (1993), Berg et al. (1995), Fehr et al. (1998), Charness and Rabin (2002), or Falk and Fischbacher (2006) focus on the reciprocity between individuals' behavior and that of others, invoking in particular the concept of "fairness". Akerlof and Yellen (1990) introduce the idea of "relative deprivation" and the associated notion of fairness and discuss their effects on relative pay comparisons.

Of particular relevance to the current paper is the seminal work by Fehr and Schmidt (1999) which associates "fairness" with "equity". Focusing on bilateral comparisons, individuals are assumed to care about the difference between their own payoff and that of their peers, where any deviation from the equitable income distribution induces utility loss. In this and most ensuing models, disadvantageous inequality is assumed to have the stronger impact on utility. The latter is also in line with findings from the psychology and management science literature on the "equity theory", indicating that people are more tolerant towards advantageous inequality in comparison to a disadvantageous one (see, e.g., Huseman et al. (1987) and Sauley and Bedeian (2000)). The bilateral comparison setting of Fehr and Schmidt (1999) is replaced in Bolton and Ockenfels (2000) by an environment where individuals care about their *relative* payoff standing. This aspect, as well as the specification of the equal payout division as the reference point, are features adopted also in our setup.

⁵The notion that individuals care about their pay relative to others exists not only in economic thought but has a long tradition also in related disciplines such as psychology, sociology, and organizational behavior. See Breza et al. (2017) and the references therein.

Fairness concerns have important implications for standard incentive theory since performance pay is likely to affect an individual’s relative income position. In this context, several studies have fruitfully incorporated the above-mentioned preference features into classical contract-theoretic settings (see Köszegi (2014) for a review of the research in behavioral contract theory). In the moral-hazard context, much of that work has revisited the effectiveness of different types of performance pay in the presence of other-regarding preferences, in particular envy or inequity aversion in the sense of Fehr and Schmidt (1999). In these environments, the focus is typically on agency relationships within firms, where workers compare their income with that of co-workers or their boss.⁶ Overall, this literature indicates that both envy and the joy of outperforming make incentive pay more effective while the opposite is true for empathy. Nevertheless, when workers suffer additional disutility due to their social preferences, it generally becomes more costly to induce participation. In particular, a so-called *inequity premium* must be paid to compensate workers for the expected disutility from pay-inequity. To lower variability in payoffs, principals then typically respond by reducing the optimal incentive pay and, consequently, contracts induce lower effort, thereby reducing output and profit.⁷ These results extend to environments where envy is the dominant factor also if individuals enjoy outperforming their peers, e.g., have status concerns or are “competitive”.

The role of other-regarding preferences has been addressed also in general-equilibrium and macroeconomic settings. Three decades ago, the macroeconomic literature has used the idea that people’s utility depends also on their consumption relative to the economy’s average in order to resolve several asset-return related “puzzles”. Specifically, Abel (1990) showed that using this feature in an otherwise “neoclassical” setting breaks the link between the risk-aversion parameter and the elasticity of intertemporal substitution. For similar reasons, Michaillat and Saez (2019) introduce wealth as a marker of social status into the utility function in a New Keynesian setting. Using a static environment, Dufwenberg et al. (2011) study whether the presence of other-regarding preferences affects the validity of the well-known welfare theorems in otherwise classical frictionless economies.

More closely related to our paper is the work of Hopkins and Kornienko (2006, 2009, 2010). These papers study economies in which an individual’s wellbeing depends on his or her status, or rank, within a society. Similar to our results, in their models, less egalitarian societies produce higher aggregate output than more equitable ones, in which individuals are more similar regarding their initial endowments. This obtains because, in less egalitarian societies, competition for status becomes difficult so that people divert fewer productive resources solely for the purpose of improving their social standing (e.g., reduce conspicuous consumption and increase growth-enhancing investment). In our world with other-regarding preferences, increased initial inequality also induces a higher aggregate level of productive effort. However, it does so not

⁶These studies include work on horizontal and vertical social preferences as well as individual, joint, and relative performance pay. See, for example, Itoh (2004), Grund and Sliwka (2005), Demougin et al. (2006), Dur and Glazer (2008), Kräkel (2008), Bartling and von Siemens (2010), Englmaier and Wambach (2010), Neilson and Stowe (2010), or Bartling (2011). Furthermore, von Siemens (2012) extends social comparisons beyond the boundaries of the firm in an adverse-selection environment.

⁷Exceptions are, for example, relational incentive contracts (e.g., Kragl and Schmid (2009), Kragl (2015)) or settings, where agents have financial constraints or limited liability (Demougin and Fluet (2003)). In these cases, the incentive effect of envy may lead to overall reduced agency cost.

by reducing socially “wasteful” private actions but rather by driving those who try to improve their societal position. Kölle et al. (2016) also consider initial wealth differences within a joint-output setting with inequality averse agents. In this environment, it turns out that appropriately increasing wealth inequality is beneficial to both parties.

Finally, complementary to our work, Upton (2019) investigates employment relationships characterized by moral hazard with ex-ante identical individuals while Demougin and Upton (2019) study an analogous environment with differently productive workers. Similar to our setting, in both models relative income concerns occur in the societal context, where the workers’ reference point is endogenously determined by the labor market equilibrium. However, different from our study, other-regarding preferences are relevant only when workers fall behind the societal average income. In Upton (2019) the workers’ inferiority aversion decreases the equilibrium average wage and ex-post inequality, as is the case in our setting when workers are ex-ante identical, i.e., when there is no initial wealth inequality (see Table 2). Demougin and Upton (2019) find that the aversion to falling behind may reduce the incentive pay needed to implement effort for low-productivity workers, thereby generating higher respective profits. This is in line with our results, where poor inferiority averse workers are concerned. In fact, a fundamental channel through which these results arise in both settings is the endogeneity of the workers’ outside option. Specifically, in the societal context, workers’ inferiority aversion has a smaller disutility impact under employment than when rejecting the contract. This relaxes their participation constraint, making them cheaper to employ. The foregoing discussion demonstrates that different sources of heterogeneity may trigger similar outcomes under similar circumstances. However, we show below that broader social preference specifications entail further societal effects.

3 The Model

We consider a static single-good economy with informational asymmetries and other-regarding preferences. The economy is populated by a measure-one continuum of individuals (agents) with identical preferences. These individuals may be either “rich” or “poor”, denoted respectively by $i = R, P$, with a commonly known initial wealth w_i , where in general $w_R > w_P$. The rich and the poor constitute, respectively, a fraction λ_R and λ_P of the population (where $\lambda_R + \lambda_P = 1$). Accordingly, the weighted average wealth is given by:⁸

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

Clearly, by definition, the rich possess above-average and the poor below-average initial wealth.⁹

⁸In the sequel, we will use the term “average” for all expression of the form:

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

⁹In the remainder, we use the term “worker” in the context of the labor market. To simplify, we use the male pronoun. Moreover, lower-case letters denote variables related to individual characteristics and decisions; they are accordingly indexed. Whenever we consider generic workers, we omit individual indexation. Upper-case letters stand for societal averages which are therefore taken as given by the workers and the firms.

To simplify, there is a single firm in the economy, evenly owned by all individuals.¹⁰

3.1 Preferences

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

All individuals participate in the labor market and may be either employed or unemployed. Employed workers exert effort e at an increasing and convex cost $c(e)$ with $c(0) = c'(0) = 0$, where both effort and its cost are non-verifiable. An employed worker receives a wage income y whereas unemployed workers obtain an income-equivalent utility benefit u . Independent of their employment status, all workers obtain an identical profit π . Let $\omega(\hat{y}, \pi, w, \hat{u}) = \hat{y} + \pi + w + \hat{u}$ denote a generic worker's total ex-post gross income-equivalent utility (where, $\hat{y} = 0$ for the unemployed and $\hat{u} = 0$ for the employed). In addition, individuals observe the average ex-ante societal wealth W , the average ex-post wage income Y and profit Π . We denote by $\Omega = Y + W + \Pi$ the societal average ex-post wealth.

Workers' utility depends on $\omega(\cdot)$ as well as on their relative position in the respective societal distribution as follows:

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

In the above, the *inequality-preference* function $f(\cdot, \cdot)$ represents the other-regarding part of the utility which is assumed to depend on the worker's own ex-post wealth *and* on the corresponding societal average.¹¹ The coefficient γ measures the worker's sensitivity to inequality (referred to henceforth as the *sensitivity parameter*) and is assumed to be non-negative. Notably, individuals are affected by their social preference also when unemployed. 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 person is unemployed.

Our formulation of social income comparisons deviates from the well-known agency models with other-regarding preferences. The latter typically use absolute bilateral income differences to represent workers' interpersonal comparisons in the sense of Fehr and Schmidt (1999). By contrast, we assume that workers care about economic inequality by taking into account deviations of ω from its societal mean Ω . This reflects our focus on the impact of other-regarding preferences within an entire economy, whereby the economy-wide average serves as a plausible reference point (see Clark et al. 2008 and the discussion in Section 7).

The function $f(\cdot, \cdot)$ is assumed to be twice continuously differentiable and may represent

¹⁰The latter assumption allows us to focus on wealth as the only source of inequality. An alternative to the single-firm assumption could have the economy populated by a countable number of firms, each employing a representative sample of workers. Even if allowing for within-firm comparisons in such a setting, our results would be unaffected because the within-firm reference point would be identical to the societal one.

¹¹Notice that, the inequality-preference function f depends only on observable, thereby excluding effort and its cost, which are private information. While this is clearly a simplifying assumption, we believe that, in the societal context, comparing gross rather than net payoffs is reasonable.

two different types of other-regarding preferences; (i) inequality aversion and (ii) what we call “competitiveness”. In case (i), workers dislike deviations from the societal average in any direction, e.g., due to envy or empathy. In case (ii), workers also suffer from downward deviations from the societal average but derive pleasure from outperforming the average.¹² In the sequel, wherever appropriate, we refer to workers who fall behind as *inferiority averse* while workers who outperform are *superiority averse* in case (i) and *superiority seeking* in case (ii).¹³ 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.

For illustration, in Figure 1 we plot both types of inequality preference for the specification introduced in Section 5. Panel (a) represents case (i), hence inequality aversion, and panel (b) case (ii) of competitiveness.¹⁴ Each panel shows the other-regarding element $\gamma \cdot f(\cdot, \Omega)$ as a function of total income and wealth (henceforth, for simplicity, referred to only as ‘income’), ω . Two sensitivity parameters γ are represented, with the lower value shown by a dashed (green) and the higher by a solid (red) curve, where the latter naturally implies a stronger impact of inequality.

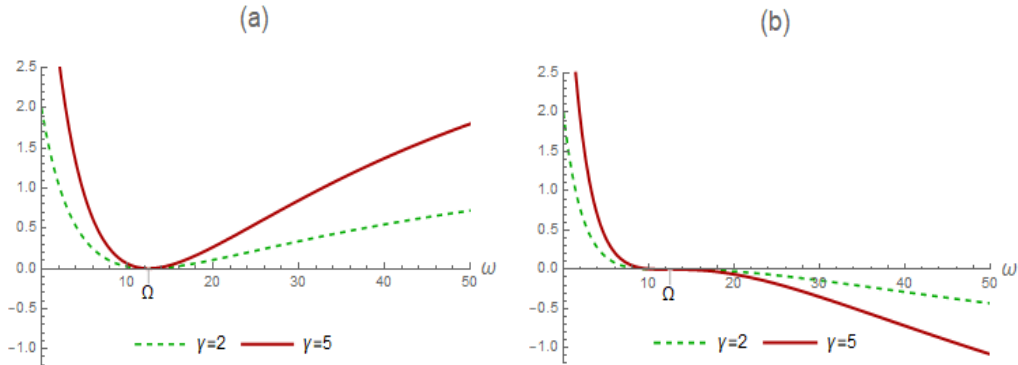


Figure 1: Disutility Function $\gamma \cdot f(\omega, \Omega)$ under (a) Inequality Aversion and (b) Competitiveness

Panel (a) shows that *any* deviation from the societal average wealth Ω (here at 12.5) leads to a utility loss and that an upward deviation of ω is less harmful than an equivalent downward deviation, thereby endogenizing the exogenous parametrization used by Fehr and Schmidt (1999). 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 societal average and are initially increasingly empathetic. However, as income becomes very high, the marginal impact of empathy starts decreasing. Technically, the

¹²That is, case (i) resembles the preferences proposed by Fehr and Schmidt (1999). In their model, preferences similar to our case (ii) would emerge if, in addition to a positive propensity for envy ($\alpha > 0$), a negative empathy parameter ($\beta < 0$) is assumed.

¹³We 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. We do not believe that, at the societal level, either type of preference is relevant.

¹⁴For the functional form and the parameters, see Section 5.

disutility function thus possesses an inflection point, henceforth denoted by $\hat{\omega}$, to the right of Ω (see Appendix A2).

For the competitive case in panel (b), people whose income falls short of the societal average incur a utility loss while those above the average enjoy utility gains.¹⁵ At the societal average Ω , 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.

Summing up the above, we formalize case (i) by Assumption 1.

Assumption 1 *To represent inequality aversion, the function $f(\cdot, \cdot)$ satisfies (i) $f(\omega, \Omega) > 0$ 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 Assumptions 1 and 2, we further assume that if the respective $\hat{\omega}$ is finite, $f_{\omega\omega}(\omega, \Omega) < 0$ or $f_{\omega\omega}(\omega, \Omega) > 0$ respectively for $\omega > \hat{\omega}$. This feature too is present in our specification below.

3.2 Production, Information Structure, Contracts, and Timing

Provided a worker becomes employed and exerts non-observable effort e , he produces an individual non-verifiable output $v(e)$ with $v'(\cdot) > 0$, $v''(\cdot) < 0$. In the process of his work, the worker stochastically generates an effort-related 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 firm observes the type of the worker, “rich” or “poor”, and offers incentive contracts accordingly.

The timing is as follows. (i) Workers seek employment with the firm. (ii) The 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 wage and b_i a bonus to be paid if $\delta_i = 1$. (iii) The worker decides whether to accept the contract or reject it. In the latter case, the worker is unemployed, obtains the utility benefit u , and contributes nothing to the firm’s profit. (iv) If the worker accepts, he

¹⁵Recall that the inequality-preference function enters the workers’ utility function with a negative sign.

chooses effort e_i . (v) The performance signal δ_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 $v(e_i) - y_i$. (vi) Finally, the profit is evenly distributed among all workers (including the unemployed).

A remark on the assumed informational structure is in order. As shown below, an individual's wealth affects his outside option. Consequently, the firm observes the workers' wealth, infers their respective outside option, and adjusts the contract accordingly.¹⁶ We believe that, in this sense, our assumption parsimoniously captures real-world situations. For example, a person observed to belong to higher social echelons (wealth in our context) is also likely to have better social connections, thereby improving his or her outside options and bargaining position.

4 Optimization Problems and Equilibrium

In this section, we present the workers' and the firm's optimization problems, generating the optimal type-dependent contracts, the corresponding effort levels and firm profits. We carry out some comparative-statics analyses at the partial-equilibrium level. Then we define the general equilibrium arising from the interaction between the workers' and the firm's decisions and the economy-wide outcomes they generate.

4.1 The Worker's Problem

Provided that a worker of type i has accepted the contract (s_i, b_i) and for given societal average ex-post wealth, $\Omega = Y + W + \Pi$, and given per-person profit, π , he chooses effort e_i to maximize the respective expected utility:

$$e_i = \arg \max_{\hat{e}_i} \begin{cases} s_i + p(\hat{e}_i)b_i + \pi + w_i - c(\hat{e}_i) \\ - [\gamma p(\hat{e}_i)f(s_i + b_i + w_i + \pi, \Omega) \\ + \gamma(1 - p(\hat{e}_i))f(s_i + w_i + \pi, \Omega)] \end{cases} \quad (3)$$

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. In the next two lines, the expression in the square brackets stands for the worker's (dis)utility from inequality, referred to in the sequel as *inequality term*. Under inequality aversion, this term is always positive and therefore implies a utility loss while, under competitiveness, it may either be positive or negative, i.e., either a utility loss or a gain. In evaluating this (dis)utility, the worker considers both possible ex-post relative wealth positions ($\delta_i = 0, 1$). 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.

¹⁶We thank Anja Schöttner and Jurjen Kamphorst for pointing out this issue. For further discussion and the implications of dropping the latter assumption see Section 7.

The incentive constraint is given by:

$$\begin{aligned}
0 &= p'(e_i)b_i - c'(e_i) \\
&\quad - \gamma p'(e_i)f(s_i + b_i + w_i + \pi, \Omega) \\
&\quad + \gamma p'(e_i)f(s_i + w_i + \pi, \Omega)
\end{aligned} \tag{IC}$$

The first line in equation (IC) coincides with the incentive constraint in moral-hazard settings with purely selfish preferences. The next two lines in (IC) emerge from the worker's inequality term. Specifically, for inferiority averse workers, they sum up to a positive number implying that any given bonus induces higher effort relative to the case of self-regarding workers, commonly known as the *incentive effect of envy*. The same holds for superiority seeking workers, but the opposite is true for superiority averse ones, where the latter feature is known as the *disincentive effect of empathy*. In addition, notice that also the fixed wage s_i appears in the worker's marginal inequality term. This implies that, apart from the bonus, also the fixed wage has an impact on the worker's optimal effort choice. We will elaborate on this in the following subsection (see Lemma 1).

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' sensitivity to inequality, γ , as indicated by $\frac{\partial s_i}{\partial \gamma}, \frac{\partial b_i}{\partial \gamma} \neq 0$ (see Lemmas A2 - A3 in the Appendix).¹⁷ We will further elaborate on the consequences of these features under the functional specifications in Section 5.3.

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

$$\begin{aligned}
&s_i + p(e_i)b_i - c(e_i) \\
&\quad - \gamma[p(e_i)f(s_i + b_i + w_i + \pi, \Omega)] \\
&\quad - \gamma[(1 - p(e_i))f(s_i + w_i + \pi, \Omega)] \\
&\quad \geq u - \gamma f(u + w_i + \pi, \Omega)
\end{aligned} \tag{PC}$$

Notice that the employment-status independent term $\pi + w_i$ appears on both sides of the above inequality and cancels out. Condition (PC) ensures that the worker is at least as well off by accepting the contract compared to rejecting it, thereby obtaining his outside option when becoming unemployed (fourth line). As mentioned above, also when unemployed, the worker experiences a utility loss (or gain) due to his other-regarding preference.

Given the foregoing remark, for $\gamma > 0$, the variables (s_i, b_i) 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 term 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' sensitivity parameter γ (see Lemmas A5 - A6 in the Appendix).¹⁸

¹⁷Table 4 in Appendix A1.4 summarizes the results of Lemmas A1 - A10 in their corresponding order.

¹⁸These lemmas also show that the impact of γ depends on the (γ, u) -combinations because these parameters have opposing effects on the workers' outside option.

4.2 The Firm's Problem

The firm also takes (π, Ω) as given. For each worker of type $i = R, P$, it designs a take-it-or-leave-it employment contract (s_i, b_i) so as to maximize the associated expected profit

$$\begin{aligned} \rho_i = \max_{s_i, b_i, e_i} & v(e_i) - s_i - p(e_i)b_i \\ \text{s.t.} & (PC), \end{aligned} \quad (4)$$

where e_i satisfies the workers' incentive constraint (*IC*). Denote by (s_i^*, b_i^*, e_i^*) the optimal incentive contracts that solve the firm's problem in (4). At that contract, the participation constraint is always satisfied and the contract is accepted by the worker.¹⁹

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 inequality term. For the inferiority averse and the superiority seeking, increasing the fixed payment algebraically lowers that term, reducing the loss of the former and raising the gain of the latter, thereby reinforcing the direct effect of s_i . By contrast, for the superiority averse, these two effects go in opposite directions, yet by assumption (see Section 3.1), 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 agency models with other-regarding preferences (see the respective literature cited in Section 2). In these models, the participation constraint typically binds because the fixed wage constitutes only a cost to the firm. In our setup, this is not obvious due to the fixed wage's impact on the incentive constraint.

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 wage then follows from the participation constraint. By contrast, as explained in the foregoing subsection, the fixed wage affects both conditions (*IC*) and (*PC*). Consequently, whether the firm will choose the contract so as to make the participation constraint binding, depends on the interaction of (*IC*) and (*PC*) via the worker's effort choice.

As a first step, the following lemma proven in Appendix 1.2 analyzes the impact of the fixed wage on effort along the (*IC*).

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*

¹⁹In principle, the expected profit ρ_i may become negative in which case the respective worker would become unemployed. As we have only two groups of workers, an entire societal group would be identically affected. For parsimony, we ignore this implausible case. Practically, in our numerical experiments below, profits are always positive.

persons with $\omega(s + b, 0) < \hat{\omega}$.

Notice that the results follow a straightforward intuition for all cases where a worker's total income and wealth are below the societal average as well as for those with "moderate" above-average income and wealth (i.e., below the respective inflection point $\hat{\omega}$). Notably, for all workers, the fixed wage has an impact on effort, i.e., it has either an *incentive* or a *disincentive effect*. Intuitively, low-income workers who receive a higher fixed wage suffer less from envy and are hence also less incentivized to earn the bonus. As a result, the fixed wage has a *disincentive effect*. Similarly, moderately rich superiority averse workers try to avoid becoming even richer and therefore reduce effort in response to a higher fixed wage. Analogously, when rich workers are superiority seeking, they try to increase their income even further and raise effort; for them, the fixed wage has an *incentive effect*. The intuition behind the remaining cases stems from the workers' very high income and wealth levels where income and wealth have a *declining* marginal effect on their respective inequality terms. For superiority averse workers, the marginal disutility of additional income is decreasing so that earning the bonus *reduces* their marginal loss due to empathy. Consequently, when they receive a higher fixed wage, they increase effort (*incentive effect*). The case of superiority seeking very rich workers is again analogous. Their joy of outperforming is declining at the margin. Accordingly, such workers reduce effort when obtaining a higher fixed wage (*disincentive effect*). We illustrate and further elaborate the foregoing in greater detail for the low- and intermediate-income level workers in Section 5.3.

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

Proposition 1 *At any given level of effort, 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 wage *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, in these cases, the marginal impact of the fixed wage on effort is likely to be too small to overturn its direct impact. This is what we find in our numerical exercises below. In the sequel, we hence only consider cases where the participation constraint binds.

The above has an important impact on the firm's expected wage cost. Given effort, to keep the participation constraint binding, the firm adjusts the worker's expected wage according to the difference between the inequality term when employed and the analogous term when unemployed (see (PC)). 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. As a result, in our setup, employing inferiority averse and superiority seeking workers is cheaper than hiring purely selfish ones. Similarly, superiority seeking workers experience an extra joy of being employed and hence they too want to avoid unemployment, allowing the firm to reduce wage costs. 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 where the result may be reversed.

Reflecting the above conclusions, the following formally characterizes the wage payments' responsiveness to the worker's sensitivity parameter when the participation constraint is binding.

Proposition 2 *For inferiority averse or superiority seeking workers and sufficiently low levels of u , at any given level of effort, an increased γ reduces both the fixed wage and the bonus required to satisfy the participation constraint.*²⁰

Proof. See Lemmas A5 and A6 in the Appendix. ■

The foregoing strongly differs from well-known agency models with other-regarding preferences in the within-firm context. To highlight the source of the difference, note that in the latter models, workers typically become ever more expensive to employ as inequality aversion increases. There, employers are forced to compensate workers for the increased expected disutility arising from interpersonal inequality. That compensation is referred to in the literature as *inequality premium* and equals the corresponding *inequality term*. In contrast, in our context, the inequality premium differs from the worker's inequality term. To clarify the difference, we rewrite (PC) as:

$$\begin{aligned}
s_i + p(e_i)b_i &= u + c(e_i) \\
&+ \gamma[p(e_i)f(s_i + b_i + w_i + \pi, \Omega)] \\
&+ \gamma[(1 - p(e_i))f(s_i + w_i + \pi, \Omega)] \\
&- \gamma f(u + w_i + \pi, \Omega)
\end{aligned} \tag{IP}$$

The first line in (IP) reflects the firm's expected wage costs that would emerge under purely self-regarding preferences. The next three lines represent the *inequality premium* in our model with other-regarding preferences. Specifically, the second and third lines contain the inequality term associated with the state of employment. This would be equivalent to the inequality premium in the agency literature. However, in our case, the inequality premium entails also the other-regarding related (dis)utility associated with unemployment and must hence be corrected appropriately. As shown in Subsection 5.3.3 below, the latter part in fact tends to reduce the inequality premium incurred by the employer relative to the inequality term alone.

4.3 Equilibrium

The various steps described above generate a feedback between the economy-wide characteristics that are taken as given by individuals and the firm and the underlying variables that both depend on and form these characteristics. In our context, a *rational-expectations equilibrium* requires that individuals correctly anticipate the values of the economy-wide variables that are generated by their expectations. Accordingly, we require these relationships to be consistent and thus define an equilibrium as follows.²¹

²⁰A formal bound \bar{u} sufficient to yield the result is derived in Appendix A1.3. Numerically it turns out that overturning the bound requires u to implausibly exceed the expected wage.

²¹Strictly speaking, the definition should have distinguished between population shares on the one hand and employment rates of poor and rich workers on the other hand. To avoid cumbersome notation, the definition already incorporates the full employment outcome of the model.

Definition 3 Given $w_R, w_P, \lambda_P, \lambda_R$, and the corresponding W , a rational-expectations type-dependent equilibrium consists of a tuple $(e_i, s_i, b_i, \rho_i, i = R, P)$ and a pair (π, Ω) such that:

(i) Given (π, Ω) and (s_i, b_i) , workers choose e_i by solving (IC).

(ii) Given (π, Ω) , expected profit ρ_i associated with the employment of a worker of type i obtain from (4).

(iii) Average wage income is:

$$Y = \sum_{i=R,P} \lambda_i (s_i + p(e_i)b_i) \quad (5)$$

(iv) Average profit is:

$$\Pi = \sum_{i=R,P} \lambda_i \rho_i \quad (6)$$

(v) Societal average ex-post wealth satisfies:

$$\Omega = Y + W + \Pi \quad (7)$$

(vi) Per-capita profit is given by:

$$\pi = \Pi \quad (8)$$

5 Model Specification

To gain further intuition on the mechanisms at the partial equilibrium, in this section, we specify a parametric environment in line with the underlying assumptions introduced above. In the following subsections, we use these specifications to graphically illustrate and discuss the contract-setting mechanism and the firm's cost of inducing effort under our inequality preference setting. The same specification is later employed in the numerical analysis presented in Section 6 below.

5.1 Production, Effort Costs, and Signal Generation

To simplify notation, individual indexation is omitted whenever appropriate.

Given effort e , a worker's individual contribution to output is:

$$v(e) = \theta \cdot e^\beta, \beta \in (0, 1), \theta > 0 \quad (9)$$

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

$$c(e) = -\ln(1 - e) - e \quad (10)$$

Note that the cost function is non-negative for any $e \in [0, 1)$ with an associated marginal effort cost of $c'(e) = \frac{e}{1 - e}$ so that $\lim_{e \rightarrow 1} c(e) = \lim_{e \rightarrow 1} c'(e) = \infty$. This guarantees that effort belongs to

the unit interval. Exploiting this feature, the probability that the firm detects a favorable signal is specified to be:

$$p(e) = e \quad (11)$$

5.2 Inequality Preferences

As explained above, workers care about their own income and wealth but also regard their economic standing relative to the economy's average. Rather than a difference, we specify as a measure of inequality the ratio between an individual's income and wealth and the corresponding societal averages (see Clark et al. (2008) and the model by Bolton and Ockenfels (2000)). We implement Assumptions 1 and 2 by the following inequality-preference function (for verification, see Appendix A2):

$$f(\omega, \Omega) = \left(\frac{1 - \left(\frac{\omega}{\Omega}\right)}{1 + \left(\frac{\omega}{\Omega}\right)} \right)^\alpha, \quad \alpha \in \mathbb{N} \quad (12)$$

In the above equation, the exponent α captures the type of preferences, whereby an even α reflects *inequality aversion* while an odd α represents the *competitive case*. We have used this functional form in Figure 1 in Section 3.1 above, with $\alpha = 2$ and $\alpha = 3$ for the respective preferences shown in (a) and (b). This preference representation is kept for all subsequent figures and the numerical experiments. Furthermore, in the figures, Ω is set at 12.5, thereby reflecting the equilibrium average societal wealth generated by the numerical experiments in Section 6.

Recall that the weight of the inequality-preference function in the worker's utility and hence his or her sensitivity to inequality is determined by the sensitivity parameter γ (see the utility function in (2)). To gain intuition on this feature, notice that γ affects the elasticity of a worker's "willingness to pay" for a change in the societal average wealth. Holding individual welfare constant, that elasticity is given by

$$\frac{d\omega}{d\Omega} \frac{\Omega}{\omega} = \frac{\gamma\alpha \left(\frac{1-\frac{\omega}{\Omega}}{1+\frac{\omega}{\Omega}}\right)^{\alpha-1} \frac{2}{\Omega} \left(1 + \frac{\omega}{\Omega}\right)^{-2}}{1 + \gamma\alpha \left(\frac{1-\frac{\omega}{\Omega}}{1+\frac{\omega}{\Omega}}\right)^{\alpha-1} \frac{2}{\Omega} \left(1 + \frac{\omega}{\Omega}\right)^{-2}}, \quad (13)$$

which is positive (implying a need to compensate in case of an increased average wealth) for both values of α as long as $\omega < \Omega$ and negative for $\alpha = 2$ if $\omega > \Omega$, but positive in the latter case for $\alpha = 3$ as long as γ is not excessively large. To gain some feeling concerning the importance of the other-regarding preferences, Table 1 reports the implied elasticity for the sensitivity parameter values of $\gamma = 5$ and $\gamma = 50$ used in our numerical experiments below, at the approximate values of Ω and ω for the poor and the rich obtained at the general equilibrium.

Accordingly, in an inequality averse economy, a 10% increase in average societal wealth requires a 3% increase in a poor persons's income or wealth to maintain his welfare at $\gamma = 5$, which rises to 8% at $\gamma = 50$. At the lower level of γ , the rich in this economy are barely willing to give up income in exchange for a reduced difference between their wealth and the societal average, but at the high γ value, they are willing to reduce their income by close to 9%. In a

competitive economy, the compensation required to placate the poor when the societal average wealth moves further away is somewhat lower. The competitive rich too need to be compensated for such a change to the extent of almost 3% at the higher value of γ .

	$\alpha = 2$		$\alpha = 3$	
	$\gamma = 5$	$\gamma = 50$	$\gamma = 5$	$\gamma = 50$
Poor	0.31	0.82	0.23	0.77
Rich	-0.05	-0.86	0.04	0.28

Table 1: Elasticity of Workers' "Willingness to Pay" for a Change in Societal Average Wealth

5.3 Incentive Contracts

As explained in Subsection 4.2, 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 graphs to gain an intuition on the contract-setting mechanism. Furthermore, the figures below illustrate the impact of the sensitivity parameter γ on the two constraints, holding effort fixed. As in Figure 1, all subsequent figures also represent the cases $\gamma = 2$ and $\gamma = 5$ by dashed (green) and solid (red) curves, respectively, distinguishing between the poor (a) and the rich (b). 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 4 in Appendix A1, to which we refer when appropriate.

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 constraints (thick) and participation constraints (thin), i.e., conditions (IC) and (PC) , for the two values of the sensitivity parameter. To isolate the impact of that parameter, all graphs hold effort fixed at its equilibrium value for $\gamma = 5$ derived in Section 6.2. Moreover, the economy's average profit and income also correspond to that equilibrium. It is important to note, however, that by changing γ the outside option changes as well. Thus, the intersection of the constraints for $\gamma = 5$ correctly reflects the equilibrium for that sensitivity parameter which is not the case for $\gamma = 2$ since the economy-wide equilibrium 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 $w_R = 40$.²² All figures correspond to parameter values of γ and u which fall in the associated lower ranges in that table. In the following, we discuss these figures in conjunction with the respective formal results presented in Lemmas A1-A10.

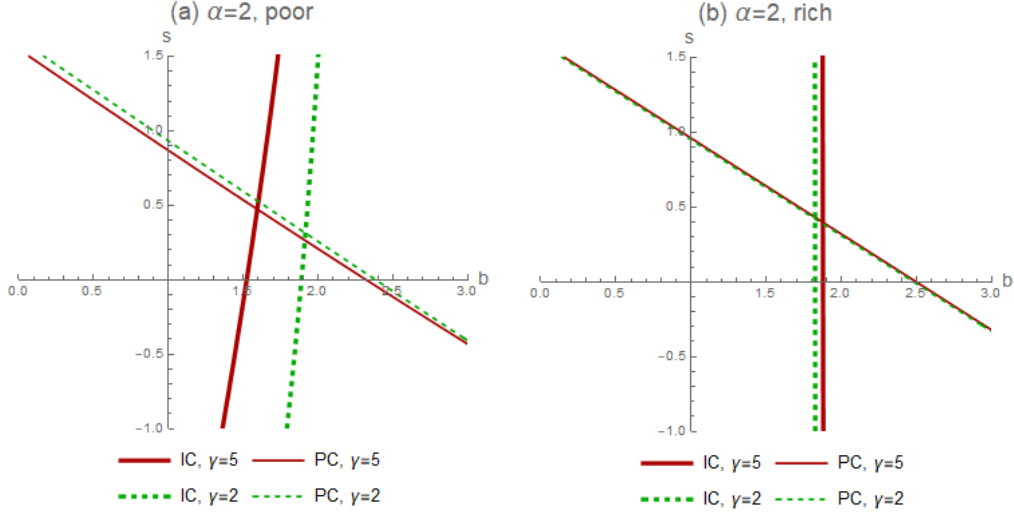


Figure 2: Incentive and Participation Constraints for Inequality Averse Workers

5.3.1 Inequality Averse Workers

Incentive Constraints

Turning first to the inferiority averse **poor workers** in Figure 2(a), the incentive constraints are upwards sloping. That is, both instruments can be used to affect the worker's effort choice. Intuitively, raising b increases the inferiority averse worker's expected utility directly as well as indirectly via the inequality term by lowering the envy felt in the state in which he obtains the bonus ($\delta = 1$). Ceteris paribus, this raises the worker's marginal reward and hence his effort. To countervail this positive effect, the fixed payment s needs to be raised due its *disincentive effect* (see Lemma 1). Such a move 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 weakened. Altogether, at a fixed effort, the two wage components are *complements*. This result is different from that usually found in the literature where variations in the fixed wage typically do not affect effort incentives and the incentive constraint would hence be vertical. The latter is not only true for agency models with purely self-regarding workers but also for well-known models using other-regarding preferences.

As to the impact of the sensitivity parameter γ , note that increasing it shifts the incentive constraint to the left. In this case, as noted in Subsection 4.1, there is an *incentive effect* often attributed to 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 needs to be reduced or, due to its disincentive effect, s needs to be raised. This emphasizes the dependence of (s, b) on γ in our context.

Next consider the superiority averse **rich workers** in Figure 2(b), for whom the incentive constraints are extremely steep.²³ This implies that it is essentially only the bonus that can

²²The choice of these values is explained below in Section 6. Note that while the initial wealth of the rich turns out to exceed the inflection point $\hat{\omega}$, the participation constraint is binding in all cases shown.

²³Consistent with the very high wealth exceeding the inflection point, the slopes are in fact slightly negative.

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 self-regarding workers, whose incentive constraints are vertical.

In contrast to the case of inferiority averse poor workers, the incentive constraint (very slightly) shifts to the right when the sensitivity parameter γ increases. Due to the *disincentive effect* associated with empathy, 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 firm needs to raise the bonus (since the fixed wage has a negligible impact).

Participation Constraints

For the **poor** inferiority averse, the participation constraints in Figure 2(a) are downwards sloping so that the fixed wage s and the bonus b are *substitutes*. Beyond the usual direct impact of the two payment modes, a higher bonus and a higher fixed wage also indirectly raise a poor worker's utility via the inequality term. Consequently, in comparison with purely self-regarding workers, the participation constraints become flatter in the (b, s) -space. In particular, in contrast to the bonus, the fixed wage reduces the envy-related disutility for *both* realizations of the signal. Therefore, the substitution ratio between b and s required to satisfy the (PC) , i.e., ds/db , is *lower* for $\gamma > 0$ than for $\gamma = 0$. Moreover, that ratio becomes even smaller as γ increases.

An increase in the sensitivity parameter γ shifts the participation constraint in panel (a) downwards. Intuitively, increasing inferiority aversion, *ceteris paribus*, raises the worker's disutility due to envy *both* when employed and unemployed but more so in the latter case, due to the low societal standing associated with it. That is, as γ increases, the worker's outside option becomes worse and his fear of getting unemployed increases. Consequently, the inequality premium is reduced (see equation (IP)). Accordingly, it becomes easier for the firm to make more inferiority averse workers participate. As explained in Subsection 4.2, this result contradicts the existing agency models where increased inequality aversion typically leads to higher inequality premia, thereby impeding workers' participation. The difference stems from the endogeneity of the workers' outside option in our societal setting, which stands in contrast to the exogeneity of that option, when social comparisons matter only within firms.

Turning to the superiority averse **rich** in Figure 2(b), the participation constraints are also downwards sloping. This is the case despite the trade-off between the direct and indirect impact of the two wage components on the expected utility of the rich under employment. While these workers directly enjoy a higher pay, they also dislike the associated greater inequality due their empathy. 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 inequality term. Moreover, in contrast to the poor, the participation constraints of the rich are steeper compared to the selfish case ($\gamma = 0$). Intuitively, for the rich, the fixed wage is less desirable because it implies the occurrence of empathy for both signal realizations. That is,

Accordingly, in this case, bonus and fixed become substitutes.

compared to the selfish case, the substitution ratio between b and s required to satisfy the (PC) is larger when $\gamma > 0$.

An increase in the sensitivity parameter γ shifts the participation constraint in panel (b) slightly upwards. Intuitively, increasing superiority aversion, *ceteris paribus*, raises the worker's disutility due to empathy when employed but less so when unemployed, thereby increasing the inequality premium. As a result, it becomes slightly more expensive to make these workers participate as γ increases. While this results resembles that found in existing agency models with inequality aversion, due to the endogeneity of the workers' outside option in our setting, the positive impact on the inequality premium is less pronounced compared to these models, where the outside option is fixed.

Optimal Contract

As noted in Subsection 4.2, the optimal contract inducing a given effort is determined by the intersection point between the two constraints. Therefore, for the **poor** inferiority averse, increasing their sensitivity to inequality seems to have countervailing effects on the optimal contract. For a given bonus, as we have seen above, a higher value of γ increases the wage payment required to induce a given effort but reduces the wage required to make the worker participate. The impact on the incentive constraint generally dominates. Accordingly, Figure 2(a) represents this property and the optimal contract implies a higher fixed wage but a lower bonus for $\gamma = 5$ relative to the $\gamma = 2$ -case when effort is held fixed.

For the **rich** superiority averse, an increase in the sensitivity parameter seems also to have an ambiguous impact on the optimal contract. A higher value of γ increases the bonus required to induce a given effort. Whether this allows a reduction in the fixed wage along the participation constraint depends on the extent to which this constraint moves up. Given its slight movement shown in Figure 2(b), the optimal fixed wage is reduced.

5.3.2 Competitive Workers

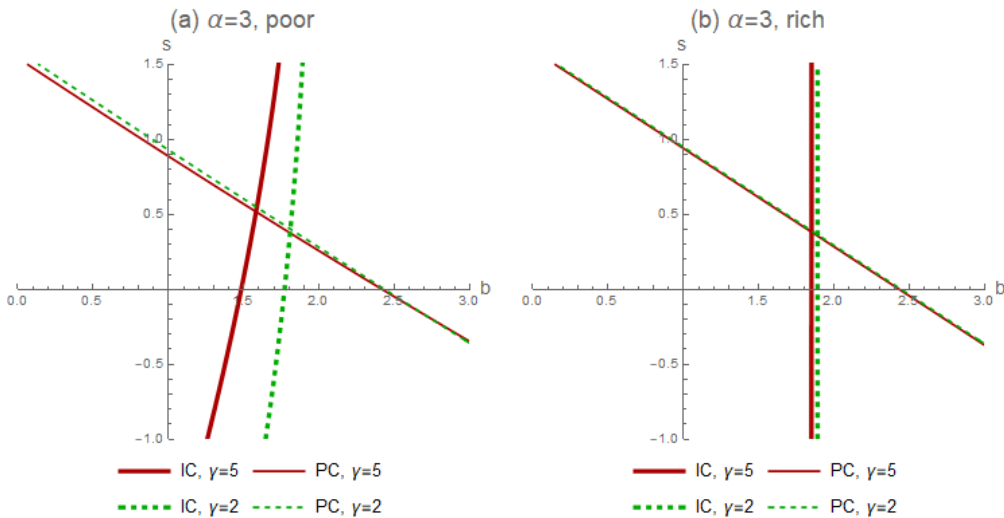


Figure 3: Incentive and Participation Constraints for Competitive Workers

Figure 3 shows the case of $\alpha = 3$. Note that **poor** competitive workers are inferiority averse which is analogous to their inequality averse peers. Consequently, qualitatively, all the features present in Figure 3(a) coincide with the equivalent case in Figure 2(a).

By contrast, the **rich** competitive are superiority seeking, i.e., derive utility from their advantageous position in the societal wealth distribution. Unlike the superiority averse, they hence enjoy both the direct and the indirect impact of the two wage components so that here the bonus and the fixed wage are *unambiguously* substitutes. Consequently, the **participation constraints** in Figure 3(b) are also downwards sloping but less so than in the $\gamma = 0$ -case. The intuition is analogous that discussed for the poor inferiority averse because, in either case, the desirability of the fixed wage is higher. The **incentive constraint** of the superiority seeking rich is very steep, reflecting the small impact of the fixed wage on their marginal utility due to their high initial wealth.

The impact of γ on the constraints of the **rich** strongly differs across the two preference types. Specifically, when increasing γ , 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, their inequality premium decreases, and it becomes easier to make the former participate. Moreover, it is also easier to incentivize them. Notice that hence competitive workers are easier to incentivize *regardless* of their initial wealth. We can therefore refer to an *incentive effect of competitiveness* more generally. Figure 3(b) also indicates the joint effect of γ on the **optimal contract** for the rich. Because of the dominance of the incentive constraint, the bonus decreases and the fixed wage increases.

5.3.3 Wage Costs

In this subsection, we discuss the firm's expected total wage costs of inducing different effort levels. Specifically, we demonstrate the impact of γ on these costs, depending on the workers' inequality preference and wealth. Figure 4 depicts the results, where the payments (s^*, b^*) satisfy the incentive and the participation constraints associated with different levels of e .²⁴ More specifically, the graph shows $s^*(e) + e \cdot b^*(e)$ for two values each of α, γ .

By the foregoing subsections, γ affects the pair (s^*, b^*) for a given effort level. Lemmas A7 and A8 in Appendix A1 indicate that the two components of the optimal contract move in countervailing directions.²⁵ Heuristically, the effect of γ on the optimal bonus dominates because both contract components are similarly present in the participation constraint, while the fixed wage affects the incentive constraint only through the inequality term. The figures below bear this heuristic out.

As expected, in all panels above, the wage costs are increasing in e .²⁶ The impact of the sensitivity parameter on these costs depends on the worker's preference and wealth type. For the poor in panels (a) and (c), increasing inferiority aversion clearly reduces their cost. This

²⁴That is, the pairs (s^*, b^*) correspond to the respective intersection points that would emerge in Figures 2 and 3 for various levels of e . In the graphs, we drop the asterisks.

²⁵For the direction of the movements of s and b , see Table 4 in Appendix A1. Recall that, for the superiority averse rich, the value of γ used in the figures is "small" in the sense of that table.

²⁶Lemmas A9 and A10 again indicate that increasing effort has countervailing effects on the optimal fixed wage and bonus. However, the first-order cost impact of increasing effort dominates.

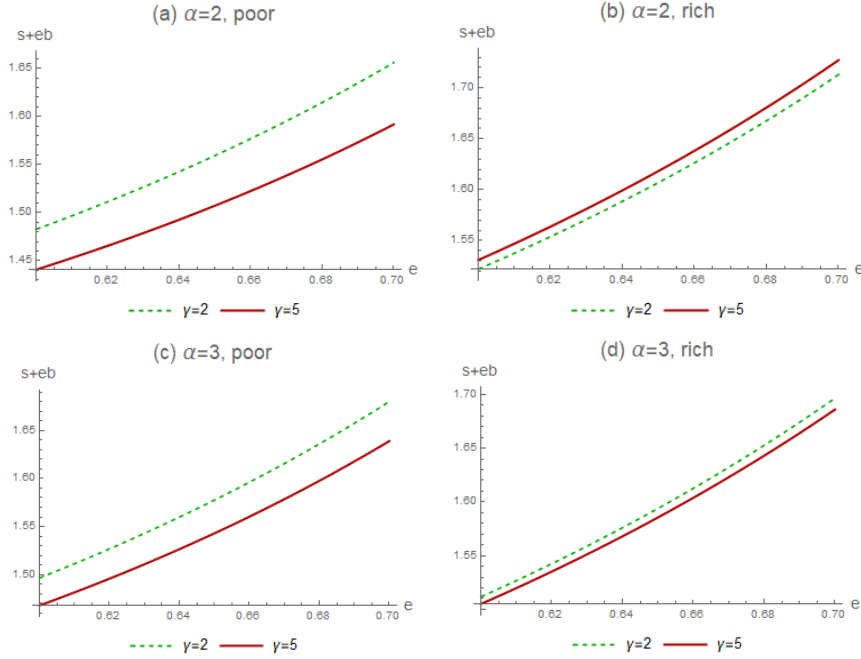


Figure 4: Expected Wage Cost for (a,b) Inequality Averse and (c,d) Competitive Workers

reflects the aforementioned incentive effect of envy as well the cost-reducing impact of γ on the inequality premium incurred by the firm. Similarly, the superiority seeking rich in panel (d) also become cheaper as γ increases, in this case due to the stronger incentive effect of competitiveness and their increased joy of income when employed. In contrast, a rich person who becomes more superiority averse, depicted in panel (b), becomes also more expensive to employ. First, the disincentive effect of empathy makes incentivization more costly. Second, due to a rich worker's increased compassion, the disutility associated with inequality is mitigated more strongly under unemployment than in the employment state, which increases his inequality premium.

Notice that Figures 4(b) and 4(d) are in line with the insights typically found in the existing literature, where however wealth differences are usually not considered; empathy raises a firm's motivational costs while competitiveness lowers them. By contrast, the results implied by Figures 4(a) and (c) contradict other static existent models with inequality averse or envious workers (e.g., Grund and Sliwka (2005) and Kragl and Schmid (2009)). In these models, typically there is a trade-off. As in our case, envy lowers the bonus required to induce some given effort. However, the inequality premium still increases in envy so that employing inferiority averse workers always comes at a cost to the firm. By contrast, as explained above, in our model, the inequality premium decreases in γ because the firm exploits the workers' increased disutility associated with being unemployed.

Altogether, the structure of the firm's expected wage costs naturally affects its optimization problem, given in (4). In particular, while the marginal benefit of effort is independent of the workers' wealth type, Figure 4 shows that both the wage level and the marginal wage costs do differ across workers. In the following section, we show that this feature affects the general-equilibrium optimal type-dependent effort levels induced by the firm and the ensuing output and profit.

6 Numerical Experiments

In this section, we turn to the general equilibrium. As there is no tractable solution to our model, we perform numerical experiments using the functional specifications introduced above. This allows us to compare various economic environments and their sensitivity to the type and intensity of other-regarding preferences and wealth distributions. The subsequent analysis highlights how the feedback effects between individual decisions and economy-wide values manifest themselves in the equilibrium income distribution. The close affinity between the results obtained below and those derived in Section 4 for the partial equilibrium suggest that the insights derived in the following are likely to extend also to other specifications of our economic environment.

In the next subsection, we explain the solution method, the parameter choice, and the experiments. The following subsection then reports the corresponding results for inequality averse and competitive economies.

6.1 Technique and Parameter Choice

We use Mathematica to numerically generate relevant equilibrium outcomes and test how they depend on the societal wealth distribution, the preference type α , and the sensitivity parameter γ .

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 λ_P , which together determine the corresponding societal average wealth W . Next, we turn to the agency problem between the firm 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 profit. In practice, we specify arbitrary initial values for (Y, Π) , set $\pi = \Pi$ and solve for the optimal contracts and the associated effort levels. The latter imply wage income y_P and y_R as well as expected type-dependent profits π_P and π_R . Using these values, we update the (Y, Π) pair and derive the new optimal contracts. This process is repeated until the difference between the initial and resulting values converges to zero. To sum, we are numerically solving a fixed-point problem, whereby the model maps (Y, Π) -pairs into themselves.

Our parameter choice tries 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 and 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 choice generates an average income (wages and profit) of about 2.5, thereby mimicking the ratio between average wealth and average income of 4 observed in Germany.²⁷

²⁷See 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>)

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 sensitivity parameter γ . The first value is set at a low level of 5 and the second value at a high level of 50. While the latter was chosen for the purpose of emphasizing the impact of the population’s other-regarding preferences on the variables of interest, the impact of intermediate values remains qualitatively similar. Notice however that, even at the higher of these values, the marginal utility of income remains positive. Finally, the value of the unemployment utility benefit $u = 1.2$ is chosen to generate an empirically plausible value for the labor share of 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 satisfy Proposition 2 (see Footnote 20).

Altogether, for an inequality averse and a competitive economy, we present seven scenarios that illustrate the impact of preference type and intensity as well as the wealth distribution. As a reference point, we show a purely self-regarding economy with $\gamma = 0$. The other-regarding cases are examined for both values of α separately. For each, we vary the population’s sensitivity to inequality γ as explained above but also the wealth distribution. Specifically, holding average wealth fixed, we consider an economy in which wealth is perfectly evenly distributed at $W = 10$ as well as an unequal economy where, in line with the aforementioned characterization, $w_P = 2.5$ and $w_R = 40$. The consideration of the two wealth scenarios allows us to disentangle the impact of the population’s other-regarding preference *per se* from that of wealth inequality. Moreover, it enables us to investigate the effect of a hypothetical, frictionless extreme wealth redistribution.

6.2 Results

Tables 2 and 3 below focus 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 low sensitivity parameter ($\gamma = 5$), and (iii) other-regarding workers with a high sensitivity to inequality ($\gamma = 50$). 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). A comparison of row (i) and the respective rows (a) identifies the impact of the other-regarding preference in isolation from that of wealth differences. The latter is captured by comparing the respective rows (a) with (b_P) and (b_R), 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, $s_i^* + e_i^*b_i^*$.²⁸ Further, we report the expected individual utility net of initial wealth. Given that there are no rents, that variable measures the difference between the workers’ total expected income (including the average equilibrium profit Π) and the effort costs as well as the expected (dis)utility arising from the

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. Accordingly, using the German data represent a moderate case of inequality and, in this sense, provides a certain “lower bound” for the effects discussed below.

²⁸Notice that all our experiments yield positive fixed wages so that imposing financial constraints on the workers would be inconsequential.

other-regarding preference. The latter is captured by the inequality term (see equation (3) and the ensuing explanation), which we also report separately under the column IT. Recall that a positive inequality term indicates a utility loss and a negative one a gain under employment. The column IP reports the inequality premium the firm has to pay in lieu of the other-regarding preferences. Thus, a negative inequality premium indicates in fact a *discount* on the firm's wage costs. We further report the general-equilibrium value of the expected contribution of worker i to the firm's profit, ρ_i^* . Finally, we report the economy-wide aggregate output, appropriately weighted from $v(e_i^*)$ as defined in Footnote 8.

6.2.1 Inequality Averse Economy

Table 2 summarizes the numerical results for an economy populated by inequality averse workers. In this and the following table results are rounded to two digits after the decimal point.

	Effort	Fixed	Bonus	Wage	Utility ^(a)	IT ^(b)	IP ^(c)	Profit	Output ^(d)
(i) Self-Regarding									
	0.65	0.39	1.86	1.60	2.02	0	0	0.82	2.42
(ii) Inequality Averse, $\gamma = 5$									
(a) $w_P, w_R = 10$	0.65	0.43	1.81	1.60	2.01	0.01	0.00	0.81	2.41
(b _P) $w_P = 2.5$	0.69	0.47	1.59	1.57	1.03	0.97	-0.11	0.92	2.47
(b _R) $w_R = 40^{(e)}$	0.64	0.40	1.88	1.60	0.62	1.49	0.02	0.80	
(iii) Inequality Averse, $\gamma = 50$									
(a) $w_P, w_R = 10$	0.61	0.64	1.53	1.57	1.97	0.05	0.04	0.78	2.35
(b _P) $w_P = 2.5$	0.86	0.39	1.25	1.47	-7.52	9.05	-0.83	1.31	2.67
(b _R) $w_R = 40^{(e)}$	0.54	0.48	2.12	1.62	-12.20	14.75	0.18	0.58	
^(a) net of wealth, ^(b) inequality term, ^(c) inequality premium, ^(d) aggregate, ^(e) exceeds inflection point									

Table 2: Results of Numerical Experiments for Inequality Averse Workers ($\alpha = 2$)

Equitable Initial Wealth When there are no initial wealth differences, the effects of the other-regarding preferences are similar for both sensitivity parameters but discernible mainly for the higher value (comparing rows (i), (ii)(a), (iii)(a) in Table 2). The results are driven by the fact that, ex post, all inequality averse workers suffer a utility loss due to either their inferiority or superiority aversion since nobody ends up earning exactly the average wage. The equilibrium optimal contract mitigates the expected utility loss. Compared to the self-regarding case, the bonus is lower but the fixed payment higher. This implies a lower equilibrium effort and a correspondingly lower probability of obtaining the bonus, thereby reducing the variability of income and the workers' expected loss. Altogether, the presence of inequality aversion still lowers the workers' expected utility and makes them costlier to employ, as manifested respectively by the positive inequality term and premium. Moreover, despite the lower expected wage, the profit

decreases because of the reduced equilibrium effort. The latter causes the economy’s output to decline.

From a qualitative perspective, under wealth equality our aforementioned equilibrium results resemble those generally obtained in the existing microeconomic literature on within-firm inequality. This observation is due to a fundamental similarity between the two settings. Specifically, in the within-firm context, where workers compare their income with one another, wealth typically does not play a role and workers are *ex ante* identical. Similarly, in our scenario above, workers are also *ex ante* identical due the equality in their initial wealth.²⁹ Accordingly, whether workers compare themselves against an average economy-wide measure or directly with their co-workers is qualitatively equivalent. However, under equal initial wealth, the impact of *ex-post* inequality is rather small and very different compared to the magnitudes and effects obtained under *inequitable* initial wealth as we discuss in the following paragraphs.

Inequitable Wealth: The Poor When workers differ in their initial wealth, the equilibrium optimal contract induces the poor inferiority averse workers to increase their effort beyond that of the equitable-wealth case despite a substantially lower bonus (comparing rows (a) with (b_P) in Table 2). With low inferiority aversion, the fixed wage is however larger. Intuitively, in this case too, this reduces variability of the payment scheme and hence the workers’ expected loss due to inferiority aversion. When the sensitivity parameter is large, the worker’s effort and the associated probability of obtaining the bonus are so high that a reduction in variability arises despite a reduced fixed wage. In any case, the participation constraint is relaxed, allowing the firm to “exploit” the inferiority aversion of the poor workers to substantially increase its profit. This is manifested by lower expected wages and the *negative inequality premium*, representing the discounts on the firm’s wage costs. The foregoing equilibrium results are enhanced by an increase in the sensitivity parameter and are accordingly consistent with the findings shown in Figure 4(a) and the discussion thereof.

Inequitable Wealth: The Rich A comparison of rows (a) and (b_R) in Table 2 reveals that the equilibrium results for the superiority averse rich are a mirror image of those for their poor peers. Under wealth inequality, their effort decreases while the associated bonus rises. Intuitively, the firm is forced to pay a very high bonus because, for the rich, the other-regarding preference weakens their responsiveness to incentive pay. This effect is reinforced as the sensitivity parameter increases. With low superiority aversion, the firm can afford to reduce the rich workers’ optimal fixed wage, thereby mitigating their inequality term. When the sensitivity parameter is large, the firm must increase the bonus even further to induce effort. As a result, the inequality term becomes so large that the firm must now also raise the fixed wage to ensure participation. In any case and in line with Figure 4(b), the rich workers become more expensive to employ, receiving a higher expected wage which compensates them for the corresponding *positive inequality premium*. Altogether, the firm’s expected profit by employing

²⁹In this respect, the current setup resembles the one used by Upton (2019). Similar to his results, here too the *ex-post* income distribution becomes more equitable as the aversion towards (disadvantageous) inequality increases. As obvious from Table 2(a), this obtains because both the bonus and the probability of obtaining it decrease in the sensitivity parameter, thereby reducing the variability of the wage scheme.

a rich worker falls below that generated under an equitable wealth distribution. Moreover, this effect becomes larger as the workers' sensitivity to inequality increases.

Output, Wage Gap, and Utility The above findings have implications for the aggregate variables and their impact on workers, in particular their utility. Compared to the equitable wealth distribution, rising initial wealth inequality leads to higher aggregate output in an inequality averse economy (compare row (a) and combined rows (b)). Clearly, this result stems from the higher equilibrium effort of the poor, outweighing the reduced effort of the rich. Nevertheless, the expected wage of the rich is larger than that of the poor (compare rows (b_P) and (b_R)). Thus, notwithstanding *every* worker's aversion towards inequality, in our example an initial inequitable wealth distribution generates in this sense even more inequality. In fact, all these effects are accentuated as the economy becomes more sensitive to inequality.

Under inequitable initial wealth, all workers obtain higher expected total income due to the higher average profit (not reported) distributed to them.³⁰ Nevertheless, both poor and rich suffer from wealth and income inequality to an extent that outweighs the aforementioned pecuniary benefits. More specifically, the inequality term increases relative to the case of equitable initial wealth (compare rows (a) with rows (b_P), (b_R)), representing the higher expected utility loss due to the other-regarding part of the preferences. Notice the striking gap between the firm's inequality premia and the workers' inequality terms emerging under inequitable wealth. These gaps expose the difference between our setting, dealing with within-society comparisons, and the literature on inequality aversion within firms, where the inequality premium and the inequality term would coincide (see equation (IP) and the ensuing discussion).

Altogether, total expected utility (net of wealth) decreases for all workers as they become more inequality averse. These utility losses trigger the question whether redistributing initial wealth would increase total welfare and whether a consensus on such a policy would emerge.

Redistribution 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. As explained in the following, such a redistribution would clearly enhance total expected welfare but does not recruit a consensus. Similar results would obtain for less extreme (costless) redistribution scenarios.

A redistribution is clearly favored by the poor because they not only gain initial wealth but also avoid the loss due to their low societal standing. Not surprisingly, despite their aversion towards inequality, the rich oppose redistribution. While, under an even wealth distribution (rows (a)), their utility net of wealth compared to an inequitable distribution (rows (b_R)) 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. This implies that, for the rich, the direct loss from wealth redistribution exceeds the reduced burden associated with inequality aversion. On the other hand, every poor person would gain 8.48 (comprised of 0.98 due to the reduced γ 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

³⁰Recall that the firm's average profit is given by the weighted sum of the corresponding per-worker profits.

for $\gamma = 50$ such redistribution would be welfare-enhancing. The personal gain of every poor worker exceeds the loss of his rich peer, yielding a weighted total societal net gain of 10.43. For $\gamma = 5$, due to the large share of the poor in the population, the total societal gain would still be positive at 1.06 although, in this case, at a one-to-one comparison, the gain of every poor worker falls clearly below the loss of the rich. In sum, the foregoing shows that, behind the “veil of ignorance”, redistribution would be desirable. These results are a different manifestation of the impact the sensitivity parameter has on the “willingness to pay” for an increase in the societal average wealth discussed in Section 5.2. In line with Table 1, also in our numerical experiments, a high sensitivity to inequality has a much larger impact on the compensation the poor require for an increased distance to the societal average, and on the willingness of the rich to give up some of their income in exchange for the reduced gap.

6.2.2 Competitive Economy

In Table 3, we turn to an economy populated by competitive workers. Remember that, in a competitive economy, 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) under an inequitable wealth distribution. This manifests itself in the equilibrium results of Table 3, where the findings for the poor qualitatively resemble those obtained in an inequality averse economy while the results for the rich are reversed.

	Effort	Fixed	Bonus	Wage	Utility ^(a)	IT ^(b)	IP ^(c)	Profit	Output ^(d)
(i) Self-Regarding									
	0.65	0.39	1.86	1.60	2.02	0	0	0.82	2.42
(iv) Competitive, $\gamma = 5$									
(a) $w_P, w_R = 10$	0.65	0.39	1.86	1.60	2.02	0.00	0.00	0.82	2.42
(b _P) $w_P = 2.5$	0.67	0.52	1.58	1.57	1.57	0.44	-0.06	0.88	2.45
(b _R) $w_R = 40^{(e)}$	0.66	0.38	1.85	1.60	2.87	-0.82	-0.01	0.83	
(v) Competitive, $\gamma = 50$									
(a) $w_P, w_R = 10$	0.65	0.41	1.84	1.60	2.02	0.00	0.00	0.82	2.42
(b _P) $w_P = 2.5$	0.81	0.54	1.18	1.50	-2.09	3.89	-0.55	1.20	2.66
(b _R) $w_R = 40^{(e)}$	0.71	0.33	1.78	1.58	10.21	-8.00	-0.14	0.98	
^(a) net of wealth, ^(b) inequality term, ^(c) inequality term, ^(d) aggregate, ^(e) wealth exceeds inflection point									

Table 3: Results of Numerical Experiments for Competitive Workers ($\alpha = 3$)

Going into detail, we observe that, when **initial wealth is equitable**, introducing other-regarding preferences barely affects the equilibrium (comparing rows (i), (iv)(a), (v)(a) in Table 3). In this case, the ex-post disutility when not obtaining the bonus and falling behind the societal average is, in expectation, 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 (compare rows (a), (b_P), (b_R)), despite the lower bonuses they receive. For the poor, the reasons are the same as in an inequality averse economy. In contrast to that case, for the rich, there is an incentive effect also in a competitive economy, as explained in Subsection 5.3.3. This allows the firm to reduce the equilibrium bonus also for them. The rich workers' fixed wage too becomes smaller under inequitable wealth and as the sensitivity parameter increases. This reflects the fact that, similar to the poor inferiority averse, also the superiority seeking rich dislike being unemployed, which relaxes their participation constraint. Consequently, the firm incurs a *negative inequality premium*, implying a discount on the employment costs also for the rich.

All of the above implies that, compared to the equitable-wealth scenario, **aggregate output** as well as the firm's equilibrium **profit** increase for rich and poor workers while expected **wages** for both become smaller. However, the reduction in the expected wage is smaller for the rich so that, similar to the case of inequality aversion, also the competitive economy becomes more inequitable in expectation. This finding is again reinforced as the economy becomes more sensitive to inequality.

While, in the competitive economy, the poor suffer a utility loss, the rich enjoy a substantial utility gain, manifested by their *negative inequality term*. The latter will hence object to any **redistribution** of their initial wealth to the poor. 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. Due to their large number, the total welfare gain of the poor is still greater than the total loss of the rich also in a competitive economy, at 6.36 compared to 6.17 for the low sensitivity parameter, and 8.93 versus 7.64 for the high sensitivity parameter. Accordingly, with a utilitarian social welfare function, a redistribution would enhance total welfare despite the lower output it would entail. Hence, as under inequality aversion, here too behind the "veil of ignorance" redistribution would be desirable.

7 Discussion and Conclusion

This paper focuses on the impact of other-regarding preferences on individual welfare and 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 the distribution of societal income and wealth through their own standing in reference to the average economy-wide income and wealth. In particular, within an economy, they are either inequality averse or competitive, where the utility of the former is adversely 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 the presence of other-regarding preferences, high initial wealth differences increase effort of those below the societal average (the "poor"). Notably, this happens although they obtain a lower bonus than they would in an economy with equitable

wealth distribution. 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, the firm exploits the poor workers’ distaste of below-average income, in particular in case they become unemployed, and consequently induce high effort at a relatively low pay. Similarly, though less pronounced, superiority seeking rich workers enjoy their advantage and therefore also become less costly. In contrast, superiority averse rich workers try to avoid becoming even richer and hence require more incentivization. Altogether, under increased income and wealth inequality, poor workers always suffer utility losses. Rich workers incur such losses in an inequality averse economy but obtain utility gains in a competitive one. While behind the veil of ignorance, everyone prefers an equitable economy, the rich oppose redistribution even when they are inequality averse. Finally, regardless of the welfare consequences, the work incentives created by wealth inequality and higher sensitivity to inequality result in increased productivity and output.

Among the key results afforded by the general-equilibrium analysis is the impact of social attitudes towards inequality on the income distribution. It turns out that inequality aversion does not, in and by itself, create any mechanism that reduces inequality. As a matter of fact, increasing inequality aversion contributes towards *higher* inequality. In this sense, these results point out a new channel through which inequality may be generated even when individuals are identical in their skills and preferences. Once they differ in their initial wealth, the presence of other-regarding preferences unleashes forces that increase inequality even further.

Clearly, the current paper is limited in scope. It uses specific numerical examples to make its point. The results however are in line with the underlying partial-equilibrium analysis carried out under a general setting. This gives us reason to believe that the main findings are representative also of other specifications. Still, an extended environment might include a more realistic wealth distribution. Also 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. This would obviously strengthen our results. A further extension may consider populations consisting of both inequality averse and competitive individuals. Since, under any circumstance, the largest part of the population is formed by the poor inferiority averse, this extension is unlikely to qualitatively change our findings.

Due to our focus on the role of other-regarding preferences, we assumed that all workers are inherently identical, distinguished only by their initial wealth. Accordingly, the model cannot account for the extent of income differences as observed in reality. The extensive literature on rising inequality shows that it is inherently related to ability differences and skill-biased technological changes (Helpman (2018)). Incorporating these elements in our model would further widen the income gap, given the empirically established positive association between wealth and education (see, e.g., Cingano (2014) and the references therein). The wages of the rich would then increase even further due to their higher ability to acquire human capital, thereby reinforcing our main findings. An additional exacerbating factor would have been generated if the rich were allowed to have a larger claim on profits.

Furthermore, skill and ability differences clearly affect the workers' outside options. This provides a 'reduced-form' rationalization for our assumption that the firm offers type(wealth)-dependent contracts (see the remark in Subsection 3.2). Nevertheless, the firm's ability to differentiate may be limited by non-discrimination laws. When we prevented the firm to use type-specific information in our model, we found that the firm still chooses to offer separating contracts. Qualitatively, all our results concerning the impact of other-regarding preferences on welfare, profits, and output are maintained. However, to create worker separation, the firm is then forced to increase the poor workers' expected pay even beyond that of the rich, thereby reducing income inequality in our setting. Whether non-discrimination laws would lower wage gaps in a more general setting, where differences in human capital are present, remains to be seen.

We believe that policy experiments would become appropriate within an extended dynamic setting. In particular, embedding our model in a growth framework would allow to explicitly study the dynamics of wealth and income distributions and their interaction with the accumulation of physical capital and economic growth (in the spirit of Hopkins and Kornienko (2006)). Such a framework would lend itself to policy analyses and international comparisons concerning the effects of tax systems, redistribution schemes, and labor-market related institutional settings affecting, for example, unemployment compensation and minimum wages.

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:

$$f_\omega \doteq \frac{\partial}{\partial \omega} f(\omega, \Omega), \quad f_{\omega\omega} \doteq \frac{\partial^2}{\partial \omega^2} f(\omega, \Omega) \quad (\text{A1})$$

To simplify notation (and with some abuse), in the sequel we define $\omega = s + w + \Pi$, and $\Omega = Y + W + \Pi$. Let $\hat{\omega} > \Omega$ denote the inflection point of $f(\cdot, \cdot)$. 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 Ω 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 $\omega + b < \Omega$, $0 < f(s + b, \Omega) < f(s, \Omega)$ (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 $\hat{\omega} < \omega$, $f_\omega(\omega, \Omega) < f_\omega(\omega + b, \Omega) < 0$.

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:

$$p'b - c' - \gamma p' [f(\omega + b, \Omega) - f(\omega, \Omega)] = 0 \quad (\text{A2})$$

From the implications of Assumption A1 we obtain the following results.

Proof of Lemma 1

Along (A2) we obtain:

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

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

Slope

Holding effort and γ fixed, along the incentive constraint the relationship between the fixed payment and the bonus is:

$$\frac{\partial s}{\partial b} = \frac{1 - \gamma f_\omega(\omega + b, \Omega)}{\gamma (f_\omega(\omega + b, \Omega) - f_\omega(\omega, \Omega))}. \quad (\text{A4})$$

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 $\Omega < \omega < \omega + b < \hat{\omega}$ 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 $\Omega < \omega < \omega + b < \hat{\omega}$, $\frac{\partial s}{\partial b} < 0$, and if $\omega > \hat{\omega}$, $\frac{\partial s}{\partial b} > 0$.

Impact of γ

For a given bonus and γ , the impact of a change in γ on s is:

$$\frac{\partial s}{\partial \gamma} = -\frac{f(\omega + b, \Omega) - f(\omega, \Omega)}{\gamma(f_\omega(\omega + b, \Omega) - f_\omega(\omega, \Omega))} \quad (\text{A5})$$

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 $\Omega < \omega < \omega + b < \hat{\omega}$, $\frac{\partial s}{\partial \gamma} < 0$ 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 γ on b :

$$\frac{\partial b}{\partial \gamma} = \frac{f(\omega + b, \Omega) - f(\omega, \Omega)}{1 - \gamma f_\omega(\omega + b, \Omega)} \quad (\text{A6})$$

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:

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

Slope

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

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

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 γ

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

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

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

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 $u < \bar{u}$, positive for $u > \bar{u}$. (ii) For the superiority averse persons with $u < \bar{u}$, if $\Omega < \omega < \omega + b < \hat{\omega}$ or $\hat{\omega} < \omega$, $\frac{\partial s}{\partial \gamma} > 0$ 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 $\gamma > \frac{1}{f_\omega(\omega, \Omega)}$, respectively $\gamma > \frac{1}{f_\omega(\omega + b, \Omega)}$. The reverse relationships hold for the same types of individuals if $u > \bar{u}$ (iii) For a superiority seeking person with $\Omega < \omega < \omega + b < \hat{\omega}$ or $\hat{\omega} < \omega$ and $u < \bar{u}$, $\frac{\partial s}{\partial \gamma} < 0$. The reverse holds if $u > \bar{u}$.

Next, we investigate the impact of changing γ on b when s is held fixed:

$$\frac{\partial b}{\partial \gamma} = \frac{pf(\omega + b, \Omega) + (1 - p)f(\omega, \Omega) - f(u, \Omega)}{p(1 - \gamma f_\omega(\omega + b, \Omega))} \quad (\text{A10})$$

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 $u < \bar{u}$, positive for $u > \bar{u}$. (ii) For the superiority averse person with $\Omega < \omega < \omega + b < \hat{\omega}$ or $\hat{\omega} < \omega$ 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 $\Omega < \omega < \omega + b < \hat{\omega}$ or $\hat{\omega} < \omega$ and $u < \bar{u}$. The reverse holds if $u > \bar{u}$.

Optimal Contract

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

$$A \begin{bmatrix} ds^* \\ db^* \end{bmatrix} = Bd\gamma \quad (\text{A11})$$

where

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

and

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

From here:

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

Accordingly:

$$\begin{bmatrix} ds^* \\ db^* \end{bmatrix} = A^{-1} \begin{bmatrix} p' [f(\omega + b, \Omega) - f(\omega, \Omega)] \\ pf(\omega + b, \Omega) + (1 - p) f(\omega, \Omega) - f(u, \Omega) \end{bmatrix} d\gamma \quad (\text{A15})$$

or:

$$\begin{bmatrix} ds^* \\ db^* \end{bmatrix} = \frac{1}{\det A} \begin{bmatrix} p' [(f(u, \Omega) - f(\omega, \Omega))(1 - \gamma f_\omega(\omega + b, \Omega))] \\ -p' [f(\omega + b, \Omega) - f(\omega, \Omega) - \gamma (f(\omega + b, \Omega) - f(u, \Omega)) f_\omega(\omega, \Omega) \\ - \gamma (f(u, \Omega) - f(\omega, \Omega)) f_\omega(\omega + b, \Omega)] \end{bmatrix} d\gamma \quad (\text{A16})$$

We can summarize the analysis by the following:

Lemma A7: For a given level of effort, an increase in γ 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

$$\frac{\partial s^*}{\partial \gamma} = - \frac{(f(u, \Omega) - f(\omega, \Omega))}{(1 - \gamma f_\omega(\omega, \Omega))} \quad (\text{A17})$$

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 γ would: (i) decrease the optimal bonus b^* for $\omega + b < \Omega$. (ii) increase the optimal bonus for the superiority averse with $\Omega < \omega$ provided γ is sufficiently small and decrease it if γ is sufficiently large (iii) decrease the optimal bonus for a superiority seeking person with $\Omega < \omega$.

Proof: Here we have

$$\frac{\partial b^*}{\partial \gamma} = \frac{f(\omega + b, \Omega) - f(\omega, \Omega) - \gamma [(f(\omega + b, \Omega) - f(u, \Omega)) f_\omega(\omega, \Omega) + (f(u, \Omega) - f(\omega, \Omega)) f_\omega(\omega + b, \Omega)]}{(1 - \gamma f_\omega(\omega + b, \Omega)) (1 - \gamma f_\omega(\omega, \Omega))} \quad (\text{A18})$$

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 γ . If γ 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 γ fixed. In this case we obtain:

$$A \begin{bmatrix} ds^* \\ db^* \end{bmatrix} = C de \quad (\text{A19})$$

with

$$C = - \begin{bmatrix} SOC \\ 0 \end{bmatrix} de \quad (\text{A20})$$

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,

$$\begin{bmatrix} ds^* \\ db^* \end{bmatrix} = - \frac{1}{\det A} \begin{bmatrix} p [1 - \gamma f_\omega(\omega + b, \Omega)] \cdot SOC \\ - [1 - \gamma (p f_\omega(\omega + b, \Omega) + (1 - p) f_\omega(\omega, \Omega))] \cdot SOC \end{bmatrix} de \quad (\text{A21})$$

Form all of the above, we obtain:

Lemma A9: For a given γ , 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 γ , 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 $\gamma > \frac{1}{f_\omega(\omega + b, \Omega)}$, (iii) b^* to increase for the superiority seeking persons with $\Omega < \omega$.

A1.4 Summary of Comparative Statics

Table 4 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 $\Omega < s + \Pi + w_R < s + b + \Pi + w_R < \hat{\omega}$ and the very rich with

$\widehat{\omega} < s + \Pi + w_R$, where, as defined above, $\widehat{\omega}$ 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.

	Inferiority Averse	Superiority Averse		Superiority Seeking	
	poor	rich	very rich	rich	very rich
Incentive Constraint					
(A1) $\frac{\partial s}{\partial b}$	> 0	> 0 if γ small < 0 if γ large	< 0 if γ small > 0 if γ large	< 0	> 0
(A2) $\frac{\partial s}{\partial \gamma}$	> 0	< 0	> 0	> 0	< 0
(A3) $\frac{\partial b}{\partial \gamma}$	< 0	> 0 if γ small < 0 if γ large	> 0 if γ small < 0 if γ large	< 0	< 0
Participation Constraint					
(A4) $\frac{\partial s}{\partial b}$	< 0	< 0 if γ small or large	< 0 if γ small or large	< 0	< 0
(A5) $\frac{\partial s}{\partial \gamma}$	u small < 0 u large > 0	u small > 0 if γ small < 0 if γ large u large > 0 if γ small < 0 if γ large	u small > 0 if γ small < 0 if γ large u large > 0 if γ small < 0 if γ large	u small < 0 u large > 0	u small < 0 u large > 0
(A6) $\frac{\partial b}{\partial \gamma}$	u small < 0 u large > 0	u small > 0 if γ small < 0 if γ large u large < 0 if γ small > 0 if γ large	u small > 0 if γ small < 0 if γ large u large < 0 if γ small > 0 if γ large	u small < 0 u large > 0	u small < 0 u large > 0
Optimal Contract (for given e)					
(A7) $\frac{\partial s^*(e)}{\partial \gamma}$	> 0	< 0 if γ small > 0 if γ large	< 0 if γ small > 0 if γ large	> 0	> 0
(A8) $\frac{\partial b^*(e)}{\partial \gamma}$	< 0	> 0 if γ small < 0 if γ large	> 0 if γ small < 0 if γ large	< 0	< 0
(A9) $\frac{\partial s^*(e)}{\partial e}$	< 0	< 0 if γ small > 0 if γ large	< 0 if γ small > 0 if γ large	< 0	< 0
(A10) $\frac{\partial b^*(e)}{\partial e}$	> 0	> 0 if γ small < 0 if γ large	> 0 if γ small < 0 if γ large	> 0	> 0

Table 4: Comparative Statics (see Lemmas 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 5. We discuss inequality aversion with $\alpha = 2$ and competitiveness with $\alpha = 3$. We extend the discussion by adding a weighing parameter μ (set to 1 in equation (12)) to the reference point in the numerator. This parameter could supplement γ as a reduction in γ or an increase in μ both decrease the splay of the disutility function and reduce the individual's sensitivity with respect to income-and-wealth deviations from the mean.

A2.1 Inequality Aversion

We investigate a somewhat more general specification of (12):

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

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 $\Omega < \omega < \hat{\omega}$ and concave for $\hat{\omega} < \omega$ where

$$\hat{\omega} = \frac{1 + 3\mu}{2\mu} \Omega \quad (\text{A23})$$

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

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

Proof: Under (A22),

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

A2.2 Competitiveness

Now we explore:

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

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 $0 < \omega < \hat{\omega}_1$, convex for $\hat{\omega}_1 < \omega < \hat{\omega}_2$ and concave for $\hat{\omega}_2 < \omega$ where

$$\begin{aligned} \hat{\omega}_1 &= \Omega \\ \hat{\omega}_2 &= \frac{1 + 2\mu}{\mu} \Omega \end{aligned} \quad (\text{A26})$$

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, as derived from the European Social Survey (2016). The histograms indicate the percentage of those who agree or disagree with the statements presented above the panels. In the figures, “agree” sums those who answered either “agree strongly” or “agree” while “disagree” combines those who replied “disagree” and “disagree strongly”. Those who answered “neither agree nor disagree” are omitted. Notice that the questions in the two panels 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, in both panels the red columns on the right represent attitudes favouring equality, while the blue ones on the left reflect tolerance towards inequality. The correlation between the columns respectively reflecting the same attitude in the two panels is identical, at 0.66, thereby indicating that they capture similar values.

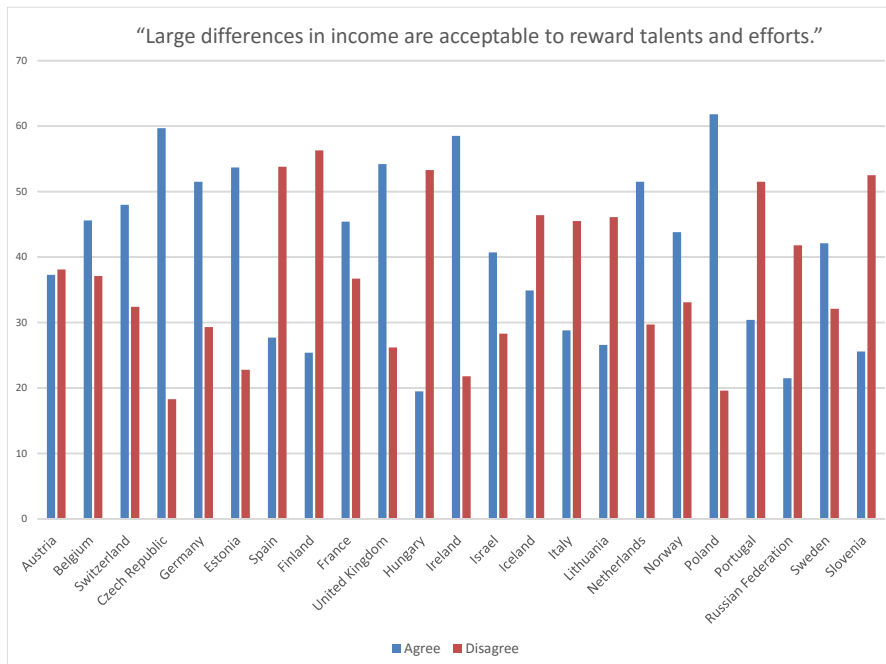


Figure 5: Attitudes towards Incentivization

Table 5 reports the results of simple logistic regressions applied to the entire sample of 35,952 respondents, estimating the likelihood of "agreeing" and "disagreeing" with the aforementioned statements, controlling for the income quintile a respondent belongs to. The omitted quintile is the lowest one, so that the coefficients reflect the respective incremental likelihood of a respondent in a given income quintile to agree or disagree, in comparison to that of a person in the lowest income quintile. The significance levels are reported in parentheses.

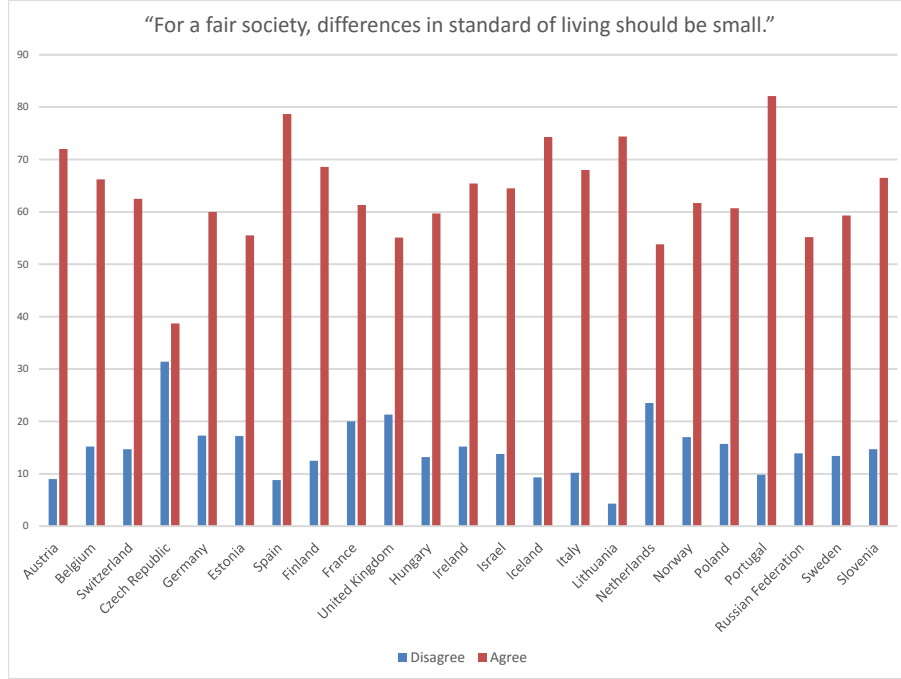


Figure 6: Attitudes towards Income Differences

(a)			(b)		
Quintile	Agree	Disagree	Quintile	Agree	Disagree
2	0.19 (0.000)	0.05 (0.252)	2	0.02 (0.719)	0.06 (0.375)
3	0.22 (0.000)	0.11 (0.022)	3	-0.08 (0.068)	0.08 (0.213)
4	0.23 (0.000)	-0.06 (0.191)	4	-0.27 (0.000)	0.17 (0.006)
5	0.51 (0.000)	-0.07 (0.198)	5	-0.39 (0.000)	0.43 (0.000)

Table 5: Logistic Regressions: Attitudes towards (a) Incentivization and (b) Income Differences

The spot estimates in panel (a) consistently show that persons from higher income groups tend to agree more often, and disagree less often, with the statement concerning the reward to effort, although most disagreement coefficients are not statistically significant. Where the fairness question is concerned in panel (b), agreement with the statement decreases with income, while disagreement increases. In this case the agreement coefficients are significant, except for that of the second quintile, whereas the disagreement coefficients are significant for the two highest quintiles.

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