

The Genuine Progress Indicator – Adjusting for inequality in consumption Working toward a GPI 2.0

The GPI, and its predecessor the ISEW, have included an adjustment for income inequality in all formulations. The standard approach constructs an index of inequality in which the full amount of personal consumption expenditure (PCE) is assumed to contribute to economic well-being in the year with the lowest level of income inequality (calculated as Gini coefficient). In years with greater inequality of income, and thus higher Gini values, consumption expenditures are then deflated by a factor equivalent to the percent change in Gini inequality. For instance, in a year with Gini 5% higher than the index year, the well-being derived from consumption expenditures is divided by a factor of 1.05 to reflect the relatively reduced welfare-value of consumption expenditures at the top.

The standard approach is fairly straightforward, relying only on PCE and the Gini coefficient, both of which are regularly reported by most government sources and other statistical bodies. It accords with our intuitive understanding that, on the whole, when lower-income individuals receive a decreasing share of national income, their well-being declines more sharply than would that of higher-income individuals were their share of the national income decreased in like amount. Having higher-incomes to start with, a relative reduction in the share of total income received by top earners is not nearly as likely to lead to any drastic reduction in the well-being of those individuals. This observation has been formulated in classical political economy as the diminishing marginal utility of income (DMUI).

Layard et al. (2008) provide a description of the importance of accounting for DMUI in normative public economics, and proceed to estimate a functional form that can be used to calculate the rate of decline based on the results of several broad-based surveys that include measures of subjective well-being (SWB) correlated with income. They discuss the classical logarithmic hypothesis (that utility declines in proportion to the log of income, in their formulation $\rho=1$) as well as the linear hypothesis (or constant marginal utility of income, $\rho=0$) before performing their regression analysis in the attempt to empirically estimate the value of parameter ρ (assumed to be the same for different individuals) based on the results of several major surveys. Their final estimate ($\rho=1.26$) suggests that, according to this formulation, the marginal utility of income declines somewhat more rapidly than the log of income (Figure 1.)

I propose that the logarithmic (or steeper) DMUI hypothesis can be used to calculate an adjustment for inequality that is both more robust and less arbitrary than the currently applied GPI index of inequality approach. The only significant drawback of which I am aware is that this proposed method requires somewhat more information about the distribution of income in a GPI study-area, or conversely, requires an additional assumption about income distribution where the only available measure of inequality is a Gini coefficient. For the purposes of demonstration here, I have used the historical tables of income distribution quintiles in the US, from the Census Bureau's Household Economic Survey (<http://www.census.gov/hhes/www/income/data/historical/inequality/>).

Estimating the decline in marginal utility of income (DMUI)

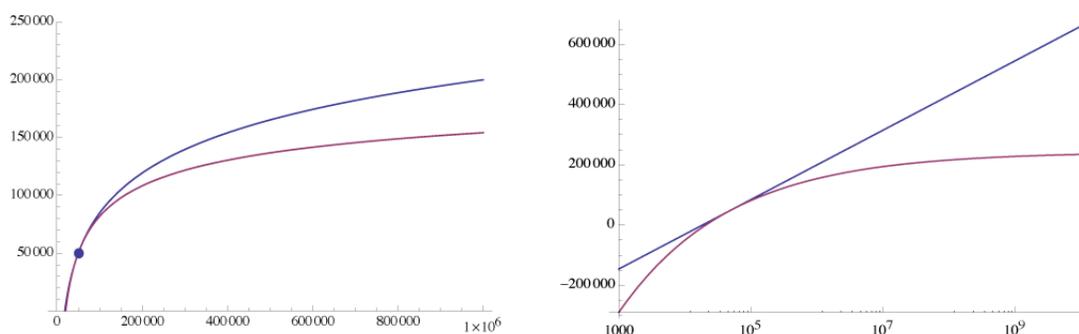


Figure 1. The logarithmic hypothesis ($\rho=1$) and the Layard et al. 2008 estimate ($\rho=1.26$) illustrated on both linear and log-linear scales. The marked point on the left-hand figure (linear scale) is the point of tangency on the right-hand figure (log-linear), normalized here at the median income (US 2012).

Note that the economic interpretation of the logarithmic DMUI hypothesis is only valid for incomes greater than unity; for incomes less than one unit, the log quickly approaches $-\infty$ which, in some sense may describe the “utility” of losing all of one’s income, but is not helpful for purposes of calculating an adjustment for GPI. If even one person in the study area has income ≤ 0 , than the entire welfare contribution of all personal consumption expenditures would be negated, a conclusion which is perhaps satisfying as a Rawlsian metaphor but ultimately unsuitable for indicating relative progress in either the amount of consumption-based welfare or its distribution.

Since the unit of income (not to say, utility) is arbitrary I have chosen to proceed with normalizing to the median income in a given study-area-period, such that a person who earns the median income is assumed to receive utility equal to one’s consumption expenditure. Furthermore, all persons who earn less than the median income are likewise assumed to receive utility equal to their PCE—in other words I assume a discontinuity in the utility from consumption, such that utility is linear up to the unit-median-income, and then declines as the logarithm (or more quickly, in the $\rho=1.26$ case) from that point up. This is not the only possible normalization of course—we could choose any unit of income to be the point of normalization. An argument can be made that the poverty threshold would be a more suitable choice of unit-income for this purpose. For simplicity of analysis and prudent postulation, I will proceed here with the median-income normalization.

Historical census data from tables H-2, H-3, and H-6 provided quintile shares of aggregate income, mean incomes for each quintile, and median income, for each year from 1975 forward. Since I have assumed a linear income-utility relation below median income, only the top two quintiles are adjusted logarithmically. This method underestimates the full amount of the decreased utility due to DMUI, but provides an adequate baseline for estimation, and thus is suitable for GPI use based on the principle of conservative estimation of adjustments to consumption. Furthermore, the $\rho=1$ logarithmic hypothesis is illustrated in Figure 2—using the $\rho=1.26$ estimate from Layard et al. (2008) gives a slightly greater (approximately 2-3% more depending on the year) decrease in total utility from PCE.

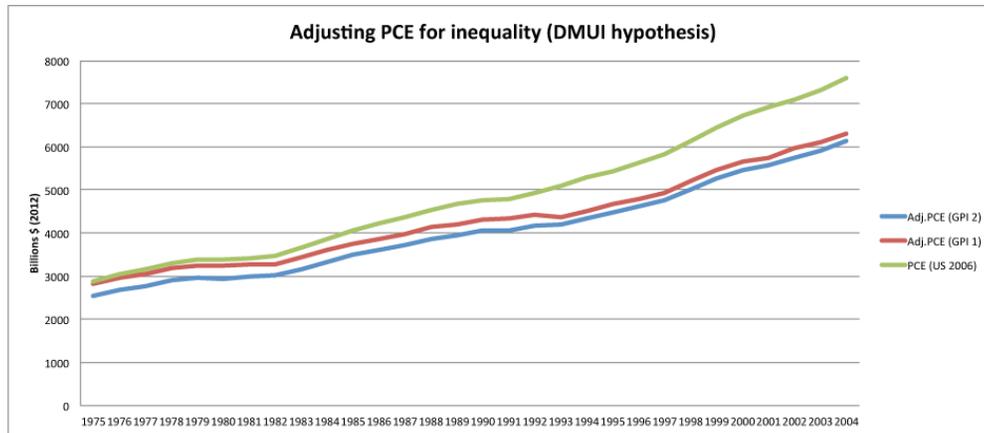


Figure 2. US Personal Consumption Expenditures from 1975-2004 (in green) from Talberth et al. (2006), with the currently prevailing GPI 1 adjustment for inequality (in red) and the proposed GPI 2 adjustment for inequality (in blue) based on logarithmic DMUI normalized on median income.

After adjusting the top two quintiles for logarithmic DMUI, the total amount of “utility-dollars” are summed, and divided by the total aggregate income for the year (figured from the census tables as the product of per capita income and population) to yield the adjustment factor, by which PCE for each year is divided. As shown in Figure 2, the logarithmic DMUI normalized on median income yields a greater adjustment (that is, decline in utility from consumption) in each year shown, for the whole US, even when only the top two quintiles are adjusted and the more conservative ($\rho=1$) parameter is used. The overall change in the adjustment, though significant, does not radically revise the outcome of GPI calculations however, and this new approach could be substituted for the old method in any number of GPI studies in a fairly straightforward way. Essentially, only one column (or row, depending on your spreadsheet) needs to be replaced in order to incorporate the hypothesis of logarithmically declining marginal utility from consumption expenditure into a final GPI account.

The prime advantage of this method is that it dispenses with the need for an arbitrary selection of a base or index year of inequality. Thus we are able to incorporate an adjustment for inequality as such, rather than merely an adjustment for the change in inequality over time as in the current GPI approach. This method also offers a wider range of possible applications and interpretations of the adjustment for inequality. As mentioned above, normalization of the logarithmic utility function on units other than the median-income is quite possible, and potentially appropriate. Normalizing on the federal poverty line (or some multiple thereof) and adjusting the top three or four quintiles would yield a substantially greater adjustment for inequality. Such an approach is easily interpreted as giving greater GPI-weight to the distribution of income in figuring genuine progress toward sustainable economic well-being.

Since the distribution of DMUI calculation gives an economy-wide adjustment factor, we only require a fairly straightforward assumption that the same factor of adjustment can be appropriately used to calculate the total utility of PCE, even where the specific details of distribution of consumption expenditure across the population are not directly available.

Although I have used quintile distributions here, any number of income brackets can be used to apply this adjustment with an increasing degree of precision, while maintaining broad comparability between different levels of distributional resolution, as well as with the accepted index of inequality approach. Lastly, while Layard et al. (2008) assumes a constant ρ across various individuals, populations, and times, this method can equally well be applied in cases where ρ is estimated to have differing value for different populations or periods of time (although we must assume that individuals in the same time and place share the same ρ for the method to maintain its GPI significance). I therefore recommend that this approach to adjustment for inequality of consumption be adopted by the community of GPI practitioners and substituted for the currently accepted index of inequality approach whenever the relevant distribution of income data are available.

Equation for median-income normalized logarithmic DMUI adjustment:

$$\text{adj}(x, m) := m \log(x/m) + m$$

where x is household income, m is median income, and \log is the natural logarithm.

References:

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