Working Paper Series

#22

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Original Citation:
Rapp, S. (2021) Asset Bias in Household Needs Measurement. *INEQ Working Paper Series*, 22. WU Vienna University of Economics and Business, Vienna.

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Asset Bias in Household Needs Measurement ⋆

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Abstract

Increasingly, the estimation of household equivalence scales relies on subjective data. This approach challenges not only traditional methodology, but also provides systematically lower estimates of household needs compared to other methods. I offer a novel take on this puzzle and argue that the failure to account for private wealth in subjective measurement is part of the explanation of why household financial needs appear to be low. Wealthy survey respondents claim to be satisfied with less income, as they can draw on their asset buffer to maintain a given living standard. Capitalising on SOEP survey data, I find that the financial needs of a household comprising five members relative to a reference household might be underestimated by up to 20% if wealth is not accounted for. Equivalence scales are central to poverty and inequality measurement, the design of social transfer systems and many other applications. Therefore, it is crucial to account for asset ownership when drawing on estimates that rely on the subjective methodology.

Keywords: equivalence scale, income satisfaction, poverty, inequality, wealth, social transfers, multidimensional measurement

1. Introduction

Equivalence scales summarise the financial needs of a household of a given size and demographic composition relative to a reference household. Does an

⋆I am thankful to Stefan Humer, Karin Heitzmann, Miriam Rehm, Wilfried Altzinger and the participants at the Chamber of Labour's Young Economists Conference for helpful discussions and comments.

adult couple household need more resources than one person living on their own? By how much? Answering these questions is decisive for the design of benefit systems, minimum income support schemes, or the determination of the rates for child maintenance after divorce. Moreover, the measurement of poverty and inequality relies on needs adjustments for income, in order to compare households of different demographic characteristics and compositions.

Several ways to obtain equivalence scales exist. Many applications employ the OECD's well-known equivalence scale or the square-root-scale.[1] Both represent a set of ratios that determines how much more resources a given household needs to attain the same level of wellbeing as a defined reference household. This type of expert equivalence scales has been challenged frequently, not at least due to the lack of their theoretical foundation (Daley et al., 2020; Decancq et al., 2015). Indeed, the OECD does not recommend the use of one particular scale (OECD, 2018). Another prominent approach to derive equivalence scales empirically is to estimate expenditure systems from household consumption data. While a number of methods exist, many suffer from identification issues (Deaton, 2019; Pollak and Wales, 1979), others have complex data requirements that cannot be met in many contexts. Lastly, the contemporary boom in subjective data use in economics (Frey and Stutzer, 2002) provides alternative epistemological foundations for equivalence scale estimation. Given the weaknesses of expert scales and objective scales recovered from expenditure data, recent contributions capitalising on subjective data circumvent the problems of traditional equivalence scale measurement (Schwarze, 2003; Biewen and Juhasz, 2017). However, they also provide systematically different scales from those suggested by traditional expenditure-based estimates or expert opinions. Indeed, the subjective methodology tends to yield results that imply significantly lower household needs than other methods (Borah et al., 2018; van den Bosch, 1996; Garner and Short, 2003).

[1] Square root rule means that the household income is divided by the square root of the household size, with the equivalence scale parameter $e = 0.5$: $\frac{Y_i}{n^e} = \frac{Y_i}{\sqrt{n}}$

This paper contributes to the literature of equivalence scale measurement by addressing the puzzle of why subjective methods tend to produce particularly low equivalence scales. Already, scholar have argued that behavioural biases in survey responses to questions on subjective income adequacy assessments introduce bias in the measurement. The argument advanced here provides evidence for the latter view. It posits that asset ownership leads respondents to overstate their income satisfaction, as they can use their wealth to support consumption. In turn, the overstatement leads to an underestimation of equivalence scale parameters. Using panel data and wealth modules from the German Socio Economic Panel (SOEP),[2] I find evidence in support of this hypothesis.

In addition to traditional equivalence scale measurement, the wealth-bias discussed here expands the literature on the relationship between wealth and subjective wellbeing. It has been previously established that a strong connection exists between wealth and subjective satisfaction with life and one's financial situation. This paper demonstrates that wealthier survey respondents even report higher satisfaction with their household income.

The paper proceeds as follows. In Section 2, I flesh out the puzzle and situate the contribution in the related literature. Subsequently, a theoretical section appraises the most suitable current approach in subjective equivalence scale measurement to demonstrate how the wealth-bias plays out. Next, I introduce the data and provide summary statistics, before moving on to the results. A final section wraps up the findings and concludes.

2. Literature Review

Before elaborating in detail about the approach pursued in this paper, I briefly review the most common measurement techniques. In contrast to the methods that dominated the literature for a long time, relatively recent methodological innovations based on subjective income satisfaction data yield uncom-

[2]This refers to the waves of 2002, 2007, 2012 and 2017

monly low estimates of household needs. While the current debate on how subjective biases in survey responses and time constraints affect equivalence scales has some explanatory purchase in view of the magnitude of recent estimates, the literature seems to be rather ignorant towards household wealth.

One of the most prominent types of equivalence scales is the OECD equivalence scale, stipulating a 50% increase in household needs for each additional adult household member, and 30% for a child. The OECD scale is part of the group of "expert scales". Expert scales are determined in a process that may involve diverse stakeholders, such as advocacy groups, researchers, or people living in poverty. Recent cross-national research estimates household financial needs based on the cooperation with expert groups. Yet, expert scales can be criticised for some degree of arbitrariness (Bradbury, 1989) and the lack of a theoretical fundament (Biewen and Juhasz, 2017). Moreover, disagreement between experts can increase the variance in estimates (Stewart, 2009).

Van de Ven et al. (2017), who derive equivalence scales from tax schedules, provide another perspective on needs measurement. The underlying assumption is that the tax schedule represents a society's judgements on household needs, as it emerges from the political process (Bradbury, 1989). Obviously, the tax schedule need not necessarily only reflect needs. For example, fiscal considerations might be important, too. Crucially, their equivalence scales from tax schedules are remarkably similar to the OECD scale, in particular for high income earners.

Alternatively, equivalence scales derived from observed consumer behaviour have a long tradition. Household expenditure surveys allow for a comparison of the consumer behaviour associated with different household types, by estimating demand functions. Many different variants exist. They reach from simply equating the share of household expenditure devoted to food across households to arrive at a measure of wellbeing comparable across households to estimating complex demand systems (Deaton and Muellbauer, 1980). Behavioural scales that capitalise on expenditure data are frequently criticised for issues of underidentification (Pollak and Wales, 1979).

The literature on subjective equivalence scales has seen rapid development in recent years, not at least in response to the weaknesses of other approaches (Ravallion, 2012). Even within the subjective programme, different types of scales exist. However, they have in common a reliance on subjective income evaluation data from household surveys. In contrast to expenditure-based approaches, they rely on stated rather than revealed preferences. One way to construct equivalence scales from subjective data is to have survey respondents evaluate a series of hypothetical income situations (Van Praag, 1968). A related approach would be to elicit the "minimum income" that survey respondents consider necessary to make ends meet (Bishop et al., 2014; Goedhart et al., 1977; Garner and de Vos, 1995). Most importantly for this study, Schwarze (2003) presents an approach where survey respondents evaluate their own current income, commenting on its adequacy on a Likert-Skale.[3]

While equivalence scales from subjective data might be an attractive tool to estimate household needs flexibly and without substantial data requirements, the resulting scales appear rather low when compared to expert or expenditure scales (Biewen and Juhasz, 2017; Borah et al., 2018; Takeda, 2010; Buhmann et al., 1988; van den Bosch, 1996; Garner and Short, 2003; Borah et al., 2021). In an informal survey Buhmann et al. (1988) find that the equivalence scale elasticity e tends to be lower for subjective approaches, compared to other types of scales. Bradbury (1989) draws similar conclusions from his survey of equivalence scales. Later surveys confirm this result (Humer and Rapp, 2020). Despite these results, explanations accounting for the systematic and puzzling effect sizes are rare. Most importantly, concerns have been raised as to whether individuals' biased perceptions of their own income are threatening valid inference from subjective equivalence scale methodology. One bias discussed in the literature arises when individuals assign different levels of income to labels such as "insufficient income", "just sufficient income" and "good income". As income is

[3]The Likert-Skale consists of discrete values on a scale from 0 to 10, ranging from "totally unhappy" (0) to "totally happy" (10).

evaluated in a hypothetical scenario – for instance a rich person thinking of an insufficient income – the evaluation might depend on an individual's current income. For example, Garner and de Vos (1995) find that when asked about the minimum necessary income, respondents were thinking mainly about current spending and life styles, instead of fundamental needs. This phenomenon, also known as "preference drift" (Kapteyn and Van Praag, 1978), can be alleviated by relying on the income satisfaction approach by Schwarze (2003). However, even subjective estimates that do not suffer from preference drift are relatively low.

Another frequently discussed bias in the literature on subjective perceptions of economic circumstances is the effect of reference groups (Clark et al., 2013; Bradbury, 1989). Many people think of their income relative to the income of others, and thus consider themselves as subjectively better or worse off than they are nominally. This can have consequences for the measurement of income satisfaction. Indeed, it can be shown that income satisfaction is not only a function of personal or household income, but also of the income of reference groups (D'Ambrosio and Frick, 2007). In view of the measurement of equivalence scales, Borah et al. (2018) apply this rationale to investigate bias in the derivation of equivalence scales based on subjective data. Isolating the reference group effect using data for Germany, they find that controlling for the reference group effect increases the equivalence scale weights for children. For adults, in contrast, the weights remain below the OECD-scale benchmark.

Lastly, the importance of other household resources in mediating income needs features centrally in the contemporary equivalence scale literature. In particular, it can be shown that time constraints increase the monetary costs of additional household members (Gardes and Starzec, 2018). For example, Van Praag and Ferrer-i Carbonell (2004) demonstrate using subjective data that families with two breadwinners have higher monetary needs. More recently, Borah et al. (2021) show that time constrained adults have substantially higher subjective income needs. This suggests that survey respondents consider non-market production when evaluating income needs. However, objective measures

of equivalence scales will likely also arrive at higher scales once the value of household production is accounted for.

Clearly, the debate has made progress towards understanding the gap between subjective methods of equivalence scale estimation and other approaches. However, a review of contributions on the matter reveals that none of the explanatory approaches so far can account for the full puzzle, suggesting that several factors might be at work. In this study, I add to the debate both on subjective equivalence scales and biases therein.

In addition, I contribute to the literature on the relationship between wealth and subjective outcomes. As recent advances in the happiness-literature demonstrate, asset ownership matters crucially for wellbeing (Brulé and Suter, 2019). Headey (2008) shows that wealth is a more important determinant of subjective wellbeing than both income and consumption. This also applies to the relationship between wealth and financial satisfaction (Headey, 2019). However, it is not clear whether spill-over effects connect wealth and income satisfaction. Do survey respondents only think of their income when they respond to income satisfaction questions? Do they also consider wealth beyond its effects on income in the form of capital gains? Some evidence points towards the existence of such links between income satisfaction and wealth: it can be shown that windfall income from lottery wins improves satisfaction with income (Oswald and Winkelmann, 2019). Hence, it is plausible to expect wealth effects on income satisfaction. If survey respondents also think of their wealth when responding to the income satisfaction question, this has important ramifications for subjective equivalence scale measurement.

3. Theory and Methodology

The previous section reveals that a discrepancy exists between subjective and other approaches to equivalence scale measurement. Suggesting that wealth ownership can partly account for this systematic difference, the following builds on the approach set out by Schwarze (2003). While reducing issues arising from

preference drift, I derive equivalence scales directly from data on satisfaction with current household income. In contrast to previous studies, I propose specifications that explicitly model the way household wealth can influence equivalence scales. This section first discusses the links between asset ownership and income satisfaction, before elaborating in detail on the derivation of equivalence scales using both income and wealth data.

3.1. Wealth and income satisfaction

The extent to which wealth satisfies similar need to income and therefore affects income satisfaction is difficult to establish ex ante. The effect of wealth on equivalence scales will depend on the functions assets perform for their owners, and consequently the composition of the household balance sheets. Fessler and Schürz (2018) argue that wealth has three main functions: precaution, use and income generation.[4]

In the case of precautionary savings, people save precisely in order to substitute income for wealth at some point. Therefore, it is plausible that survey respondents with low savings that can help them support consumption will have more difficulties making ends meet with a given income. This is particularly true for households experiencing income shocks.

Some forms of wealth are illiquid, such as housing wealth. For such forms of wealth, the use function might be of particular relevance when it comes to constructing equivalence scales. If certain properties of an asset do not only act as a store of value, then one be content with a smaller income as long as the asset performs certain services. For example, housing assets primarily satisfy housing needs. Therefore, outright owners do not need additional income to satisfy housing needs.

[4]Other accounts might include further functions of wealth, such as power (Fessler et al., 2012). I use a simplified framework which seems most appropriate for the purpose of this paper, since functions such as power are likely to be relevant only for the very top of the distribution.

The income generation function of wealth might also have important ramifications for equivalence scale measurement. For example, it might be difficult to sell business assets at any given point in time. Even so, however, these assets can impact income satisfaction. On the one hand, components of business wealth, such as vehicles, can help save consumer expenditure. On the other hand, they can affect income satisfaction as owners of business wealth might need less income to feel comfortable about their future financial position, not at least in retirement. This might be particularly relevant in enterprises where owners leave profits in the companies, and benefit primarily from capital gains. For such long-term considerations, liquidity and immediate consumption potential might be less important. In order to assess the extent to which the effect of interest is driven by non-liquid assets, I supplement the analysis of net wealth with estimates that use financial wealth only. Financial assets are considerably more liquid than business or housing wealth, for example.

3.2. Constructing equivalence scales with income and wealth data

Constructing equivalence scales from income satisfaction data, Schwarze (2003) assumes that income satisfaction questions provide information about equivalent income. Rather than stating their satisfaction with their actual nominal income, respondents take their (household's) needs into account when answering the income satisfaction question. Hence, income satisfaction S_{it} (at time t for individual i) can be considered as a function of several household characteristics, including the household size h_{it}, other characteristics X_{it} (for example: gender, nationality and education) and its income Y_{it}. Schwarze (2003) substitutes income for equivalent income, as households primarily evaluate the latter when asked about income satisfaction. Therefore, Y_{it} becomes Y_{it}/h_{it}^{e}, $e \in]0;1[$. In this specification, the parameter e refers to the equivalence scale elasticity.[5]

[5]Buhmann et al. (1988) argue that most equivalence scales can be represented by one parameter e (the equivalence scale parameter). They refer to this parameter as the family size elasticity of need.

Assuming no economies of scale within the household, the parameter assumes unity. This implies that larger households require proportionately more spending to be equally well off. In contrast, if the economies of scale were perfect, the elasticity would correspond to zero. Equation 1 summarises this line of thought. The indices identify every individual respondent i at time t.

$$S_{it} = \beta_0 + \beta_1 \ln \left(\frac{Y_{it}}{h_{it}^e} \right) + X'_{it}\gamma + \epsilon_{it} \tag{1}$$

Rearranged, equation 1 gives the following equation, where $\alpha = \beta_1 e$. This equation can be estimated from the data:

$$S_{it} = \beta_0 + \beta_1 \ln Y_{it} - \alpha_0 \ln h_{it} + X'_{it}\gamma + \epsilon_{it} \tag{2}$$

The equivalence elasticity parameter can be recovered from the estimated specification by $e = -\alpha_0/\beta_1$. The basic specification can be readily extended by differentiating between children and adults (Schwarze, 2003).

Crucially, the estimated coefficient scale parameter e will be biased if household wealth is correlated with income satisfaction and income itself. Much like the income coefficient, all other estimates that involve β_1 parameters will be biased as well. To alleviate this form of omitted variable bias, household wealth has to be included in the specification. This requires some additional assumptions on the relationship between household wealth and size, as the identification problem in equation 3 demonstrates. Indeed, while one option would be to include the real value of household wealth into the analysis, it might well be possible that households do not evaluate their actual wealth when answering questions about income satisfaction. In this case, one would have to adjust wealth for household size as well, much like household income, the latter being the very purpose of the enterprise.

Little consensus exists as to whether and what equivalence scales should be applied to the analysis of the distribution of wealth (Balestra and Tonkin, 2018; Maestri et al., 2014; Cowell et al., 2017). Indeed, multiple approaches to wealth equivalence scales exist. That includes ignoring equivalence scales in most of

the cases. In addition, employing scales similar to those designed for income, as well as per capita equivalisation, where the household net wealth is divided by the household size, are proposed in the literature (Sierminska and Smeeding, 2005). Given these difficulties, it is helpful to consider how the problem plays out in terms of the wealth bias.

$$S_{it} = \beta_0 + \beta_1 \ln\left(\frac{Y_{it}}{h_{it}^{e}}\right) + \beta_2 \ln\left(\frac{W_{it}}{h_{it}^{\tau}}\right) + X_{it}'\gamma + \epsilon_{it} \tag{3}$$

$$= \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln W_{it} - \alpha_\tau \ln h + X_{it}'\gamma + \epsilon_{it} \tag{4}$$

Since the coefficient on the log of the household size α_τ now also contains the parameters β_2 and τ[6], the elasticity e can only be computed as usual if $\tau = 0$. More generally, e in a specification including wealth is, instead of $-\alpha_0/\beta_1$, computed as follows:

$$\frac{-\alpha_\tau - \beta_2 \tau}{\beta_1} \tag{5}$$

Therefore, in the estimations of the main results, I consider the case of perfect economies of scales to wealth, corresponding to an equivalence scale elasticity for wealth τ of zero. This choice is based on the most popular practice in view of equivalising wealth (Sierminska and Smeeding, 2005). Secondly, I show the implications of equating τ and e. Lastly, a possible case is that wealth does not have any economies of scale at all ($\tau = 1$). Reported in this way, I cover both extreme poles of wealth equivalisation, thus arriving at a range of possible values for the wealth-bias. Therefore, depending on the stipulated value for the equivalence scale elasticity for wealth, the income equivalence scale parameter e can be recovered from the estimated coefficients as follows:

[6] $\alpha_\tau = \beta_1 e + \beta_2 \tau$

$$e = \begin{cases} \frac{-\alpha}{\beta_1} & \text{if } \tau = 0 \\ \frac{-\alpha}{\beta_1+\beta_2} & \text{if } \tau = e \\ \frac{-\alpha_\tau-\beta_2}{\beta_1} & \text{if } \tau = 1 \end{cases}$$

Income satisfaction cannot be directly observed, and usually comes in the form of an ordinal variable where income satisfaction is represented as the realisation of an outcome on a Likert-Skale. This requires the careful choice of the empirical specification. While ordered logit models are a popular choice (Schwarze, 2003; Borah et al., 2018), it has been stressed previously that unobserved heterogeneity between individuals suggests the use of fixed effects estimators.

Given the categorical nature of the dependent variable and the data's panel structure, one option is to collapse the response variable into a binary outcome, and employ Chamberlain's conditional logit fixed effects model (Chamberlain, 1982). Even though this approach has been employed previously, it implies the loss of important variance on the dependent variable. As only observations can be used for identification that also experience a change in the dependent variable at some point in time, a large number of observations cannot be included. Alternatively, the extension of Chamberlain's conditional logit fixed effects model to ordered categorical data is a feasible option - the BUC/BUC-τ[7] estimator (Baetschmann et al., 2020). The latter method will serve as the main estimation framework, while the binary Chamberlain estimator is reported as a benchmark. Moreover, results for ordered logit without fixed effect will be provided along the main results. Yet another option is to treat the dependent variable as a continuous variable. In this case, ordinary least squares and its application to demeaned data would be suitable estimators. However, if the results are not in accordance with estimates obtained from approaches that treat the dependent variable as categorical, they should not be given much weight.

[7] blow-up and cluster regression

4. Data

I use data from the German Socio-Economic Panel (SOEP) to estimate the impact of private wealth on income satisfaction and hence equivalence scales. The SOEP is a large-scale panel survey carrying out interviews with a representative sample of the German population since 1984. Among a range of diverse topics, the data contains information on well being and subjective outcomes, health, financial circumstances and employment. One of the key advantages of SOEP-data is that it draws together information on household assets and income satisfaction. Without doubt, survey information on wealth has its drawbacks. For example, substantial underreporting and poor coverage of the wealthiest households have serious implications for the data quality (Vermeulen, 2016). However, abstracting from issues such as tax avoidance that distort tax collection, wealth tax records are rare, and not available for a large number of countries. At the same time, surveys allow to gather subjective data, such as income satisfaction. In addition, the SOEP is a longitudinal data set, allowing to control for unobserved heterogeneity.

For this exercise, only survey waves are analysed that cover the wealth module, which is part of the questionnaire in five year intervals (2002, 2007, 2012, 2017). I reduce the total sample of all panel participants in each year to individuals who completed both the wealth module and the relevant questions on income satisfaction. In addition, the empirical analysis makes further sample restrictions in accordance with Borah et al. (2018): Only individuals aged 18 and above are considered, while I also exclude households with more than two adults. Adults are either the household head or their partners and spouses. Finally, the sample does not contain households in the top and bottom percentile of the net wealth distribution, preventing uncommonly low and high values of wealth from unduly affecting the results. After those adjustments, 70,281 observations remain. Approximately 30% of individuals are only observed once throughout the whole period.

The dependent variable, satisfaction with household income, comes as a

Likert-scale ranging from 0 to 10. As discussed above, this has important implications for the estimation approach. Most respondents report income satisfaction levels of 8, while on average the response ranges between 6 and 7, as reported in table 1.

Table 1: Descriptive statistics

	Mean	SD	Min	Max	N
Income Satisfaction	6.56	2.24	0.00	10.00	70,281
log(income)	10.29	0.65	0.00	13.63	70,281
ihs(net wealth)	8.92	6.60	-11.21	15.06	70,281
hh size	2.46	1.22	1.00	11.00	70,281

log refers to logarithmic transformation, *ihs* refers to inverse hyperbolic sine transformation. *hh size* means household size.

The income measure corresponds to annual household post government income. Even though the satisfaction variable is measured on the personal level, the survey asks for satisfaction with household income. Naturally, the choice of household income as independent variable follows. Household post government income includes both income from labour and capital. Especially in view of the endeavour at hand, the latter is particularly important: Considering total capital and labour income already accounts for the fact that wealthy household have a higher income and thus higher income satisfaction. Beyond market income, household post government income includes private and public transfers (housing allowances, child benefits, minimum income support, etc.) as well as social security pension income (old age, disability, survivors). Additionally, total family taxes as derived from tax-benefit microsimulations are deducted.

While income from most assets is included in the income variable, imputed rents from owner-occupied housing is not. Therefore, owner-occupiers might state higher income satisfaction, as they also include their hypothetical rental income when providing information about income satisfaction. In a robustness

check, I include imputed rents in the income definition. Thus, it is possible to establish whether even for homeowners, there is an asset effect beyond income that is relevant for income satisfaction.

In view of wealth, different concepts can be used. Most common definitions in the literature include liquid assets, financial assets, total assets or net wealth. Moreover, some accounts include public pension wealth, whereas others do not include such forms of assets into the measurement of wealth (Bönke et al., 2019). In contrast to measures of household assets, net wealth nets out assets and debt. For the most part, the analysis at hand will focus on net wealth.[8] Net wealth corresponds to the sum of a household's marketable wealth net of its liabilities. Hence, negative values are not uncommon.

Table 1 provides summary statistics for the key variables. Measures of income and wealth are provided in their logarithmic forms. For table 1, income satisfaction is converted into a continuous variable, rather than an ordinal variable. The summary statistics refer to the sample constructed for the purpose of this study.

5. Results

Table 2 begins with an overview over different model specifications on the main results. Specifically, it aims at establishing the equivalence of results across cross-sectional ordered logit estimation and fixed effects estimation both with continuous and ordered dependent variables. Whereas models 1 and 2 are estimated only with time fixed effects and a battery of control variables[9] not reported in the table, the columns 3 to 6 add individual fixed effects while dropping the control variables. For each model type table 2 reports one specification

[8] The SOEP uses multiple imputations to account for the uncertainty involved in measuring wealth accurately. I take the imputation in account by averaging net wealth across the five available implicates. Moreover, I perform an inverse hyperbolic sine transformation so as to include observations with negative net wealth.

[9] Age, age squared, gender, employment status, education, nationality

without wealth (columns 1, 3 and 5), in the conventional form of equivalence scale estimation. Wealth is added to the specifications with even numbers. Information on the model fit is provided through a measure of (pseudo) R^2.[10] Moreover, table 2 provides mean estimates for the equivalence scale elasticity. To demonstrate the crucial role of the assumptions about returns to scale of household wealth, results are reported for $\tau = 0$, $\tau = e$ and $\tau = 1$.

Comparing the first two columns, the marginal effect of income on income satisfaction falls as wealth is introduced in the specification. Theoretically, this is due to a positive association between income and wealth, and a positive association between wealth and income satisfaction. The latter in its transformed form has a significant and positive impact on income satisfaction. Yet, the wealth effect is much smaller than the marginal impact of income itself, as the estimate of the wealth-coefficient in the second column suggests. In contrast to the income-coefficient, the coefficient on household size remains almost constant when household assets are included in the analysis. As a consequence, this tends to lead to an increase in the scale parameter e, displayed in the bottom of the panel. However, the magnitude of the increase depends crucially on the assumptions about the scale parameter for wealth τ. In fact, the increase in the scale parameter for income is more limited if $\tau = 1$. For example, while according to model 1, the scale parameter amounts to 0.42, it corresponds to 0.38 if $\tau = 1$ in model 2.

As unobserved heterogeneity between individuals might bias the results, I introduce fixed effects in the models 3 and 4. At the same time, both specifications maintain the ordered categorical nature of the dependent variable, drawing on the BUC/BUC-τ estimator by Baetschmann et al. (2020). In line with previous research (Borah et al., 2018), the fixed effects approach strongly affects the results. The parameters for both income and household size drop dramatically in magnitude. Falling from around 0.55 to 0.27 from specification

[10] The conventional residual sum of squares is only provided for the estimations with linear dependent variables.

1 to 3, the household size parameter is more than halved, while the estimates for household income fall by around 0.4 units. Following from the over proportional response of the numerator, the equivalence scale elasticities fall notably. Despite the level shift, the effect of introducing wealth in the models does not change substantially. Even in the extreme case of $\tau = 1$, the estimated income equivalence scale elasticity e increases in model 4, relative to model 3 by roughly 2 percentage points.

Turning to the final pair of specifications in table 2 (columns 5 and 6), where the income satisfaction variable is treated as a continuous dependent variable, the coefficient estimates for both income and household size fall further. Again, however, they do not decrease in tandem. While β_1 is reduced by roughly 0.25 units, the household size parameter is more than halved. In sum, the shifts in the coefficients' magnitudes lead to another dramatic fall in the estimated equivalence scale elasticity, which corresponds to 0.13 in model 5. This implies much higher economies of scale within the household, than the elasticities estimated by ordered logit models. Together with a small decline in the income coefficient, the changing household size parameter has substantial implications for the level of equivalence scale elasticity. Even so, the increase in the elastiticy once wealth is accounted for is still present.

Table 2: Determinants of income satisfaction and the equivalence scale elasticity

	Ordered Logit		Ordered Logit		Linear	
	(1)	(2)	(3)	(4)	(5)	(6)
log(income)	1.532***	1.379***	1.169***	1.137***	0.892***	0.869***
	(0.017)	(0.017)	(0.055)	(0.055)	(0.028)	(0.028)
log(hh size)	-0.554***	-0.576***	-0.265**	-0.297***	-0.119*	-0.151**
	(0.030)	(0.030)	(0.088)	(0.087)	(0.058)	(0.058)
#kids	-0.0573	-0.0231	0.00390	-0.00157	-0.0957	-0.0965
	(0.041)	(0.041)	(0.115)	(0.115)	(0.084)	(0.084)
log(hh size) ×#kids	0.0579*	0.0492*	-0.0209	-0.0127	0.0260	0.0306
	(0.023)	(0.023)	(0.069)	(0.069)	(0.050)	(0.050)
ihs(net wealth)		0.0489***		0.0217***		0.0212***
		(0.001)		(0.003)		(0.002)
N	70281	70281	41801	41801	70281	70281
(p)-R^2	0.0650	0.0708	0.0689	0.0716	0.0636	0.0636
FE			×	×	×	×
$e(\tau = 0)$	0.36176639	0.41756095	0.22668974	0.2608681	0.13366662	0.17406578
$e(\tau = e)$		0.40326135		0.25598537		0.16991737
$e(\tau = 1)$		0.38210105		0.24179385		0.1496515

Standard errors in parentheses.*log* refers to logarithmic transformation, *ihs* refers to inverse hyperbolic sine transformation. *hh size* means household size. # means "number of", $(p) - R^2$ is a measure of $(pseudo)R^2$. FE indicates individual fixed effects. The bottom panel provides equivalence scale elasticities. Dependent variable in all specifications: Satisfaction with income. Control variables omitted. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Interestingly, in most specifications the coefficients on the number of children are not statistically significant. One possible explanation is that the fixed effects approach, which is chosen in most of the specifications, can account for the absence of significant results. Indeed, Borah et al. Borah et al. (2018) argue that restricting one's attention only to households with changing composition, one might underestimate causal effects, leading to lower estimates. This, so the argument goes, results from anticipation effects. Expecting a child, for example, respondents might change their income expectations and satisfaction already in advance. The same holds for the coefficients on the interaction terms for the number of children and household size, that are required to construct specific scales for children. The lack of precision in of the estimates makes a meaningful interpretation difficult. This leaves the interpretation, that the additional needs do not seem to differ systematically between children and adults in the sample examined.

A comparison of the estimates in the first pair of columns (1 and 2) with those in the second pair (3 and 4) suggest that introducing individual fixed effects changes the results substantially. The decline in the estimate magnitudes lends support to the expectations-hypothesis. Despite the arguments that can be levied against employing fixed effects estimation, I consider fixed effects estimation informative in this context. Firstly, important contributions in the field rely on fixed effects (for example Schwarze (2003)). Therefore, it is important to demonstrate that the wealth-effect cannot simply be controlled for using panel methods. Secondly, the fixed effects estimator seems to provide a more conservative estimate of the wealth-effect. In view of the models 5 and 6, it does not seem sensible to rely on the assumption that the ordinal variable can be transformed smoothly into a continuous variable, since the results are affected strongly and the nature of the dependent variable suggests ordered logit estimation. Given this reasoning, I will proceed with specifications 3 and 4 in table 2 to carry out the robustness checks.

Having examined the consequences of correcting for the omitted variable bias in household needs measurement, I expose the specifications 3 and 4 from table

2 to a battery of robustness checks. To begin with, the first pair of columns in table 3 addresses the choice of the income variable. Arguably, the changes in the estimates upon the introduction of wealth in the specification could result from owner occupied housing. Homeowners, at least outright owners, might indeed need less income to support a given standard of living. If it was only a matter of home ownership, the issue of omitting wealth from the estimation can be addressed by adding imputed rental income to the income of owner-occupiers. Yet, the specifications 1 and 2 in table 3 suggest that there is a wealth effect beyond home ownership. In the income measure, specifications 1 and 2 include imputed rents for owner occupiers. Despite the changes in the operationalisation of income, the key result persists: accounting for wealth in equivalence scale estimation results in a higher equivalence scale parameter. Again, even if $\tau = 1$ is assumed, a wealth-enhanced specification yields smaller economies of scale and a higher e.

The next pair of columns replicates the specifications 3 and 4 in table 2, though only financial wealth is considered in column 4. Notably, financial wealth enters the model through a logarithmic transformation, since it can only assume positive values, and excludes debt. Many forms of financial wealth, including savings, bank accounts or stock, is more liquid than real wealth. Therefore, financial wealth might be particularly suitable as a supplement to income in view of supporting a given living standard. Columns 3 and 4 suggest that financial wealth plays an important role in shaping the asset effect. Indeed, the results suggest that changing the perspective from net wealth to financial wealth only does not seriously affect the conclusions drawn from 2.

Table 3: Determinants of income satisfaction: robustness checks

	Imputed Rents		Financial Wealth		Binomial	
	(1)	(2)	(3)	(4)	(5)	(6)
log(income)			1.169***	1.131***	1.164***	1.127***
			(0.055)	(0.055)	(0.061)	(0.061)
log(adj. income)	1.222***	1.188***				
	(0.056)	(0.056)				
log(hh size)	-0.284**	-0.311***	-0.265**	-0.312***	-0.437***	-0.473***
	(0.088)	(0.087)	(0.088)	(0.087)	(0.107)	(0.107)
#kids	0.0209	0.0141	0.00390	0.0320	-0.156	-0.155
	(0.115)	(0.115)	(0.115)	(0.115)	(0.157)	(0.158)
log(hh size) ×#kids	-0.0290	-0.0206	-0.0209	-0.0255	0.0588	0.0617
	(0.069)	(0.069)	(0.069)	(0.069)	(0.094)	(0.094)
ihs(net wealth)		0.0209***				0.0248***
		(0.003)				(0.004)
log(fin wealth)				0.0400***		
				(0.004)		
N	41801	41801	41801	41801	19296	19296
(p)-R^2	0.0696	0.0721	0.0689	0.0739	0.0587	0.0615
$e(\tau = 0)$	0.23212811	0.26202928	0.22668974	0.27601942	0.37547069	0.41988977
$e(\tau = e)$		0.25756809		0.26657779		0.41086124
$e(\tau = 1)$		0.24470884		0.24060149		0.39791512

Standard errors in parentheses. *log* refers to logarithmic transformation, *ihs* refers to inverse hyperbolic sine transformation. *hh size* means household size. # means "number of", $(p) - R^2$ is a measure of $(pseudo)R^2$. FE indicates individual fixed effects. The bottom panel provides equivalence scale elasticities. Dependent variable in all specifications: Satisfaction with income. Control variables omitted. All specifications include time and entity fixed effects. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Finally, I collapse the dependent variable into a bivariate factor variable. All satisfaction scores above 7 are coded to assume unity, while those equal to or below 7 are set to zero. This imitates the approach by Schwarze (2003), thus circumventing the estimation of a full ordered logit model with fixed effects. It allows employing a conventional bivariate logit fixed effects estimator, following Chamberlain (1982). The results resemble very much those of columns 1 and 2 in table 2. Indeed, collapsing income satisfaction into a bivariate indicator pushes the estimates of the equivalence scale elasticity upwards. The rather pronounced contrast to the other results from fixed effects estimation with an ordinal dependent variable should not be considered in isolation of the substantial reduction in the number of observations. Indeed, the variance in the dependent variable is reduced sharply, and a larger share of observations does not change over time. These observations are dropped.

6. Discussion

Coming back to the problems set out in the beginning, I provide an explanation of the puzzle of particularly low equivalence scale elasticities recovered from subjective data. Indeed, the empirical analysis suggests that asset ownership plays a role in shaping respondents' perceptions of income satisfaction. If the latter are included in the specifications and appropriately modeled, the estimated elasticities for income increase substantially. This suggests that the difference between equivalence scales estimated from consumption behaviour or household reference budgets and subjective approaches actually might not be that pronounced.

In terms of the magnitude of the effect, while statistically significant, it is moderate when compared to other estimates of bias in equivalence scale measurement in the literature. For example, Borah et al. (2018) arrive at changes in the equivalence scale parameter due to reference groups between five and ten percentage points. The effects estimated here seem to be at the lower bound of this range, particularly if the equivalence scale parameter for wealth is assumed

to be rather high. Therefore, it needs to be noted that, given the magnitude of the measured effect, other forces might be at play as well that can contribute to the high economies of scale established in subjective treatments of equivalence scale measurement.

To assess the economic significance of the difference in scale parameter, I illustrate how the parameters translate into estimates of household needs using a back-of-the envelope calculation.[11]

If Y_r, the income of the reference household, is set to unity, one can compute the additional of households of different sizes relative to the reference household. This yields a progression of household needs as a function of household size as depicted in figure 1. The graph illustrates that the difference between the equivalence elasticities from model 3 and 4 in table 2 becomes particularly salient as household size increases. In fact, the wedge becomes relatively larger as household size increases. The light grey area illustrates the range of needs that emerges from different assumptions about the parameter τ. Even though uncertainty about τ does not allow for pinning down a definite value, the range of possible values for household needs after wealth is taken into account is still above needs measured by ignoring wealth, as the dashed line below the grey area suggests.

While the wealth-effect might not be the only explanatory factor in the puzzle of systematical differences between subjective equivalence scales and other methods of household needs measurement, the effect's economic significance has important implications for policy. Indeed, underscoring the economic sig-

[11] I start by setting the income of the reference household Y_r equal to the equivalent income of household i:

$$Y_r = Y_i = Y_r = \frac{Y_i}{h_i^e} = Y_r = h_i^{-e} Y_i$$
$$\frac{Y_r}{h_i^{-e}} = Y_i$$

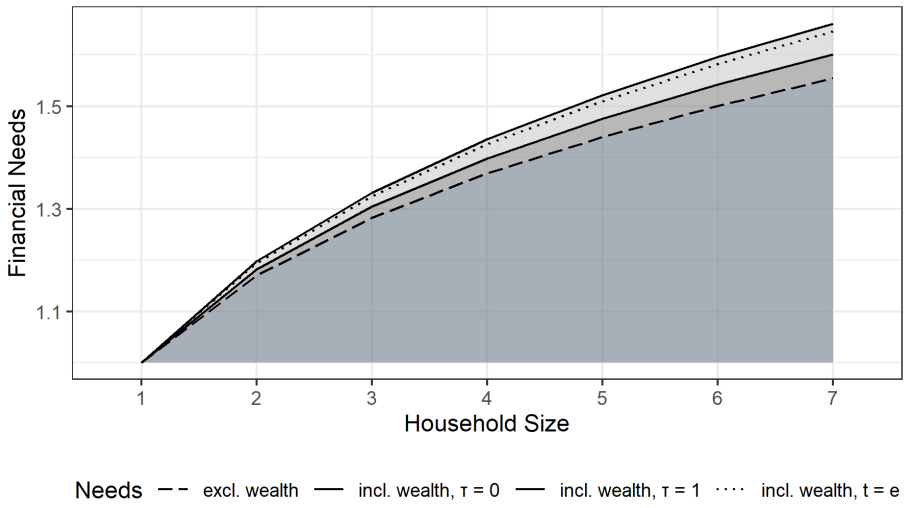

Figure 1: Household needs as a function of household size. Comparing specifications

Notes: This graph computes household needs for households comprising one to seven members. The estimates for e are taken from models 3 and 4 of table 2.

nificance of the effects established in this paper, figure 1 demonstrates how differences in the scale parameter translate in household needs. Roughly, the difference between a specification without wealth and one that includes wealth ($\tau = 1$), corresponds to more than eight percentage points difference in additional needs relative to the reference household for a household of five. In turn, this translates into higher household needs by between one fifth and a quarter. For the design of family transfers, minimum income schemes and other policies, this difference matters crucially.

Naturally, keeping in mind that it is not trivial and potentially not helpful to distinguish right and wrong when it comes to measuring household needs (Nelson, 1993). The bias discussed in this paper does not suggest that hitherto attempts to identify equivalence scales from subjective data are wrong. Much rather, this contribution endeavours to raise "awareness that what estimated equivalence scales actually measure might not be what they were meant to measure" (Borah et al., 2018, 33). Especially in view of the calibration of

transfers, it is crucial to know what factors impact needs measurement. For example, if equivalence scales are employed to design minimum income schemes, one might want to correct for wealth effects in equivalence scale measurement, as the target group of such schemes will typically not be wealthy. On the contrary, asset tests are an integral part of many minimum income schemes, and therefore by design cover households with low asset endowments. Therefore, adjusting for wealth when considering household needs is essential.

7. Conclusion

To conclude, this paper analyses why equivalence scales estimated from subjective data tend to imply particularly high economies of scale within the household. Complementing previous literature that highlighted reference group effects, I argue that asset ownership contributes to explaining the low equivalence scales. Based on survey data from the SOEP, I provide a framework to measure the impact of asset ownership on subjective equivalence scale measurement, and estimate a set of equivalence scales building on this adjusted procedure.

The findings provide strong evidence for the hypothesis that the neglect of asset ownership in equivalence scale measurement yields artificially high economies of scale in the household and thus low equivalence scales. As wealthy households are more satisfied with a given income, controlling for assets increases the equivalence scales. While the wealth effect is likely to only provide a partial explanation for systematically low measured household needs in subjective assessments, the needs as measured by procedures accounting for wealth could be almost 20% higher than those measured ignoring assets.

This essay points out important avenues for further research. For instance, even though the analysis suggests that assets can play a decisive role in household needs measurement, it cannot precisely establish the magnitude of the bias, as equivalence scales for assets have to be known ex ante. Since the direction of the bias is established unambiguously, further research is needed to determine the nature of economies of scale in view of wealth. Therefore, overall, this

treatment does not only provide a potential explanation for the puzzle of low subjective equivalence scales, but it also makes a case for a multidimensional approach towards measuring household needs.

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