The subjective wealth distribution: How it arises and why it matters to inform policy?[a]

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July 2024

Manuscript

Abstract

We estimate the relationship between people's biased perceptions of their rank in the wealth distribution and savings behavior. Using unique wealth survey data from Austria, we uncover a significant bias in self-assessed distributional ranks. Our estimates indicate that individuals who underestimate their wealth rank have a savings rate approximately 50% higher than those who assess their rank accurately. To identify a causal effect of 2.3 percentage points in additional saving per wealth decile of underestimation, we introduce a novel instrumental variable. Our findings inform contemporary macroeconomic models and contribute to understanding the impact of information bubbles on economic decisions.

JEL Codes: D12, D31, E21, J62

Keywords: Subjective wealth perception, Wealth distribution, Savings rate, Economic decision-making, Instrumental variable (IV) approach, Policy impact, Social segregation, Information bubbles

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[0]a The views expressed herein are those of the authors and do not necessarily reflect those of the Oesterreichische Nationalbank or the Eurosystem.

1 Introduction

The role of the distribution of income and wealth in determining aggregate savings receives considerable attention against the backdrop of the decline in the natural interest rate. While prior studies primarily address measured income distributions, we highlight the significance of individuals' subjective perceptions in economic decision-making. Capitalizing on a novel survey instrument where individuals rank themselves in the national distribution of wealth, we estimate predictive effects that perceived relative wealth ranks are strongly related to savings. We also employ a novel instrumental variable approach by leveraging the implementation of a wage transparency law to identify a causal effect. Our findings are at the core of economics, the saving decision in consumer demand. Therefore, the study informs contemporary macroeconomic models (predictive effect) and aids in evaluating the impact of social segregation and information bubbles on economic decisions influenced by individual social status perceptions or any other phenomenon which changes the perception of relative social status (causal effect).

Findings Our main findings consist of two novel empirical insights. Firstly, the paper reveals that Austrian survey respondents have substantial difficulties in assessing their own rank in the wealth distribution. There is a strong tendency towards the middle. While overestimation prevails in the least affluent tercile of the net wealth distribution, respondents in the upper two terciles are prone to underestimate their wealth rank. The share of individuals with accurate perceptions falls along the distribution of wealth. Comparing bias for perceptions of the wealth distribution with results from the realm of income, it turns out that people

misconceive their rank in the wealth distribution by a much greater margin than their rank in the income distribution. Crucially, we find evidence that this is not an artefact of the survey setup and social desirability in the response behavior, but that economic behavior changes with biased perceptions. In particular, we document non-trivial differences in savings rates between those who accurately assess their rank in the wealth distribution, and individuals who over- or underestimate it. Our estimates indicate that individuals underestimating their wealth rank exhibit a savings rate roughly 50% higher than those accurately assessing their position. Our regression results show that underestimating one's wealth rank by 1 wealth decile goes along with a 0.8 percentage point higher savings rate. As the common support of underestimators and overestimators with regard to the wealth rank is sparse, our regression results that establish predictive effects rest on strong extrapolation outside the common support. However, additionally we employ a novel instrumental variable approach and leverage a wage transparency policy which leads individuals to perceive themselves higher up in the wealth ladder. Using this approach we establish a causal effect of a 2.3 percentage points lower savings rate for one decile of higher self-perception in the wealth distribution, which confirms and strengthens our original result. We are confident, that our instrumental variable is particularly credible as it directly affects income rank perceptions which we show to be tied in with wealth perceptions. Using survey data before the wage transparency law was in place, we are also able to show that the channel did not exist before the policy. The IV approach is less sensitive to the common support issue as it only rests on the differences in perceived rank explainable by the wage transparency law.

Macroeconomics The robust evidence on the relationship between misperceptions and savings empirically established in this paper for the first time informs recent debates in macroeconomics on the role of heterogeneity for the aggregate behavior of economies. As the natural rate of interest (r*) falls, trends such as the high savings rates at the top of changing income and wealth distributions have pivoted to the center of the debate (Mian, Straub, and Sufi 2021; Summers 2015). Therefore, heterogeneity in savings behaviour is central to current empirical studies (Fagereng, Holm, and Natvik 2021; Jappelli and Pistaferri 2020). One of the most robust findings on propensities to consume and heterogeneity is the strong association between income (Misra and Surico 2014) or cash-on-hand (sum of current income and wealth) and savings (Gelman 2021; Jappelli and Pistaferri 2014). This paper documents heterogeneity in savings rates from a behavioral perspective. We argue that macroeconomic models should consider that individual decisions are rooted in individuals' subjective realities. Consequently, it's crucial to incorporate perceived distributions alongside measured ones. To this end, we emphasize the significance of survey research, which provides insights into individuals' perceptions.

Microeconmics Our empirical contributions also matter for understanding the implications of social comparisons for economic behavior at the micro-level. For example, a large literature on conspicuous consumption and the effects of upward-looking comparisons ("keeping up with the joneses") suggests that individuals consider their relative position when making consumption decisions (Agarwal, Qian, and Zou 2021; Bagwell and Bernheim 1996). More recently, a set of studies considers economic choices beyond expenditure, including durable consumption

and financial decisions (Bricker, Krimmel, and Ramcharan 2021; Roussanov 2010; Agarwal, Mikhed, and Scholnick 2020). In addition, others investigate the implications of relative pay for labor market behavior (Card et al. 2012). In political economy, social comparisons play an important role in explaining political preferences (Albacete, Fessler, and Lindner 2022; Fehr, Mollerstrom, and Perez-Truglia 2022; Hauser and Norton 2017; Cruces, Perez-Truglia, and Tetaz 2013). A common finding is that individuals across the income distribution place themselves in the center of the distribution, with policy preferences consistent with their perceived income rank (Cruces, Perez-Truglia, and Tetaz 2013; Hvidberg, Kreiner, and Stantcheva 2020; Hoy and Mager 2021). Windsteiger (2022) shows how residential segregation contributes to income rank perceptions clustering around the middle of the distribution, feeding into policy preferences.

Theory Lastly, this empirical relationships documented in this paper lend support to theoretical approaches where (relative) wealth is introduced in the utility function. While such models have been used to study wealth-accumulation patterns (Kopczuk and Lupton 2007; Carroll 1998), they play a key role in recent contributions in macroeconomics and optimal taxation (Michaillat and Saez 2021; Saez and Stantcheva 2018). We present a minimal model incorporating the subjective wealth rank into a utility function, aimed at illustrating the primary observable implication for savings decisions documented in our empirical analysis. This integration serves to bridge theoretical insights with the empirical contributions outlined in the main body of the paper.

Contribution In this paper, we break new ground by providing evidence on perceptions of relative wealth and their effects. We measure bias in wealth perceptions rather than income perceptions and deliver an analysis of the consequences of such biased perceptions for savings behavior. In contrast to other studies that have looked at consumption and cash-on-hand or the relationship between financial decisions and relative wealth shocks, we can disentangle the contribution of measured rank in the distribution and biased perceptions thereof. At the same time, models with macroeconomic heterogeneity, not least when they feature relative wealth in utility functions, do not address behavioral bias. Yet, relative status comparisons in particular are prone to the representativeness heuristic, arising from individual failure of applying Bayes' rule to information that people receive (Kahneman and Tversky 1972). By providing our predictive effects we deliver a characterization of (conditional) differences between savings rates by perception of relative wealth rank which can be used to inform macroeconomic models. By identifying the causal part of this association using our novel instrumental variable approach we provide a tool to evaluate the effects of policy interventions, developments or events which have an impact on the savings rate which is mediated through the perception of relative wealth.

Policy The findings open up interesting questions for policy design. For example, it may be possible to employ targeted information treatment tools to manage consumption from a macroeconomic perspective. Moreover, as subjective assessments of people's own position in the wealth distribution account for high savings rates in certain parts of the population, changes in the determinants of misconceptions could change the transmission mechanism of monetary policy. One may

think of similar interventions in the area of financial stability and strengthening household resilience. At the same time, the rise of social media and AI may provide an even stronger amplifier of differences in perceptions and resulting differences in economic behavior. Our causal estimates allow to quantify the effects on savings for any change in relative wealth rank perceptions.

Roadmap The remainder of the paper is organised as follows. Next, we present a minimal model of savings decisions introducing perceived wealth ranks in section 2. Then we introduce the data and provide descriptive statistics. Section 3 also documents the degree of bias in perceived ranks in the wealth distribution among respondents. Subsequently, section 4 gives the main results. We complement the main results with robustness checks and additional results. Section 5 concludes.

2 A minimal model

We set up a minimal two-period model to illustrate a potential mechanism introducing the subjective wealth distribution into a standard framework.

Setup There are two periods. Individuals earn income Y in period 1 (working age), consume C in period 1, and save $S = Y - C$ for period 2 (retirement). S represents consumption in period 2 and constitutes wealth before retirement. Let $F(\cdot)$ be individuals' subjective expectation of the distribution function of wealth across the population. $F(S)$ is therefore the individuals' subjective expected rank of their own level of wealth S in the wealth distribution F. Restricting the model further, we assume that individual beliefs are of the form $F(s) = F(s, \Delta) = \min(\max(F_0(s) + \Delta, 0), 1)$, where F_0 is the true distribution of wealth, and Δ is a

shift in perceived ranks, capturing mistaken beliefs.

Preferences Individuals have a preference over consumption in either period. They might additionally have a preference over wealth ranks. Individuals choose savings S to maximize utility

$$U(S, \Delta) = u(C) + u(S) + v(F(S, \Delta)) = u(Y - S) + u(S) + v(F(S, \Delta)),$$

where in the first two terms, $u(\cdot)$, reflect the utility from consumption, assumed to be strictly increasing and concave ($u'(C) > 0$, $u''(C) < 0$). The third term, $v(\cdot)$, is non-standard, denotes a preference and represents the utility from perceived wealth ranks, concave over $[0, 1]$. Our main theoretical result below will characterize the dependence of savings on belief distortions. For such a dependence to exist, we require a decreasing marginal utility of perceived wealth ranks, in addition to the presence of belief distortions.

Utility maximization, given the assumed form of belief distortions, implies the first order condition $\partial U(S, \Delta)/\partial S = 0$, which can be written as

$$u'(Y - S) = u'(S) + v'(F_0(S) + \Delta) \cdot F_0'(S),$$

assuming that the utility maximizing S is such that $0 < F(S, \Delta) < 1$.

This condition states that the marginal utility of first period consumption (from income not saved) equals the sum of the marginal utility of second period consumption, plus the product of the marginal utility of perceived wealth ranks and the derivative of the true distribution of wealth. It balances the marginal

utility of consumption today against the marginal utility of consumption in the future (savings today) plus the utility derived from perceived wealth rank.

To derive comparative statics of savings S with respect to belief distortions Δ, consider the derivative of the first order condition with respect to Δ. We get

$$\frac{\partial^2 U(S,\Delta)}{\partial S^2} \cdot \frac{\partial S}{\partial \Delta} + \frac{\partial^2 U(S,\Delta)}{\partial S \partial \Delta} = 0,$$

where $\frac{\partial^2 U(S,\Delta)}{\partial S^2} < 0$ by the second order condition for optimal S, and

$$\frac{\partial^2 U(S,\Delta)}{\partial S \partial \Delta} = v''(F_0(S) + \Delta) \cdot F_0'(S),$$

where in turn $F_0'(S) \geq 0$, and v'' is negative by assumption on the decreasing marginal utility of ranks. The derivative of $u'(S)$ with respect to Δ is zero, by construction.

Combining these equalities and inequalities, we get

$$\frac{\partial S}{\partial \Delta} = -\frac{v''(F_0(S) + \Delta) \cdot F_0'(S)}{\frac{\partial^2 U(S,\Delta)}{\partial S^2}} \leq 0 \tag{1}$$

Based on this setup, we derive observational implications that underscore the impact of subjective wealth perceptions on savings behavior, bridging traditional economic assumptions with insights from behavioral economics. The features of our minimal model directly relate to belief distortions possibly based on biased extrapolation from a segregated social environment and utility from relative rank or status.

Observational implications The framework introduced leads to the following two observational implications. One based on the standard model and one based on the behavioral extension. Transitioning from the classical to a behavioral framework by incorporating Δ reveals contrasting outcomes. While classical assumptions predict uniform savings behavior irrespective of subjective perceptions, the inclusion of $v(\cdot)$ and Δ introduces variability in savings decisions, underscoring the influence of individuals' beliefs about their wealth rank:

1. For the **neoclassical reference model**, $v \equiv 0$, and therefore the first order condition becomes

$$u'(Y - S) = u'(S).$$

   In particular:

   (a) Savings increase in income, but less than proportionally, if u is increasing and concave.

   (b) The distortion in perceived wealth ranks Δ does not affect savings.

2. For a model with preferences over wealth ranks, we have $v \neq 0$. As v is concave in the perceived rank, $v'(F_0(S) + \Delta)$ is a decreasing function in Δ. We get the following comparative statics of savings decisions:

   (a) As in the neoclassical model savings increase in income.

   (b) In contrast to the neo-classical model, savings are decreasing in Δ. To see this, consider equation 1. The formula demonstrates that an decrease in Δ (believing one is worse off than they are) leads to greater savings.

Given this minimal theoretical framework, we hypothesize that (i) in accordance with standard economic theory, savings will increase with income and wealth (permanent income) and (ii) particularly, and in addition to standard economic theory, underestimating one's position in the wealth distribution will be associated with an increased savings rate. Hypothesis (ii) translates to empirically testing the null hypothesis $\frac{\partial S}{\partial \Delta} = 0$ as in the standard model against the alternative $\frac{\partial S}{\partial \Delta} < 0$

Note, that the belief distortion (and decreasing marginal utility from perceived wealth) lead to higher inequality in savings and wealth. In short, given their typical distortions towards the middle rich people save more than they would without distortion while poor people save less than they would without distortion. This feature might add in turn to observed increases of inequality in wealth and income.

3 Data

For the main analysis, we employ data from the second and third wave of the Austrian Household Finance and Consumption Survey (HFCS).[1] For our novel instrumental variable approach we additionally match data on firm size at the district level.

Main analysis Since 2010 the HFCS is an ongoing harmonised household survey conducted throughout the euro-zone as an initiative of the European Central Bank (ECB). Much like the Survey of Consumer Finances (SCF) in the US, the HFCS collects detailed information on the balance sheet of households. The HFCS

[1] To demonstrate the power of the instrument in section 4.3, we also use data from the 2010 wave of the HFCS. Descriptive statistics are in the appendix.

aspires to follow the high data quality standards implemented in the SCF. Reliance on CAPI interviews and extensive consistency checks contribute to the data quality. Furthermore, the data providers offer multiple imputations to correct for non-response behavior and complex survey weights. From a battery of questions on assets and liabilities of each household, we obtain net wealth as the sum of both real and financial assets minus all household debt. In addition, the HFCS provides information on portfolio choice, labor market outcomes, consumption and individual demographics. This paper relies mainly on balance sheet data as well as income flows. Table 1 provides a compact overview of key variables featuring in the analysis.

The income measure includes wages, salaries, self-employed and property income, as well as monetary social transfers (including pensions). Taxes and social security contributions are deducted. For the most part, this paper uses equivalized income. To that end, we employ the modified OECD-scale. While the analysis refers to the household level, we include some individual characteristics of the main respondent. Across waves, the average respondent is likely to be male and slightly above 50 years in age.

To construct a savings variable, we combine data on the amount of money set aside for savings purposes each month[2] with information on debt repayment (principal and interest). The savings rate s for each household h follows from dividing the monthly savings flow S plus debt repayment R by monthly net household income Y:

[2]The survey question reads as: *How much money can you usually save or put aside each month, for example in order to fund large expenditures, for emergencies or to accumulate wealth?*. In a small minority of observations, savings exceed income. Therefore, we limit savings in the subsequent analysis to income.

Table 1: Key variables descriptive statistics

Variable	Min	Median	Mean	Max
		2014		
Male (1)	0	1	0.6	1
Size (count)	1	2	2.1	8
Age (years)	18	54	54	85
Net income (€)	498.4	2121.6	2449.9	18000
Savings (€)	0	200	343.5	30000
Net wealth (€)	-504	85.9	258.4	43733.7
		2017		
Male (1)	0	1	0.6	1
Size (count)	1	2	2.1	8
Age (years)	17	54	53.8	85
Net income (€)	300	2400	2718.2	100000
Savings (€)	0	200	432.4	100000
Net wealth (€)	-636.6	82.7	250.3	42843.5

Note: This table provides summary statistics for key variables. Net wealth in thousands. Net income refers to monthly household net income. Size is household size. Male assumes unity for male reference person. Age refers to reference person. Savings are the sum of monthly active savings and debt repayment.

Source: HFCS 2014, 2017 - ECB and OeNB.

$$s_h = \frac{S_h + R_h}{Y_h} \times 100 \tag{2}$$

Table 2 provides descriptive statistics for savings and savings rates. Across both HFCS waves, the share of households who engage in saving is relatively stable around three quarters. The most notable difference is that between waves, the mean and median savings among savers increased, while the median remains constant between waves across the whole population. Mean savings, as well as savings rates both in terms of means and medians increased between waves across

both groups.

Table 2: Savings rates descriptive statistics

	2014		2017	
measure	savers	all	savers	all
Mean saving (€)	446.7	343.5	576.4	432.4
Median saving (€)	283.6	200	341	200
Mean savings rate (%)	15.8	12.2	17.2	12.9
Median savings rate (%)	11.9	8.6	13.2	9.6
Population share (%)	76.9		75	

Note: This table provides summary statistics for savings. Savings derive from active monthly saving (AHI0420) and monthly debt repayment. Dividing by net monthly household income yields savings rates.

Source: HFCS 2014, 2017 - ECB and OeNB.

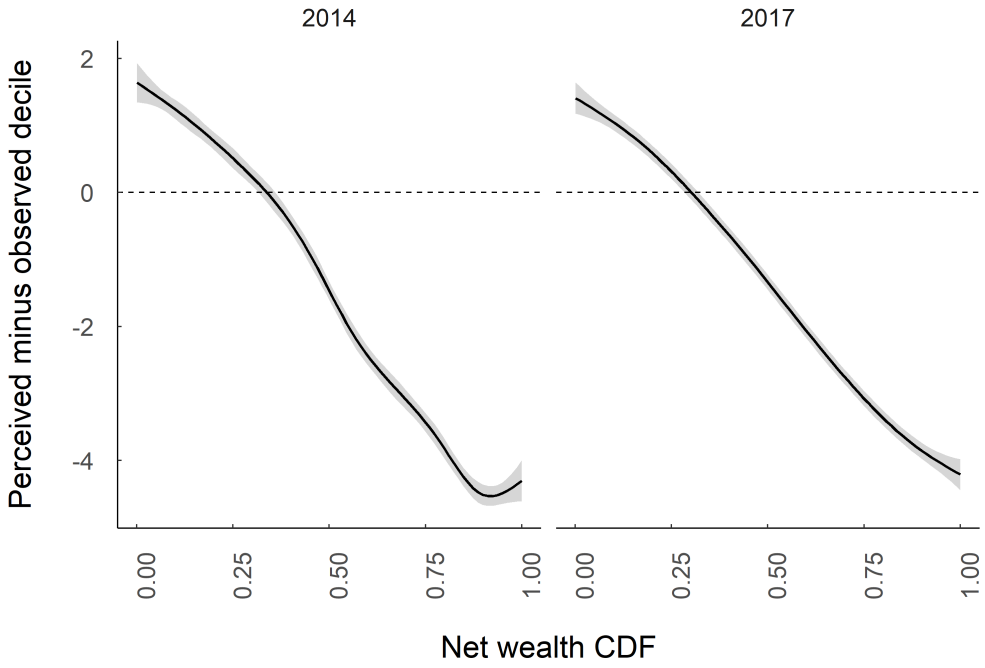
Capitalizing on the flexibility of household surveys and their capacity to elicit subjective information, the Austrian HFCS also collects a wide range of information on individual attitudes, preferences and perceptions. We draw on a special question, asking the main respondent in each interview to situate their household in the national net wealth distribution. The question reads as follows: "If you consider the entire net wealth of your household, which position in the wealth distribution do you think your household occupies?" The respondents can then either name a decile rank, or choose the appropriate decile using a slider. Figure 1 plots a smoothed estimate of the difference between self-declared decile rank and decile rank based on the data on household wealth from the survey against the CDF of net wealth.[3]

Positive values of the smoothed estimate of the bias imply that respondents

[3]The smoothed line is based on a generalised additive model with a penalised cubic regression spline.

overestimate their rank in the distribution, whereas negative values result from underestimation. The graph illustrates a negative association between decile rank and biased perception of rank in the wealth distribution. This pattern is robust across different survey waves. Individuals overestimating their rank in the distribution tend to be biased to a lesser degree than underestimators. At the bottom of the distribution, the bias amounts to two deciles in difference to the actual distributional rank. At the other end of the wealth distribution, the bias is twice that size in absolute terms. Between the first and the second tercile, approximately, the bias changes from positive to negative in each wave.

Figure 1: Self-perceptions along the net wealth distribution



Note: The x-axis represents the CDF of the net wealth distribution. The y-axis plots a smoothed estimate of the mean difference between perceived decile and decile based on survey-elicited net wealth. Estimates are constructed from averaging across implicates. Survey weights are taken into account.
Source: HFCS 2014, 2017 - ECB and OeNB.

Common support One of the methodological challenges we encounter in our analysis is the issue of common support for over- and underestimators of wealth rank. Naturally there are no overestimators in the highest decile and no underestimators in the lowest decile. Beyond that, large areas with sparse support that contain predominantly either over- or underestimators exist. As a result, it is difficult to draw reliable inferences about the effect of being an over- or underestimator at a particular point of the wealth distribution. In our case, the effect of interest is the impact of over- or underestimating one's wealth rank on savings behavior. As we lack full common support, we are essentially forced to extrapolate the effect outside the range of the data, which can introduce bias and reduce the reliability of our estimates.

To mitigate this issue, we also employ alternative specifications where we use the difference between perceived rank and measured rank as a continuous variable. This allows us to capture the nuanced variations in how far off individuals are in their wealth rank estimations, rather than crudely categorizing them as over- or underestimators. Still, the issue of very sparse common support remains.

In this context our instrumental variable approach becomes particularly useful. By leveraging the wage transparency law as an instrument, we can better isolate the causal effect of misperceptions on savings behavior. The IV approach is less sensitive to the common support issue as it only rests on the differences in perceived rank explainable by the wage transparency law.

Instrumental variable approach To generate random variation in misperceptions, we capitalise on a policy promoting wage transparency in Austria. See subsection 4.3 for further details. We use data from Statistics Austria on enterprise

demography (from 2011 onward) to address the absence of workplace employee data in the HFCS. Particularly we employ district-level data on the prevalence of large firms, defined as those with at least 100 employees among all firms with any employees in 113 geographical units. This approach has two limitations: it cannot precisely measure firms just above the 150-employee threshold where the policy takes effect, and district-level firm size data for 2010 is unavailable. We address this limitation in appendix A.

4 Results

This section presents findings on biased perceptions and economic outcomes. Primarily, we focus on savings behavior as the main result and estimate predictive effects. Subsequently, this section appraises the robustness of the findings, both in view of covariates and the operationalization of the dependent variable. In addition, our results feature a causal analysis based on the instrumental variable identification strategy.

4.1 Main results

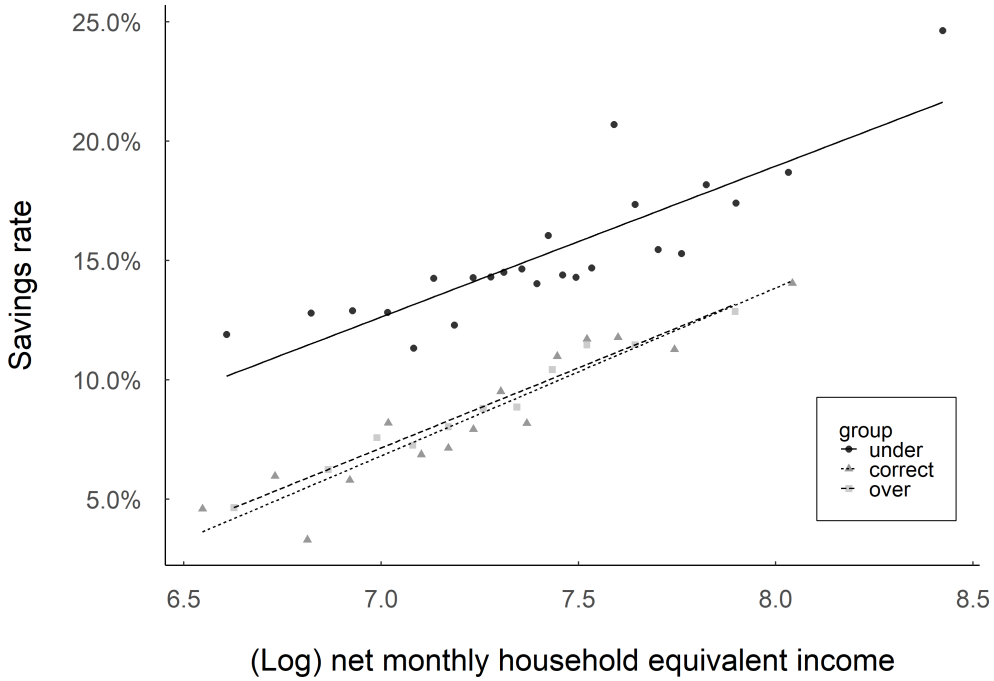
Figure 2 displays the main result of this paper at a glance. It shows the savings rate as a function of (log) equilvalized income. The graph plots this relationship for overestimators, underestimators and those who correctly assess their rank in the wealth distribution separately using a binned scatter plot. Figure 2 reveals a strong correlation between biased perceptions and the monthly savings rate. At all income levels, respondents who underestimate their rank in the wealth distribution save most. Overall, this difference amounts to more than five percentage points.

Given mean savings rates between 12% and 13%, this is an economically significant difference. In relative terms, savings among underesimators are by about 50% higher than among individuals who place themselves in the correct decile of the wealth distribution. Overestimators differ from individuals with correct assessments only to a limited extent. Their average savings rate ranges only slightly above the average savings rate among respondents with accurate self-assessments. The slopes of the linear functions also differ between groups. The flattest relationship between income and savings flows prevails among underestimators. This implies a heterogeneous relationship between biased perceptions and savings, narrowing slightly as equivalized disposable income increases.

The next set of result introduces control variables and offers variants of figure 2 with different residualizations. In the fist panel of figure 3, we condition on demographic variables. They include the gender of the respondent, along with a second degree polynomial of their age. Considering savings conditional on these variables does not change the substantive conclusions drawn from figure 2. The second panel shows that savings rates residualized for employment outcomes (employment status of the main respondent, whether they work on a temporary contract, and four ISCO-based occupational indicators) do not change the conclusions either. The third panel in figure 3 introduces wealth controls (ihs-transformed[4] net wealth and a second-order polynomial of net wealth). This allows us to address the argument that both a downward bias in perceived rank in the wealth distribution as well as high savings rates are correlated with wealth, leading to a spurious correlation between biased perceptions and saving. Conditioning on wealth leads to a small change in the slope of the fitted line among all groups. However, even with

[4]Inverse hyperbolic sine transformation

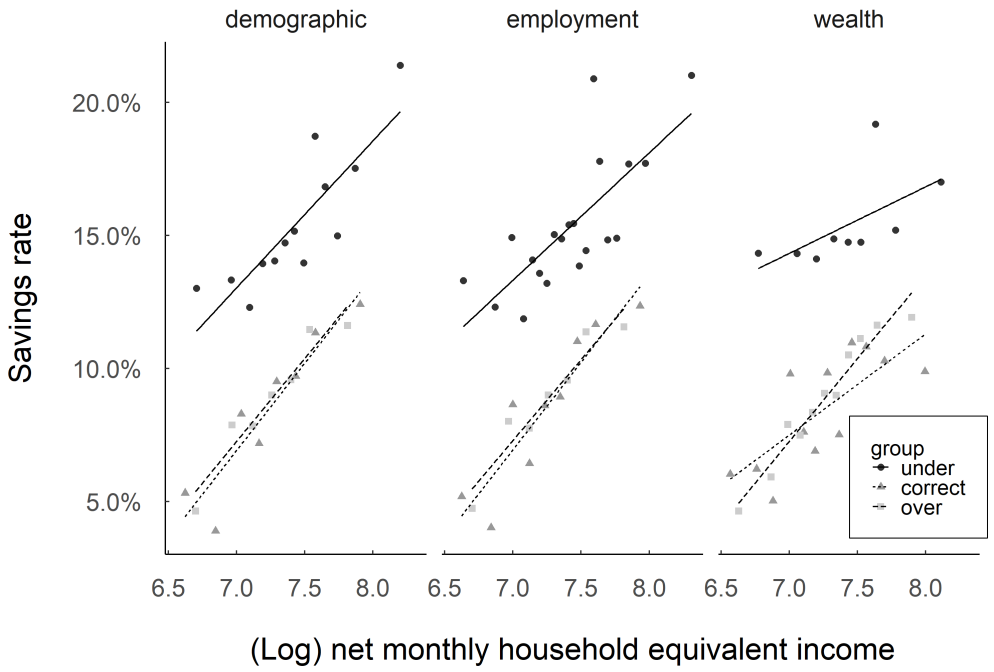
Figure 2: Average savings rate across the income distribution



Note: The x-axis refers to equivalized monthly household net income. The y-axis represents monthly savings as a fraction of household net income. The solid line plots the relationship between income and savings for individuals who underestimate their household's position in the wealth distribution. The dashed line refers to overestimators. The dotted line is the savings rate as a function of income for individuals with correct assessments. Estimates are constructed from averaging across implicates. Survey weights are taken into account.
Source: HFCS 2014, 2017 - ECB and OeNB.

the flexible controls for net wealth, the relationship between savings, income and misperceptions remains present in the data.

Figure 3: Residualised average savings rate across the income distribution



Note: The x-axis refers to equivalized monthly household net income. The y-axis represents monthly savings as a fraction of household net income. The solid line plots the relationship between income and savings for individuals who underestimate their household's position in the wealth distribution. The dashed line refers to overestimators. The dotted line is the savings rate as a function of income for individuals with correct assessments. The graph controls for a second-degree polynomial of age, alongside the gender of the respondent in the first panel. The second facet is based on savings residualized for employment outcomes (ISCO job classification, temporary contracts and whether the respondent is employed). Savings in the third facet are residualized based on ihs-transformed net wealth, and third-degree polynomial of net wealth. Estimates are constructed from averaging across implicates. Survey weights are taken into account.
Source: HFCS 2014, 2017 - ECB and OeNB.

In addition to the graphical evidence, table 3 provides regression results supporting our findings to establish the statistical significance of the results. In each

column, the dependent variable is the savings rate in percent. Each specification pools data from the 2014 and 2017 wave of the HFCS, adding a wave fixed effect. The first column estimates the difference in mean savings rates for the different directions of the bias in perceptions. The reference group consists of individuals with correct assessments. Underestimators save by 6.23 percentage points more than individuals in the reference group. The estimate is statistically significant at conventional levels. The point estimate of the difference in savings rates between overestimators and respondents in the reference group is positive but statistically insignificant. The wave fixed effects and the group indicator variables explain 5% of the variance in savings rates. Moving on to the next column, we introduce wealth and income controls in the form of ihs-transformed income and net wealth. The point estimate of the additional savings among downward-biased individuals falls to 4.54 percentage points, though it maintains statistical significance. The results for survey respondents who overestimate their rank in the wealth distribution do not change substantially relative to the first column in Table 3. The R^2 doubles, indicating a substantially improved fit. In the final column, we add a set of personal controls to the specification. They include gender, a second order age polynomial, three educational dummies and seven industry dummies. Compared to the specification in column 2, the changes are marginal. Individuals who underestimate their position in the wealth distribution have higher savings rates than their peers by a margin of 4.6 percentage points. The savings rates among overestimators are still close to the savings rates of respondents who accurately assess their decile rank.[5] Crucially, the results rest on strong extrapolation outside

[5]Note, that appendix A.3 includes table 12, which replicates table 3 but using a continuous measure of misperception - the difference between the perceived and measured wealth rank. In the continuous case we find a 0.8 percentage point higher savings rate for a each decile of under-

Table 3: Perceptions and savings: Main results

	Uncond diff (pp)	OLS I (pp)	OLS II (pp)
Perceived below observed	6.23***	4.54***	4.57***
	(0.22)	(0.22)	(0.25)
Perceived above observed	0.31	0.26	0.18
	(0.25)	(0.22)	(0.21)
Net wealth (ihs)		0.12***	0.14***
		(0.02)	(0.02)
Net eq. income (ihs)		6.10***	5.36***
		(0.26)	(0.30)
Wealth and income controls	No	Yes	Yes
Personal controls	No	No	Yes
Wave fixed effects	Yes	Yes	Yes
R2	0.05	0.10	0.10
Nobs	6048	6048	6048

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. *Multiple imputations taken into account. 100 replicate weights. All specifications feature the savings rate in percent as the dependent variable. Income and wealth controls refer to ihs-transformed household net wealth and monthly equivalent household net income. Personal controls include a second-degree age polynomial, three education dummies and seven industry dummies. pp refers to percentage points.*
Source: HFCS 2014, 2017 - ECB and OeNB.

of the sparse common support of these groups. This is especially true at the tails of the distribution where under- (in the case of the first decile) and overestimation (in the case of the tenth decile) can not exist logically.

Table 4 replicates the results in table 3, adding interactions between wealth and the direction of bias in perceptions of respondents' rank in the wealth distribution. The third row in each column reports the estimates for the interactions of wealth (inverse hyperbolic sine transformed) and underestimation, whereas the fourth row refers to the group of overestimators. The results in the first and second row refer to the differences in savings behavior across overestimators and underestimators relative to respondents with accurate self-assessments at zero net wealth. Across specifications, respondents at zero net wealth save less if they underestimate their

estimation or less strong overestimation (-0.8 percentage points for each decile of overestimation or less strong unerestimation).

relative wealth position rather than if they overestimate it. However, the results at zero net wealth among underestimators need to be interpreted with care, since only a small group of individuals at zero net wealth underestimate their wealth. As wealth increases, the differences between groups becomes smaller and reverses. The first column shows bivariate associations without further control variables. In this specification, a unit increase in transformed wealth is associated with an increase in the difference in savings rates between underestimators and respondents with more accurate perceptions by 2.23 percentage points. This implies that underestimators start oversaving around a net wealth level of approximately €43,000. The effect is the opposite for overestimators, where savings fall by 0.39 percentage points relative to the reference group. Both estimates of the interaction effects are statistically significant at conventional levels. The results in the next column are of a similar order of magnitude. The interaction effect for individuals with low perceived ranks is 1.88 percentage points. It is -0.32 for overestimators. In qualitative terms, the coefficient estimates in the third column introducing a set of controls for personal characteristics are in line with the results in the other specifications. The interaction of downward-biased perceptions and wealth increases marginally to 1.94 percentage points, while the point estimate for overestimators is -0.32.[6]

Our main results, as delineated in our minimal model outlined in section 2, are as follows: Elevated savings rates among underestimators, as depicted in figures 2 and 3, lend credence to Hypothesis (ii). This hypothesis posits that underestimating one's rank within the wealth distribution correlates with an increased rate

[6]Note, that appendix A.3 includes table 13, which replicates table 4 but using our continuous measure of misperception.

Table 4: Perceptions and savings: Interaction effects

	Uncond diff (pp)	OLS I (pp)	OLS II (pp)
Perceived below observed	−23.79***	−19.56***	−20.15***
	(0.91)	(0.88)	(0.87)
Perceived above observed	3.35***	2.65***	2.52***
	(0.44)	(0.38)	(0.40)
Perceived below observed X net wealth	2.23***	1.88***	1.94***
	(0.09)	(0.08)	(0.08)
Perceived above observed X net wealth	−0.39***	−0.32***	−0.32***
	(0.04)	(0.04)	(0.04)
Net wealth (ihs)	0.33***	0.22***	0.23***
	(0.04)	(0.03)	(0.03)
Net eq. income (ihs)		4.57***	4.00***
		(0.24)	(0.29)
Income controls	No	Yes	Yes
Personal controls	No	No	Yes
Wave fixed effects	Yes	Yes	Yes
R2	0.11	0.13	0.14
Nobs	6048	6048	6048

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. *Multiple imputations taken into account. 100 replicate weights. All specifications feature the savings rate in percent as the dependent variable. Interaction terms are based on bias-dummies and ihs-transformed net wealth. Income refer to ihs-transformed monthly equivalent household net income. Personal controls include a second-degree age polynomial, three education dummies and seven industry dummies. pp refers to percentage points.*
Source: HFCS 2014, 2017 - ECB and OeNB.

of savings, a proposition expressed by the validity of equation 1.

Moreover, the regression analysis presented in table 3 reveals significantly positive coefficients for "Perceived below observed," thereby providing further support for Hypothesis (ii). Concurrently, the positive coefficients associated with income and wealth variables reinforce Hypothesis (i), which suggests a positive relationship between savings rates and both income and wealth levels, as evidenced by the non-falsification of this hypothesis.

Additionally, table 4 not only corroborates these findings but also introduces

more detailed insights by employing a more flexible functional form. While Hypothesis (i) continues to stand, Hypothesis (ii) is falsified for net wealth amounts below €43,000. Above this threshold, however, equation 1 remains applicable.

4.2 Sensitivity

The first step in appraising the sensitivity of our findings is the replication of the baseline results while controlling for wealth ranks and income as flexibly as possible. Table 5 summarizes this exercise. Each specification controls for personal characteristics, household net disposable income and wave fixed effects. The first column reveals that controlling for other individual characteristics and the CDF of net wealth yields excess savings among underestimators of around 0.53 percentage points. The surplus savings of individuals with a positive bias ranges at 0.95 percentage points. The fit of the model improves only marginally relative to the simple models presented in subsection 4.1. Column 2 estimates a model with personal controls and terciles as dummy variables. We find that the coefficient among individuals who are more pessimistic about their relative wealth rank in society amounts to 1.2 percentage points. The coefficient for overestimators corresponds to 0.85 percentage points. The R^2 is 0.14. Next, column 3 reports the results for the interaction effects of biased perceptions and net wealth tercile. The substantive conclusion still holds. It is mostly individuals within the second tercile of net wealth who save more when they underestimate their relative wealth position. Among respondents with positive bias, it is the group in the top tercile who accumulate surplus savings relative to their peers with more accurate ideas about their relative affluence.

Table 5: Perceptions and savings: Flexible controls

	CDF (pp)	Tercile (pp)	Tercile X (pp)
Perceived below observed	0.53*	1.20***	0.38
	(0.23)	(0.23)	(0.38)
Perceived above observed	0.95**	0.85**	0.95*
	(0.23)	(0.22)	(0.30)
Perceived below observed X net wealth T2			1.24*
			(0.50)
Perceived below observed X net wealth T3			0.79
			(2.50)
Perceived above observed X net wealth T2			−0.95
			(0.64)
Perceived above observed X net wealth T3			10.97**
			(3.67)
R2	0.15	0.14	0.14
Nobs	6048	6048	6048

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. *Multiple imputations taken into account. 100 replicate weights. All specifications feature the savings rate in percent as the dependent variable and control for ihs-transformed equivalent monthly household net income, wave fixed effects and personal characteristics. Personal controls include a second-degree age polynomial, three education dummies and seven industry dummies. The first column controls for the CDF of net wealth and the second column for terciles of net wealth. Interaction terms in the third column are based on bias-dummies and tercile-dummies of net wealth. pp refers to percentage points.*
Source: HFCS 2014, 2017 - ECB and OeNB.

In a next step, we investigate whether the results are sensitive to the operationalization of saving in our main specification. We appraise whether the results hold among saving households (intensive margin) only, and whether the decision to participate in positive savings is associated with perceptions. Finally, we also offer a different measure of savings. Table 6 summarizes the results of this exercise, the selection of control variables parallelling that of the first column in table 3.

In the first column, we limit the sample to households with positive monthly savings. Both statistical and economic significance of the baseline results in table 3 do not change. Among individuals who underestimate their relative affluence, savings exceed those of the reference group (no bias) by five percentage points. Sav-

ing respondents with upwardly biased perceptions do not differ from the reference group in statistically significant orders of magnitude. The second column refers to a logit model. The outcome variable is an indicator distinguishing households who save from those with no monthly savings. The coefficient on underestimating one's rank in the wealth distribution is positive and statistically significant at conventional levels. Underestimators have 1.19 times the odds of being savers relative to individuals in the unbiased group. There is no effect among respondents who think they rank high compared to their position in the distribution of net wealth as measured by netting out household assets and liabilities. The final column of table 6 tests for our finding's sensitivity to the measurement of the savings rate. Instead of summing debt repayments and self-declared monthly savings before dividing by disposable monthly net income, this specification rests on a savings measure constructed with the consumption variables in the HFCS. We aggregate monthly household expenses including rent, utilities, food and alimony payments, ignoring spending on consumer durables and payments for loan repayments and home improvement. Leaving the denominator of the savings rate unchanged, the alternative savings measure follows from the residual of consumption and disposable monthly net income. Compared to the baseline specification, the measurement of the savings rate affects our findings. The excess saving among underestimators almost triples. In contrast, the difference in savings behavior between the reference group and individuals with positively biased perceptions of their ranking in the wealth distribution is remarkably stable. Both groups do not differ much in terms of savings. In terms of fit, the specification in the third column outperforms the other models ($R^2 = 0.12$).

Table 6: Perceptions and savings: Additional results

	Savers (pp)	Participation (log odds)	Indirect savings (pp)
Perceived below observed	5.00***	0.17***	15.25***
	(0.33)	(0.01)	(0.38)
Perceived above observed	0.34	0.01	0.36
	(0.44)	(0.01)	(0.40)
Wealth and income controls	No	No	No
Wealth X income	No	No	No
Personal controls	No	No	No
Wave fixed effects	Yes	Yes	Yes
R2	0.04		0.12
Nobs	4522		6048

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. *Multiple imputations taken into account. 100 replicate weights. The dependent variable in column 1 is the savings rate based on monthly net household income and monthly savings including debt repayment. The specification refers to the population with positive savings only. Column 2 refers to a logit model with participation in monthly saving as the dependent variable. Column 3 uses savings derived from household monthly consumption and monthly net household income as the dependent variable. pp refers to percentage points.*
Source: HFCS 2014, 2017 - ECB and OeNB.

4.3 An IV approach to biased perceptions

The main result points towards a strong association between savings and perceptions that individuals hold about their position in the wealth distribution. However, the result may be driven by endogeneity and therefore just delivers predictive effects. For example, reverse causality may arise if there was an additional causal mechanism by which the savings ability at a given wealth and income level makes individuals feel more or less optimistic about their relative economic position. In addition, there may be unobserved heterogeneity that correlates with misperceptions and savings behavior. In a world with imperfect information, it can be costly to acquire information. As a result, some agents will have biased perceptions about inequality and their position in the distribution (Cruces, Perez-Truglia, and Tetaz 2013). If the individual cost of acquiring additional information correlates with both misperceptions and savings behavior, our estimates are biased. Against the

backdrop of these arguments, we propose a new instrumental variables approach designed to pinpoint the causal component within the association.

To generate random variation in misperceptions, we capitalise on a policy promoting wage transparency in Austria. Phased in between 2010 and 2014, the policy requires large firms (more than 150 employees) to provide their employees with information on mean or median earnings within the firm. Originally, the policy was intended to promote pay transparency in order to reduce the gender pay gap. We argue that rather than reducing the gender wage gap, treated individuals changed their wealth rank perceptions as a result of the policy.

While the policy did not affect male and female wages, separation rates fell in treated firms (Gulyas, Seitz, and Sinha 2023). As quits are strongly associated with employee perceptions about the fairness of pay schedules (Dube, Giuliano, and Leonard 2019), the fall in job separation is likely to result from employees facing a better relative pay situation than they anticipated (Gulyas, Seitz, and Sinha 2023).[7]

Our instrument is based on the idea that treated individuals update their prior beliefs towards a higher relative wealth position. The argument requires agents to extrapolate from their ranking in the income distribution to their rank in the wealth distribution. Figure 4 in the appendix shows that there is a strong relationship between misperceptions of income and wealth ranks.

We match data on the prevalence of large firms at the district level to the survey data. Prevalence is measured as the share of firms with at least 100 employees rel-

[7]This is particularly the case since the within-firm perspective and the disaggregation of wages by occupations narrows down reference groups to include increasingly similar individuals. At the same time, the exemption of managerial positions from pay transparency requirements may add to more positive perceptions of treated individuals' relative economic position.

ative to all firms with a positive number of employees in 113 different geographical units.[8] The instrument is relevant if respondents in regions with higher treatment intensity have more optimistic perceptions about their rank in the wealth distribution. At the same time, the instrument satisfies the exclusion restriction if firm size does not directly affect savings of individuals. As business owners in regions with a high share of large firms may also save more due to their ownership of larger firms, we limit the sample to individuals without business wealth. Moreover, we believe that this sample restriction is necessary since the self-employed were not subject to the pay transparency law by definition.

The IV regressions are most similar to the second column of the baseline results in table 3. However, we measure misperceptions on a continuous scale to capture the magnitude of bias rather than collapsing the variable into categories. At the same time, we add a regional dummy variable for each federal state.

Table 7 presents the results of the IV approach, dropping coefficients on control variables. The first column reports the coefficient where we instrument misperceptions. The coefficient implies that a one decile increase in the bias (where positive and negative values represent over- and underestimation respectively) leads to a 2.31 percentage point decrease in savings. Column 2 shows the first stage with the magnitude of bias as the regressand. The number of observations increases, since the second column includes data from the first wave of the HFCS. The interaction terms in table 7 summarize the effect of firm size on the dependent variable for

[8]The district level data on firm size comes with two limitations. Firstly, we cannot measure the share of firms which are exactly above the threshold of 150 employees. The measure of treated firms will therefore slightly overstate the true share of treated firms. Secondly, no data on firm size by district is available for the year 2010. Since we use the 2010 wave of the HFCS with the 2011 data on firms to demonstrate that the instrument has no direct effect on savings and misperceptions before the introduction of pay transparency, we discuss this limitation in detail in the appendix.

each survey wave separately. Crucially, there is no relationship between the share of large firms and biased perceptions in the first survey wave. The point estimate of the corresponding coefficient amounts to 1.54. In statistical terms, the point estimate is not significantly different from zero. However, in subsequent waves, a strong association between perceptions and the treatment intensity exists. Both interaction effects between wave dummies and the share of large firms are large and statistically significant at conventional levels. Both estimates suggest that a one percentage point increase in the share of large firms in a respondent's district is associated in an 0.2 to 0.3 decile increase in the magnitude of bias. The final column provides tentative evidence on the exclusion restriction. The dependent variable is the savings rate.[9] The coefficient estimates refer to the relationship between the savings rate and the share of large firms. Again, there is no statistically significant effect of firm size at the district level and the savings rate in 2010. In contrast, the coefficients on firm size are significant both in statistical and economic terms in the 2014 and 2017 wave of the HFCS after the phasing-in of the pay transparency law.

Overall, the results in Table 7 suggest that the introduction of pay transparency creates a relationship between the prevalence of large firms at the district level and both misperceptions and household savings behavior. Therefore, the large firm share at the district level is a good indicator of treatment intensity. Using this variable as an instrument, the results suggest that the effect of biased perceptions on savings remains large and significant.

[9]Providing estimates for 2010 requires reliance on the savings measure constructed from consumption data introduced in subsection 4.2

Table 7: Perceptions and savings: Instrumental Variables

	IV (pp)	First stage (deciles)	Exclusion (pp)
Bias	-2.31^{***}		
	(0.38)		
Large firm share		1.54	-4.79
		(4.29)	(24.59)
Large firm share X 2014		28.30^{***}	-312.82^{***}
		(5.06)	(37.37)
Large firm share X 2017		21.74^{***}	-226.29^{***}
		(4.17)	(34.71)
Wealth and income controls	Yes	Yes	Yes
Wealth X income	No	No	No
Personal controls	No	No	No
Wave fixed effects	Yes	Yes	Yes
Nobs	6048	8381	8381
R2		0.31	0.32

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. *Multiple imputations taken into account. 100 replicate weights. IV refers to the coefficients from an instrumental variables regression, where perceptions are instrumented. The instrument is the share of firms with at least 100 employees by region (Large firm share). The corresponding first stage is labelled First stage. The dependent variable in the first colunm is the savings rate, while it is the magnitude of perception bias in the second. The final row has savings based on the consumption variables as a dependent variable. Households with business wealth excluded. pp refers to percentage points.*
Source: HFCS 2010, 2014, 2017 - ECB and OeNB and Arbeitsstättenzählung 2011, 2014, 2017 (Registerzählung and Abgestimmte Erwerbsstatistik) - Statistics Austria

5 Summary remarks

The savings decision of the consumer is at the heart of macroeconomics. This paper sheds light on a vital yet often overlooked aspect of this decision, namely individuals' subjective perceptions.

Our findings illuminate a significant disparity between individuals' self-assessed wealth distribution ranks and objective reality, revealing a pervasive bias. More strikingly, this bias manifests substantial implications for economic behavior. Those underestimating their wealth rank exhibit a savings rate approximately 50% higher than their counterparts with accurate self-assessments. In the continuous case underestimating one's wealth rank by 1 wealth decile goes along with a 0.8 percentage point higher savings rate. These findings persist even after accounting for various household and individual characteristics and employing diverse functional forms. To deal with the issue of common support and at the same time identify the causal part of this effect, we introduced a novel instrumental variable approach, capitalizing on the implementation of a wage transparency law. This approach is less sensitive to the limitations imposed by sparse common support, as it only rests on the differences in relative wealth perceptions explainable by the transparency policy. We establish a causal effect of similar magnitude, namely 2.3 percentage points lower savings rate for one decile of higher self-perception in the wealth distribution.

Our insights challenge existing macroeconomic models, advocating for the inclusion of perceived distributions alongside measured ones. We emphasize the need for macroeconomic models to recognize that individual decisions are rooted in subjective realities. Our predictive effects can be used to inform macroeconomic

models and help them to incorporate wealth perceptions into their frameworks. Our causal estimates allow to quantify the effects on savings for any change in relative wealth rank perceptions which can be triggered by a large set of potential policies and other social- and economic phenomena. At the microeconomic level, we contribute to our understanding of social comparisons while the empirical findings lend support to theoretical models that incorporate (relative) wealth in utility functions.

While perceptions of relative affluence are certainly driven by demographics and individual personal traits, they are likely to evolve looking forward. Trends in residential segregation are likely to amplify the bias towards the middle. At the same time, the rise of social media and AI may provide an even stronger amplifier of biased beliefs. Online echo chambers allow individuals to select into groups of like-minded people with potentially similar economic backgrounds, giving homogeneous groups the opportunity to exchange views and perceptions. This behavior is facilitated by content algorithms matching individuals with information and other agents based on prior information about background, preferences and behavior.

Our contributions have far-reaching implications for policymakers. The existence of biased wealth perceptions opens avenues for targeted information treatments to influence macroeconomic trends and monetary policy transmission mechanisms. The determinants of savings rates and marginal propensities to consume are central to the transmission mechanism of monetary policy. Fiscal stimuli may also be more effective if paired with policies that aim at giving agents a better sense of their actual position in the wealth distribution.

Our analysis points out several avenues for future research. Most importantly,

it would be interesting to study the implication of biased perceptions in view of other economic choices. This includes portfolio choice or labor market outcomes. In addition, our causal analysis could be supplemented by laboratory experiments to further explore heterogeneous treatment effects, for example. This would be particularly useful in view of designing policies that aim at alleviating bias in wealth rank perceptions.

Acknowledgements

We want to express our gratitude for the support of Maximilian Kasy. We also acknowledge feedback from Markus Knell and the audience at research seminars at the European Central Bank, the Oesterreichische Nationalbank, the Austrian Economic Association, and the OECD.

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A Appendix

A.1 Descriptive statistics

Table 8 reports the mean savings rate for each decile of the equivalized net household disposable income distribution (by type of bias). Table 9 replicates this analysis, using median instead of mean savings rates. Table 10 refers to mean savings rates across all deciles of the household net wealth distribution, whereas table 11 reports medians.

Table 8: Mean savings rates for different perception biases and income deciles

Household income decile	Underestimator (%)	No bias (%)	Overestimator (%)
1	10.3	4.3	4.8
2	12.8	8	8.6
3	11.6	6.4	5.5
4	13.7	7.9	8.9
5	14.5	9	8
6	16.5	9.4	10.7
7	15.2	10.2	9.3
8	16.5	11.5	8.7
9	18.3	11.8	13
10	20.6	15.5	11.2

Note: This table provides savings rates for different perception biases for the ten deciles of equivalized household net disposable income. Savings derive from active monthly saving (AHI0420) and monthly debt repayment. Dividing by net monthly household income yields savings rates. Source: HFCS 2017 - ECB and OeNB.

A.2 Biased perceptions of wealth and income ranks

Data from the first wave of the HFCS (2010) allows comparing perceptions of relative wealth with respondents' assessments of their position in the income distribution. Figure 4 explores the relationship between income and wealth rank

Table 9: Median savings rates for different perception biases and income deciles

Household income decile	Underestimator (%)	No bias (%)	Overestimator (%)
1	5.3	0	0
2	8.8	3.9	3.8
3	8.7	3.2	1.9
4	9.3	6.8	6.4
5	11.9	7.9	6.2
6	12.8	6.5	7.2
7	12.1	8.7	7.2
8	13.8	9.7	6.7
9	14.3	8.5	11.9
10	16	12.7	9.4

Note: This table provides savings rates for different perception biases for the ten deciles of equivalized household net disposable income. Savings derive from active monthly saving (AHI0420) and monthly debt repayment. Dividing by net monthly household income yields savings rates. Source: HFCS 2017 - ECB and OeNB.

Table 10: Mean savings rates for different perception biases and net wealth deciles

Household net wealth decile	Underestimator (%)	No bias (%)	Overestimator (%)
1		4.2	6.9
2	3.7	5.6	5.4
3	7	8	9.9
4	8.1	9.4	11.8
5	12.4	12.5	12.9
6	14.1	15.4	12.9
7	15.8	15.3	19.2
8	18.8	14.1	55.9
9	17.6	16.8	35
10	21	36.9	

Note: This table provides savings rates for different perception biases for the ten deciles of household net wealth. Savings derive from active monthly saving (AHI0420) and monthly debt repayment. Dividing by net monthly household income yields savings rates. Source: HFCS 2017 - ECB and OeNB.

Table 11: Median savings rates for different perception biases and net wealth deciles

Household net wealth decile	Underestimator (%)	No bias (%)	Overestimator (%)
1		0	0
2	0	3.2	2.8
3	4.7	6.7	8.3
4	7	8	8.6
5	9.9	10	9
6	11.7	10.5	11.1
7	13	12.6	17.5
8	16.3	10.5	55.9
9	15.5	17.1	35
10	16.8	30	

Note: This table provides savings rates for different perception biases for the ten deciles of household net wealth. Savings derive from active monthly saving (AHI0420) and monthly debt repayment. Dividing by net monthly household income yields savings rates. Source: HFCS 2017 - ECB and OeNB.

perceptions. We grouped observations by the magnitude of bias in both income and wealth rank perceptions (ranging from -9 to +9).

A.3 Results with continuous bias

Here, we present the results of the main specifications, drawing on a different operationalization of biased perceptions. Rather than grouping individuals by the direction of bias into those who underestimate their position, as opposed to overestimators and respondents with accurate perceptions, we measure bias on a continuous scale in in tables 12 and 13.

A.4 Instrumental variables with leading values

Statistics Austria only provides data on enterprise demography from 2011 onward. To show that our instrument has no direct impact on savings and misperceptions

Table 12: Perceptions and savings: Main results with continuous bias

	Uncond diff (pp)	OLS I (pp)	OLS II (pp)
Perception bias	-1.09^{***}	-0.77^{***}	-0.80^{***}
	(0.03)	(0.04)	(0.04)
Net wealth (ihs)		0.13^{***}	0.15^{***}
		(0.02)	(0.02)
Net eq. income (ihs)		6.27^{***}	5.51^{***}
		(0.28)	(0.32)
Wealth and income controls	No	Yes	Yes
Personal controls	No	No	Yes
Wave fixed effects	Yes	Yes	Yes
R2	0.05	0.09	0.10
Nobs	6048	6048	6048

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. *Multiple imputations taken into account. 100 replicate weights. All specifications feature the savings rate in percent as the dependent variable. Perception bias refers to perceived decile minus observed decile. Income and wealth controls refer to ihs-transformed household net wealth and monthly equivalent household net income. Personal controls include a second-degree age polynomial, three education dummies and seven industry dummies. pp refers to percentage points.*
Source: HFCS 2014, 2017 - ECB and OeNB.

Table 13: Perceptions and savings: Interaction effects

	Uncond diff (pp)	OLS I (pp)	OLS II (pp)
Perception bias	1.56^{***}	1.00^{***}	0.92^{***}
	(0.17)	(0.15)	(0.16)
Perception bias X net wealth	-0.18^{***}	-0.14^{***}	-0.14^{***}
	(0.01)	(0.01)	(0.01)
Net wealth (ihs)	0.53^{***}	0.33^{***}	0.35^{***}
	(0.03)	(0.03)	(0.03)
Net eq. income (ihs)		5.56^{***}	4.90^{***}
		(0.23)	(0.27)
Income controls	No	Yes	Yes
Personal controls	No	No	Yes
Wave fixed effects	Yes	Yes	Yes
R2	0.08	0.11	0.11
Nobs	6048	6048	6048

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. *Multiple imputations taken into account. 100 replicate weights. All specifications feature the savings rate in percent as the dependent variable. Perception bias refers to perceived decile minus observed decile. Interaction terms are based on bias-dummies and ihs-transformed net wealth. Income controls refer to ihs-transformed monthly equivalent household net income. Personal controls include a second-degree age polynomial, three education dummies and seven industry dummies. pp refers to percentage points.*
Source: HFCS 2014, 2017 - ECB and OeNB.

Figure 4: Misperceptions income versus wealth

Note: This graph illustrates the correlation of biased distributional rank perceptions in terms of income and wealth. Respondents are grouped by the magnitude of their bias in terms of net wealth and net monthly income rank. The size and color of the bubbles indicate the number of households in each group. Multiple imputations and survey weights are taken into account.

Source: HFCS 2010 - ECB and OeNB.

prior to the reform, we merge the 2011 district-level data to the 2010 data from the HFCS. Due to the high persistence of the share of large firms in each district across time, we are confident that the 2011 data is a sufficiently good proxy for the missing 2010 information. Table 14 provides evidence for this argument. It replicates the results from table 7, substituting not only the 2010 data for its leading values, but also using 2018 and 2015 data with the 2017 and 2014 HFCS waves respectively. The IV estimate in the first column does not change substantially (increasing from -2.31 to -2.17 compared to the estimates of table 7). The same

Table 14: Perceptions and savings: Instrumental Variables

	IV (pp)	First stage (deciles)	Exclusion (pp)
Bias	−2.17***		
	(0.37)		
Large firm share		1.56	−3.62
		(4.30)	(24.59)
Large firm share X 2014		29.38***	−292.49***
		(4.83)	(37.91)
Large firm share X 2017		20.59***	−226.60***
		(4.16)	(35.33)
Wealth and income controls	Yes	Yes	Yes
Wealth X income	No	No	No
Personal controls	No	No	No
Wave fixed effects	Yes	Yes	Yes
Nobs	6048	8381	8381
R2		0.31	0.32

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. *Multiple imputations taken into account. 100 replicate weights. IV refers to the coefficients from an instrumental variables regression, where perceptions are instrumented. The instrument is the share of firms with at least 100 employees by region (Large firm share). The corresponding first stage is labelled First stage. The dependent variable in the first colunm is the savings rate, while it is the magnitude of perception bias in the second. The final row has savings based on the consumption variables as a dependent variable. Households with business wealth excluded. pp refers to percentage points.*
Source: HFCS 2010, 2014, 2017 - ECB and OeNB and Arbeitsstättenzählung 2011, 2015, 2018 (Registerzählung and Abgestimmte Erwerbsstatistik) - Statistics Austria

holds for the other two specifications, appraising the effect of firm size on savings and misperceptions before and after the reform. The coefficients maintain their signs, order of magnitude and statistical significance when compared to the results presented in section 4.3.