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Measuring International Inequality Aversion

Richard S.J. Tol*

Abstract: I measure the rate of aversion to inequality in consumption as expressed in the development aid given by rich countries to poor ones between 1965 and 2005. Over time, OECD countries have become *less* concerned about international inequity. Even for a fairly leaky bucket, the consumption rate of inequity aversion is less than the rate of risk aversion, which implies that the pure rate of inequity aversion is negative. That is, rich countries would prefer to see greater inequality between rich and poor countries.

Corresponding Author: Richard.Tol@esri.ie

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*Economic and Social Research Institute, Dublin, Ireland
Institute for Environmental Studies, Vrije Universiteit, Amsterdam, The Netherlands
Department of Spatial Economics, Vrije Universiteit, Amsterdam, The Netherlands
Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA, USA

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1. Introduction

As globalisation intensifies, so does the need for evaluating policies from the perspective of a global planner. There is no global planner, but considering what she would do provides a useful yardstick against which to measure more realistic policy interventions. Policy analyses at the global scale are immediately confronted with income differences that are greater than in any individual country, and with income redistribution policies that are less effective. This paper focuses on the effect of income distribution on policy evaluation. While many analysts consider a strictly utilitarian welfare function with risk-averse agents, this implies that uncertainty and inequality are evaluated with a single parameter – even though they are conceptually and numerically different (Carlsson *et al*., 2005; Saelen *et al*., 2008). This spells trouble for policies that are both risky and affect the income distribution. A straightforward generalisation of the welfare function introduces a second parameter, so that inequality aversion and risk aversion can assume different numerical values. In this paper, I seek to measure the rate of inequality aversion.

The procedure for this is as follows. I assume that the global planner has the power to redistribute income from the countries of the OECD to the rest of the world, and that this is a measure of inequality aversion at the global scale. As OECD countries voluntarily disburse development aid, the measured inequality aversion is that of "the OECD", not that of the world.[1] However, a similar model is followed in problems such as climate change, where it is proposed to spend money on reducing greenhouse gas emissions in the OECD, primarily to the benefit of the poor (Schelling, 1995). The measured rate of inequality aversion can be used to evaluate problems in which rich countries are the donors and poor countries the beneficiaries. Applying the measured inequality aversion in other contexts should be done with great care, if at all.

[1] Alternatively, this could be interpreted as altruism (cf. Johansson-Stenman, 2005).

The paper proceeds as follows. Section 2 defines inequity aversion, drawing on previous research. Section 3 presents the exact method of measurement, combining the literature in Section 2 with another literature on income redistribution. Section 4 presents the empirical findings. Section 5 concludes.

2. Defining inequity aversion

Consider a social welfare function in the sense of Bergson (1938) and Samuelson (1975):

$$(1) \qquad W(U_1,U_2,...,U_I)=\begin{cases}\sum_{i=1}^{I}\frac{U_i^{1-\omega}}{1-\omega} & \omega\neq 1\\ \prod_{i=1}^{I}U_i & \omega=1\end{cases}$$

where W is social welfare, U_i is utility of actors i=1,2,…,I, and ω is a parameter, that can be interpreted as the pure rate of inequity aversion (see Boadway and Bruce, 1984). At the margin, an increase in utility for a relatively happy actor r compares to a utility increase for relatively unhappy actor p (U_r>U_p) as

$$(2) \qquad \frac{\partial W/\partial U_r}{\partial W/\partial U_p}=\left(\frac{U_p}{U_r}\right)^{\omega}\begin{cases}>1 & \omega<0\\ =1 \quad \text{for} & \omega=0\\ <1 & \omega>0\end{cases}$$

That is, for ω=0, the social planner is indifferent between the actors, regardless of their initial utility. For ω>0 (ω<0), the social planner prefers an increase in the utility of the relatively unhappy (happy) actor over an increase in the utility of the relatively happy (unhappy) actor. The strength of this preference is larger for a larger absolute value of ω, so that ω is indeed a measure of aversion against inequity in the distribution of utility. This is underlined if one considers that

$$(3) \qquad \lim_{\omega\uparrow\infty}W=\min_i\{U_i\};\ \lim_{\omega\downarrow-\infty}W=\max_i\{U_i\}$$

That is, in the limits, the welfare function equals either the Rawlsian maximin welfare function or the Nietzschean maximax welfare function.

Now consider a CRRA utility function

$$(4) \qquad U_i=\begin{cases}\frac{C_i^{1-\eta}}{1-\eta} & \eta\neq 1\\ \ln C_i & \eta=1\end{cases}$$

where C is consumption and η is the rate of risk aversion.

Then the social planner evaluates a relative shift in consumption as

$$(5) \qquad \frac{\partial W / \partial C_r}{\partial W / \partial C_p} = \left(\frac{C_p}{C_r} \right)^{\eta+\omega(1-\eta)} \begin{cases} >1 & \eta+\omega(1-\eta)<0 \\ =1 \quad \text{for} & \eta+\omega(1-\eta)=0 \\ <1 & \eta+\omega(1-\eta)>0 \end{cases}$$

Note that (5) introduces the consumption rate of inequity aversion: $\eta+\omega(1-\eta)$. For η =0, the *pure* rate of inequity aversion (ω) equals the *consumption* rate of inequity aversion ($\eta+\omega(1-\eta)$). For ω=0, the (social) consumption rate of inequity aversion equals the (individual) rate of risk aversion. For other values of η and ω, pure inequity aversion, consumption inequity aversion, and risk aversion are numerically different.

3. Measuring international inequity aversion in the OECD

Okun's (1975) "leaky bucket" is a frequently used method to estimate inequity aversion within countries (e.g., Amiel *et al.*, 1999). The basic thought is that an inequity-averse social planner would take from the rich and give to the poor. If it were costless to redistribute income, then everyone would have the same income (or the social planner would be inequity-neutral). However, if only a fraction of the income taken from the rich reaches the poor, then it is possible to have both an unequal income distribution and an inequity-averse social planner. The metaphor arises because the social planner uses a "leaky bucket" to transfer income. The leakier the bucket, the more unequal is the optimal income distribution given a degree of inequity aversion. Vice versa, the degree of inequity aversion, implied by the assumption that the observed income distribution is optimal, increases as the bucket gets leakier.

I here measure the degree of inequity aversion of countries in the OECD, implied by the official development aid given to developing countries. Note the leap of faith. I assume that the OECD *collectively* acts as a *global planner* when deciding to aid developing countries. I need one additional assumption, namely that the global planner is only interested in distributional issues between countries, but not within countries. Note that there are few data on how aid is distributed across the income distribution in developing countries. Then, the global welfare function becomes:

$$(6) \qquad W = \sum_{i=1}^{I} P_i \frac{\left(c_i^{1-\eta}\right)^{1-\omega}}{(1-\omega)(1-\eta)^{1-\omega}}$$

where c_i is average per capita consumption in country i and P_i is the number of people in that country. Equation (6) follows from assuming that the global planner considers each individual separately but evaluates each individual in a country at the country average per capita income.

With this assumption, for any level and pattern of aid, for any degree of leakiness, and for any degree of risk aversion, the degree of inequity aversion follows from

(7a)

$$\sum_{i\in OECD} P_i\left(c_i\right)^{(1-\eta)(1-\omega)} - P_i\left(c_i + a_i\right)^{(1-\eta)(1-\omega)} = \sum_{i\notin OECD} P_i\left(c_i + a_i\right)^{(1-\eta)(1-\omega)} - P_i\left(c_i\right)^{(1-\eta)(1-\omega)}$$

with

(7b) $$\lambda \sum_{i\in OECD} A_i = \sum_{i\notin OECD} A_i$$

where a is per capita aid received, A is total aid received, and λ is the degree of leakiness. Note that a and A are negative in donor countries.[2] That is, aid is given up to the point that the welfare loss of the OECD exactly equals the welfare gain of the non-OECD.

4. Results

I solved in Equation (7) for λ=0.05, 0.1, 0.2, …, 0.9, 0.95, and consider results for various values of η. I took data on population, GNI, and ODA *received* for 1965-2005 from the World Resources Institute (http://earthtrends.wri.org/). I took data for ODA *given* from the OECD Development Assistance Committee (http://www.oecd.org/dac/stats). I rescaled aid received per country so that total aid received equals total aid given for each year, time the leakage rate λ.[3]

Figure 1 shows selected results per year. Table A1 has the full results. The top line is the consumption rate of inequity aversion, which equals either parameter if the other

[2] Note that $(1-\omega)^{-1}$ and $(1-\eta)^{-(1-\omega)}$ drop out of (6).

[3] Note that GNI is measured in dollars as exchanged on the currency market. Using Geary-Khamis dollars would substantially reduce the number of observations. Furthermore, this would imply λ>1, which does not match the observations below.

equals zero. In 1965, ω=0.79 (for η=0) and it steadily falls by 0.0060 (s.d. 0.0003) per year to ω=0.54 in 2005. That is, OECD countries have grown less averse to income differences with other countries.

The numerical value of 1-(1-η)(1-ω) is also telling. It is lower than commonly assumed values for η – which is typically set at unity or higher (Evans, 2005). This implies that, for a reasonable choice of η, ω must be negative – that is, OECD countries display equity aversion rather than inequity aversion. This is shown in Figure 1 as well. For η=1.0, ω<0. For η=0.5, ω>0, but only barely so in recent years. Figure 1 also shows the sensitivity to the leakiness of the bucket. The leakier the bucket, the greater the implied rate of inequity aversion.

5. Conclusion

I measure the pure rate of inequity aversion as expressed in development aid flows from the OECD to developing countries, parameterised on the effectiveness of such aid. The consumption rate of inequity aversion is smaller than the rate of risk aversion, even if only a small fraction of aid given reaches its target. This implies that the pure rate of inequity aversion is negative, as result that contrasts with other results based on surveys and experiments (Amiel *et al*. 1999; Saelen *et al*., 2008). Note, however, that I measure the rate of *global* risk aversion of the *rich* countries. An alternative interpretation is therefore that the people at the top end of the global income distribution consider the gap between rich and poor to be fair or indeed not wide enough.

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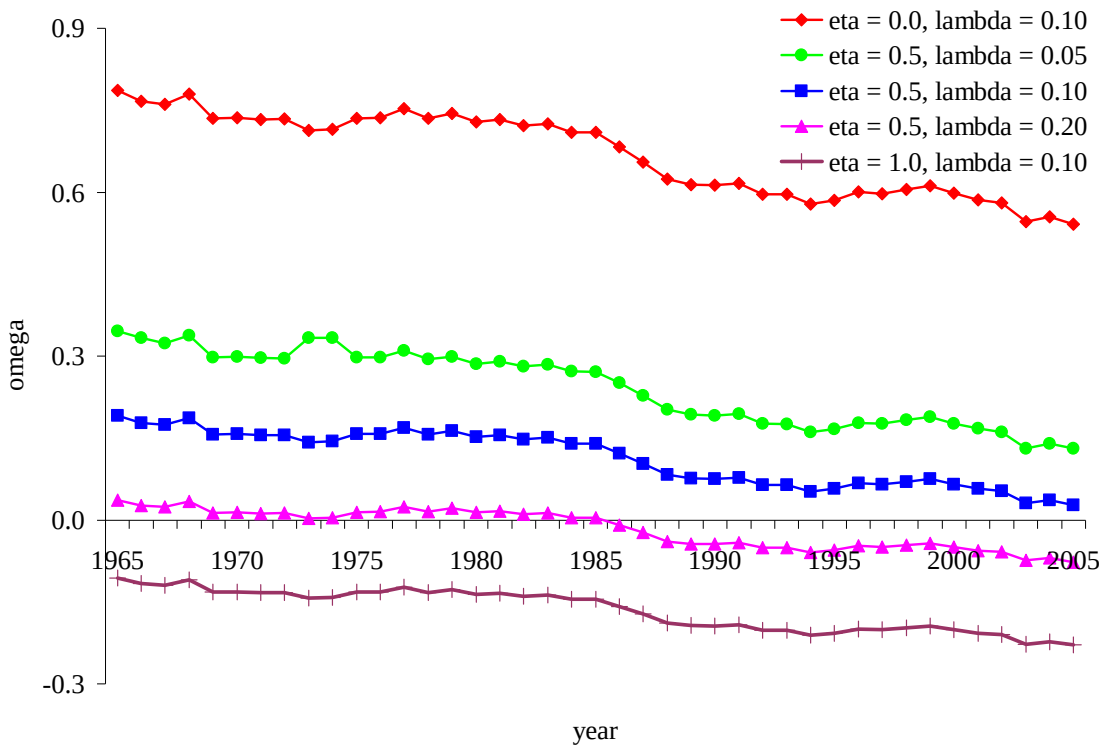

Figure 1. The pure rate of inequity aversion (ω) between 1965 and 2005 for different values of risk aversion (η) and leakiness (λ).

Table A1. The value of 1-(1-η)(1-ω) for different leakage rates and different years.

Year\ λ	1.00	0.95	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.05
1965	1.000	0.982	0.963	0.922	0.875	0.822	0.759	0.682	0.584	0.446	0.213	-0.019
1966	1.000	0.982	0.964	0.924	0.879	0.827	0.766	0.691	0.595	0.461	0.234	0.000
1967	1.000	0.983	0.964	0.925	0.880	0.828	0.767	0.693	0.598	0.465	0.239	0.014
1968	1.000	0.982	0.963	0.922	0.875	0.822	0.759	0.683	0.585	0.449	0.220	-0.007
1969	1.000	0.983	0.965	0.926	0.882	0.832	0.773	0.701	0.609	0.481	0.265	0.053
1970	1.000	0.983	0.965	0.926	0.881	0.831	0.771	0.699	0.607	0.479	0.263	0.052
1971	1.000	0.983	0.965	0.926	0.882	0.832	0.773	0.701	0.610	0.482	0.267	0.056
1972	1.000	0.983	0.965	0.925	0.881	0.831	0.771	0.699	0.608	0.480	0.266	0.057
1973	1.000	0.983	0.966	0.928	0.885	0.836	0.778	0.708	0.619	0.495	0.287	0.000
1974	1.000	0.983	0.966	0.928	0.885	0.836	0.779	0.709	0.619	0.494	0.285	0.000
1975	1.000	0.983	0.964	0.925	0.881	0.830	0.770	0.698	0.606	0.479	0.264	0.054
1976	1.000	0.983	0.964	0.924	0.880	0.829	0.769	0.697	0.605	0.477	0.264	0.054
1977	1.000	0.982	0.963	0.922	0.876	0.823	0.762	0.688	0.594	0.463	0.247	0.035
1978	1.000	0.982	0.964	0.924	0.879	0.828	0.768	0.696	0.604	0.477	0.265	0.059
1979	1.000	0.982	0.963	0.922	0.876	0.823	0.762	0.689	0.596	0.468	0.256	0.051
1980	1.000	0.982	0.964	0.924	0.879	0.827	0.768	0.696	0.605	0.479	0.272	0.071
1981	1.000	0.982	0.964	0.923	0.878	0.827	0.767	0.694	0.603	0.476	0.267	0.065
1982	1.000	0.982	0.964	0.924	0.880	0.829	0.770	0.699	0.609	0.485	0.278	0.079

1983	1.000	0.982	0.964	0.924	0.879	0.828	0.768	0.697	0.606	0.481	0.274	0.073
1984	1.000	0.983	0.965	0.926	0.882	0.832	0.774	0.705	0.616	0.494	0.290	0.092
1985	1.000	0.983	0.965	0.926	0.882	0.832	0.774	0.704	0.616	0.494	0.291	0.093
1986	1.000	0.984	0.966	0.929	0.887	0.840	0.784	0.717	0.632	0.514	0.317	0.124
1987	1.000	0.984	0.968	0.933	0.893	0.848	0.795	0.730	0.649	0.535	0.345	0.159
1988	1.000	0.985	0.970	0.937	0.899	0.856	0.806	0.745	0.667	0.559	0.376	0.198
1989	1.000	0.986	0.970	0.938	0.901	0.859	0.809	0.749	0.672	0.565	0.386	0.210
1990	1.000	0.986	0.971	0.938	0.901	0.859	0.809	0.749	0.672	0.566	0.388	0.213
1991	1.000	0.985	0.970	0.937	0.900	0.857	0.807	0.747	0.670	0.563	0.384	0.209
1992	1.000	0.986	0.971	0.939	0.903	0.861	0.813	0.754	0.680	0.576	0.404	0.236
1993	1.000	0.986	0.971	0.938	0.902	0.861	0.812	0.753	0.679	0.576	0.404	0.236
1994	1.000	0.986	0.972	0.940	0.905	0.865	0.818	0.761	0.689	0.589	0.422	0.260
1995	1.000	0.986	0.971	0.940	0.904	0.863	0.816	0.758	0.685	0.583	0.414	0.250
1996	1.000	0.985	0.970	0.937	0.900	0.858	0.809	0.750	0.675	0.572	0.400	0.233
1997	1.000	0.986	0.971	0.938	0.902	0.860	0.811	0.752	0.678	0.574	0.403	0.236
1998	1.000	0.986	0.970	0.937	0.900	0.858	0.809	0.749	0.673	0.569	0.395	0.226
1999	1.000	0.985	0.970	0.937	0.899	0.857	0.807	0.746	0.670	0.564	0.388	0.217
2000	1.000	0.986	0.971	0.938	0.902	0.860	0.811	0.752	0.677	0.574	0.402	0.236
2001	1.000	0.986	0.972	0.940	0.905	0.864	0.817	0.759	0.686	0.584	0.414	0.249
2002	1.000	0.986	0.972	0.941	0.906	0.865	0.818	0.761	0.688	0.587	0.420	0.258

2003	1.000	0.987	0.974	0.944	0.911	0.873	0.828	0.775	0.706	0.611	0.455	0.303
2004	1.000	0.987	0.973	0.943	0.909	0.871	0.825	0.771	0.701	0.605	0.445	0.291
2005	1.000	0.987	0.974	0.946	0.913	0.876	0.832	0.779	0.711	0.616	0.458	0.304

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