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Ulrich Schmidt, Philipp C. Wichardt

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Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
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Abstract

Over the last decades, research in behavioural economics has demonstrated that individual welfare (utility), as relevant for economic decision making, depends not only on absolut but also on distributional aspects. Moreover, evidence is gathering that something similar holds for aggregate welfare, i.e. that GDP alone is an insufficient predictor for various supposedly welfare related variables on a societal level. This note shows that distributional concerns on an aggregate level can indeed be derived from distributional concerns on an individual level: integrating individual inequity aversion into a utilitarian social welfare function yields a simple welfare measure which comprises both GDP and income inequality as measured by the Gini index.

JEL-Codes: D010, D630.

Keywords: Gini index, inequality, welfare.

Ulrich Schmidt
Kiel Institute for the World Economy
Kiellinie 66
Germany – 24105 Kiel
ulrich.schmidt@ifw-kiel.de

Philipp C. Wichardt
Department of Economics
University of Rostock
Ulmenstr. 69
Germany – 18057 Rostock
philipp.wichardt@uni-rostock.de

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1 Introduction

This note analyses the implications of inequity aversion for welfare measurement which is a central topic in economics and moral philosophy (Kohlberg, 1981; Sen, 1984; Harsanyi, 1976; Rawls, 1972). In fact, one of the fundamental assumptions in economics is that individuals – as well as societies at large – constantly strive to improve their economic situation. A crucial question for any economist, therefore, is how to assess economic well-being, i.e. how to judge the quality of a situation, both on an individual and on a societal level.

For a long time, individual well-being was essentially assessed based on monetary expected utility (von Neumann and Morgenstern, 1944). Similarly, well-being of society was measured in terms of aggregate income, i.e. GDP. Over the last decades, however, distributional aspects have gained considerable ground in the discussion of economic utility and welfare (e.g. Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000; Oishi and Kesebir, 2015).

For example, ample empirical research has demonstrated that individual well-being not only depends on absolut but also on relative aspects (see Camerer, 2003, for a review of typical arguments from the literature).[1] Not surprisingly, these insights have fostered various models of individual utility which also account for distributional preferences (e.g. Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). Most prominent today, perhaps, is the model of inequity aversion proposed by Fehr and Schmidt (1999), which conveniently combines a taste for own utility as well as effects of positive and negative deviations from others in a technically tractable way.

In a similar vein, evidence has gathered suggesting that various variables such as trust, health or educational performance of school children are related to inequality rather than to absolut measures of economic performance of society only, e.g. GDP (see Wikinson and Picket, 2009, for a review). Moreover, Oishi and Kesebir (2015) argue that it is indeed income inequality which can be used to explain why economic growth does not always lead to increased happiness.[2] Thus, also on a societal level, the evidence suggests that a useful welfare measure ought to depend on both absolute

[1] A large body of evidence from behavioural economics, psychology, anthropology and neuroscience shows that humans are typically inequity averse (Fehr and Schmidt, 1999; Adams, 1965; Bolton and Ockenfels, 2000; Dawes et al., 2007; Loewenstein et al., 1989; Henrich et al., 2005; Tricomi et al., 2010). In fact, inequity aversion has also been observed for non-human primates (Brosnan and de Waal, 2003) and is regarded as a crucial factor for the evolution of human cooperation (Fehr and Schmidt, 1999; Fowler et al., 2005; Dawes et al., 2007).

[2] In the more economic discussion, the concept of happiness is also referred to by Köszegi and Rabin (2008).

aspects (e.g. size of GDP) and relative ones, i.e. equality; more general (philosophical) arguments suggesting an integration of inequality into measures of welfare, indeed, can be found already earlier (e.g. Sen, 1984; Harsanyi, 1976; Rawls, 1972). Yet, while a variety of alternative welfare measures integrating a tradeoff between efficiency and equality have been proposed (e.g. Daly and Cobb, 1989), for example in connection with the "beyond GDP initiative,"[3] these measures have usually been criticised for being arbitrary and lacking a theoretical basis (e.g. Neumayer, 1999; Fleurbaey and Blanchet, 2013).

In the present note, we take up the discussion about appropriate welfare measures from a theoretical perspective. In particular, we demonstrate how an aggregate welfare measure which accounts for both absolute and relative wealth can be derived from a standard individual utility function which also accounts for a taste for equality. More specifically, we assume that the agents of a society have a preference for inequity aversion as proposed by Fehr and Schmidt (1999). By simple aggregation, we then derive a social welfare function which combines average income with the famous Gini index (Gini, 1912).

Since its invention, the Gini index has been widely used as a standard measure for economic inequality of a country.[4] Yet, despite its intuitive appeal and frequent use, the Gini index has also been a controversial measure of income inequality as it so far lacks a theoretical basis, i.e. it has not been derived from a social welfare function (c.f. Atkinson, 1970).

In the remainder of this note, we provide the missing link between individual utility, the value of equality and, in particular, the Gini index.

[3]The measurement of economic welfare has received substantial attention in the current political debate. An example is the "beyond GDP initiative" of the European Commission, the European Parliament, the Club of Rome, OECD and WWF which has promoted the development of welfare indicators which are as clear and appealing as the traditionally used GDP, but more inclusive of environmental and social aspects of progress (see https://ec.europa.eu/jrc/en/event/beyond-gdp-measuring-progress-true-wealth-and- well-being-nations-7763).

[4]To give some examples through the sciences: Oishi and Kesebir (2015, *Psychological Science*) use it in discussion the connection between happiness and inequality; de Andrade et al. (2015, *The Lancet*) use it in their discussion of social determinants of health; or Durante et al. (2012, British Journal of Social Psychology) use it in discussing ambivalence of stereotype content. Its virtue as a measure of economic inequality is already emphasised by Morgan (1962; see also Ceriani and Verme, 2012). It is also included in the prominent Index of Sustainable Economic Welfare (ISEW; Daly and Cobb, 1989). Last but not least, regarding its relevance for the political, UN, World Bank and OECD regularly report the Gini index for most countries worldwide.

2 The Model

For the purposes of our argument, we build on the model of inequity aversion by Fehr and Schmidt (1999). Consider a society with n subjects and assume that each subject has income x_i, $i = 1, \ldots, n$, with incomes arranged in increasing order, i.e. $x_i > x_m$ for $i > m$. Utility of person i, then, is given by

$$V_i = x_i - \frac{\alpha}{n-1} \sum_{j>i} (x_j - x_i) - \frac{\beta}{n-1} \sum_{k<i} (x_i - x_k), \tag{1}$$

where the parameter α (β) measures the individual i's distaste of disadvantageous (advantageous) inequality.

As is common for utilitarian approaches, we take social welfare as given by the sum of individual utilities. Moreover, we follow Harsanyi (1955) who derived a utilitarian welfare function by assuming an impartial ex ante situation (veil of ignorance; cf. Rawls, 1972) where individuals do not know the position they will have (later) in society and, hence, assign equal probability ($1/n$) to all possibilities. Furthermore, according to Harsanyi, individual preferences – individual values of the parameters α and β in our case – converge in such an impartial ex ante situation.

Integrating equal weighing of outcomes and equal preferences into our argument, we obtain the following expression for social welfare (W):

$$W = \sum_i \frac{1}{n} V_i = \sum_i \frac{1}{n} [x_i - \frac{\alpha}{n-1} \sum_{j>i} (x_j - x_i) - \frac{\beta}{n-1} \sum_{k<i} (x_i - x_k)]. \tag{2}$$

A simple calculation of sums and rearranging shows that this can be rewritten as

$$W = \sum_i x_i [\frac{1}{n} + \frac{\alpha + \beta}{n(n-1)} (n + 1 - 2i)]. \tag{3}$$

Thus, once we assume inequity aversion on an individual level, this also shines through in social welfare: each income is weighted by a factor which depends on the income's rank in the distribution, i.e. incomes below the median are overweighted (compared to the equal weighting of $1/n$) and incomes above the median underweighted.[5] Consequently, the obtained social welfare measure exhibits inequality aversion, i.e. even distributions of income in society are preferred to uneven ones.

[5] For example, the lowest income is weighted by $\frac{1}{n} + \frac{\alpha+\beta}{n} > \frac{1}{n}$, the highest income by $\frac{1}{n} - \frac{\alpha+\beta}{n} < \frac{1}{n}$ whereas the median income receives precisely the weight $1/n$.

Result 1 *Assuming inequity aversion on an individual level, aggregation leads to a measure of social welfare which reflects a societal preference for even distributions.*

In fact, more can be said. Further rearranging the expression for social welfare in equation (3), we can rewrite W as

$$W = \mu\big[1 - (\alpha + \beta)G\frac{n}{n-1}\big] \tag{4}$$

where μ is average income and G is the Gini index (Gini, 1912), i.e.

$$G := \frac{\sum_i 2ix_i}{n\sum_i x_i} - \frac{n+1}{n} \tag{5}$$

Finally, taking limits for $n \to \infty$, we get the following simple expression for a social welfare measure:

$$W = \mu\big[1 - (\alpha + \beta) \cdot G\big]. \tag{6}$$

Thus, integrating inequity aversion into a utilitarian welfare function, we are able to derive a simple welfare measure, which is based on average income – as GDP per capita – but also accounts for income inequality, measured by the Gini index.[6]

Proposition 1 *Considering a society of n individuals (n large) and assuming individual utility to reflect inequality aversion as proposed by Fehr and Schmidt (1999), i.e. individual utility is given by*

$$V_i = x_i - \frac{\alpha}{n-1}\sum_{j>i}(x_j - x_i) - \frac{\beta}{n-1}\sum_{k<i}(x_i - x_k).$$

Then, simple aggregation leads to a social welfare function that can be approximated as a combination of aggregate income in society, μ, and a measure of inequality in society, namely the Gini index, G:

$$W \approx \mu\big[1 - (\alpha + \beta) \cdot G\big].$$

[6]For this specific example, the trade-off between average income and equality is determined by the sum of α and β, i.e. the sum of parameters of aversion to disadvantageous and advantageous inequity. This is arguably an artefact of the simplifications made in the choice of individual utility functions. In general, we would indeed expect the relative weighing to be more complex. The purpose of this note, however, was not to determine the best possible social welfare function but only to demonstrate that once we acknowledge monetary *and* distributional preferences on an individual level this translates rather simply – by aggregation – into a combination of well known social measures of aggregate wealth and distributional aspects.

Note, as a final remark regarding the eventual expression for social welfare, that a similar measure, namely $W = \mu(1 - G)$, had already been proposed by Sen in 1976. Yet, apart from a general argument in favour of accounting for both the absolute level of income and distributional aspects in social welfare, his proposal lacks a further theoretical foundation; a drawback that also affects the Gini index itself (Atkinson, 1970). The present discussion can be seen as filling this gap.[7]

3 Concluding Remark

In the preceding section, we have demonstrated how assuming inequality aversion (Fehr and Schmidt, 1999) on an individual level – by simple aggregation – gives rise to a social welfare measure that captures aggregate and distributional aspects. In particular, the argument provides a formal justification, based on individual preferences, for the use of the Gini index (Gini, 1912) in assessing social welfare.

We want to conclude by expressing a word of caution regarding the interpretation of our result and, in particular, the functional form of the derived welfare measure. The reason for this may be rather obvious. The point is simply that, while we are convinced that people care about equality, the exact functional form of the utility function proposed by Fehr and Schmidt (1999) to capture this, of course, is a simplification (as any model). And, at the risk of misinterpreting the intentions of Fehr and Schmidt, it supposedly was not proposed in view of possible aggregations but rather to account for certain patterns in individual behaviour. Thus, any empirically precise measure of social welfare is likely to need further calibration and testing.

The purpose of this note, however, was not an empirical but a theoretical one. In our view, the fact that simply aggregating a stylised individual utility function reflecting inequity aversion allows us to derive an expression for social welfare that contains the Gini index – a measure that, as we have argued earlier, is related to various patterns on an aggregate level but which so far has lacked a theoretical foundation – provides not only considerable theoretical support for the use of the Gini index (in addition to the already existing empirical support). By providing a link between a model of individual preferences and an empirically successful measure of aggregate social welfare, it also suggests that both tools, despite their simplicity, indeed coherently capture something which is relevant for the real world.

[7] See Footnote 6.

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