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BEYOND GDP? WELFARE ACROSS COUNTRIES AND TIME

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Beyond GDP? Welfare across Countries and Time
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ABSTRACT

We propose a summary statistic for the economic well-being of people in a country. Our measure incorporates consumption, leisure, mortality, and inequality, first for a narrow set of countries using detailed micro data, and then more broadly using multi-country data sets. While welfare is highly correlated with GDP per capita, deviations are often large. Western Europe looks considerably closer to the U.S., emerging Asia has not caught up as much, and many developing countries are further behind. Each component we introduce plays a significant role in accounting for these differences, with mortality being most important.

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1. Introduction

As many economists have noted, GDP is a flawed measure of economic welfare. Leisure, inequality, mortality, morbidity, crime, and the natural environment are just some of the major factors affecting living standards within a country that are incorporated imperfectly, if at all, in GDP. The Stiglitz Commission Report (Stiglitz, Sen and Fitoussi, 2009) was the latest attempt to sort through the criticisms of GDP and seek practical recommendations for improvement. Though there are significant conceptual and empirical hurdles to including some of these factors in a welfare measure, standard economic analysis is arguably well-equipped to deal with several of them.

We propose a simple summary statistic for the welfare of a country's population, measured as a consumption equivalent, and compute its level and growth rate for a diverse set of countries. This welfare measure combines data on consumption, leisure, inequality, and mortality using the standard economics of expected utility. The focus on consumption-equivalent welfare follows in the tradition of Lucas (1987), who calculated the welfare benefits of eliminating business cycles versus raising the growth rate.

As an example, suppose we wish to compare living standards in France and the United States. GDP per person is markedly lower in France: France had a per capita GDP in 2005 of just 67 percent of the U.S. value. Consumption per person in France was even lower — only 60 percent of the U.S., even adding government consumption to private consumption. However, other indicators looked better in France. Life expectancy at birth was around 80 years in France versus 77 years in the U.S. Leisure was higher in France — Americans worked 877 hours (per person, not per worker) versus only 535 hours for the French. Inequality was substantially lower in France: the standard deviation of log consumption was around 0.54 in the U.S. but only 0.42 in France.

Our welfare metric combines each of these factors with the level of consumption using an expected utility framework. We do this in two ways. First, we use detailed micro data from household surveys for 13 countries to provide a measure of welfare with as few assumptions as possible. Then, we use publicly-available multi-country data sets to construct cruder welfare measures for 152 countries. Cross-checking these "macro" results with the detailed "micro" results suggests that there is valuable information even using the coarse multi-country data sets.

Our consumption-equivalent measure aims to answer questions such as: what proportion of consumption in the U.S., given the U.S. values of leisure, mortality, and inequality, would deliver the same expected flow utility as the values in France? In our results, lower mortality, lower inequality, and higher leisure each add roughly 10 percentage points to French welfare in terms of equivalent consumption. Rather than looking like 60 percent of the U.S. value, as it does based solely on consumption, France ends up with consumption-equivalent welfare equal to 92 percent of that in the U.S.[1]

The French example applies more broadly to Western Europe as a whole, but for the poorer countries of the world, the opposite is typically true. Because of lower life expectancy and higher inequality, their consumption equivalent welfare is often less than their income: Western Europe is closer to the U.S., but poor and middle-income countries are typically further behind. More generally, our findings can be summarized as follows:

1. GDP per person is an informative indicator of welfare across a broad range of countries: the two measures have a correlation of 0.98. Nevertheless, there are economically important differences between GDP per person and consumption equivalent welfare. Across our 13 countries, the median deviation is around 35% — so disparities like we see in France are quite common.

2. Average Western European living standards appear much closer to those in the United States (around 85% for welfare versus 67% for income) when we take into account Europe's longer life expectancy, additional leisure time, and lower inequality.

3. Most developing countries — including much of sub-Saharan Africa, Latin America, southern Asia, and China — are substantially poorer than incomes suggest because of a combination of shorter lives and extreme inequality. Lower life expectancy reduces welfare by 15 to 50% in the developing countries we examine. Combined with the previous finding, the upshot is that, across countries, welfare inequality appears even greater than income inequality.

4. Growth rates are typically revised upward, with welfare growth averaging 3.1% between the 1980s and the mid-2000s versus income growth of 2.1%. A boost

[1] Our calculations do not conflict with Prescott's (2004) argument that Americans work more than Europeans because of lower marginal tax rates in the U.S. But the higher leisure in France partially compensates for their lower consumption.

from rising life expectancy of more than a percentage point shows up throughout the world, with the notable exception of sub-Saharan Africa. If welfare grows 3% instead of 2% per year, living standards double in 24 years instead of 36 years; over a century, this leads to a 20-fold increase rather than a 7-fold increase.[2]

The U.S.-France comparison, and our results for other countries, emphasize an important point. High hours worked per capita and a high investment rate are well-known to deliver high GDP per capita, other things being equal. But these strategies have associated costs that are not reflected in GDP. Our welfare measure values the high GDP but adjusts for the lower leisure and lower consumption share to produce a more complete picture of living standards.

This paper builds on a large collection of related work. Nordhaus and Tobin (1972) introduced a "Measure of Economic Welfare" that combines consumption and leisure, values household work, and deducts urban disamenities for the U.S. over time. We incorporate life expectancy and inequality and make comparisons across countries as well as over time, but we do not attempt to account for urban disamenities. The United Nations Human Development Index combines income, life expectancy, and literacy, first putting each variable on a scale from zero to one and then averaging. In comparison, we combine different ingredients (consumption rather than income, leisure rather than literacy, plus inequality) using a utility function to arrive at a consumption-equivalent welfare measure that can be compared across time for a given country as well as across countries. Ravallion (2010) criticizes "mashup indices" like the Human Development Index for their arbitrary nature; our approach is explicitly grounded in economic theory. Fleurbaey (2009) contains a more comprehensive review of attempts at constructing measures of social welfare.

Becker, Philipson and Soares (2005) use a utility function to combine income and life expectancy into a full income measure. Their focus is on the evolution of cross-country dispersion, and their main finding is that dispersion decreases significantly over time when one combines life expectancy with income. Our broader welfare measure includes leisure and inequality as well as life expectancy, and uses consumption instead of income as the base. All of these differences are first-order to our findings. And we emphasize results for individual countries, not just trends in dispersion.

[2]Our results reinforce research on welfare gains from rising life expectancy. See Nordhaus (2003), Becker, Philipson and Soares (2005), Murphy and Topel (2006), and Hall and Jones (2007).

Fleurbaey and Gaulier (2009) construct a full-income measure for 24 OECD countries. Like us, they incorporate life expectancy, leisure, and inequality. Our paper differs in many details, both methodological and empirical. For example, we focus on consumption instead of income, report results for countries at all stages of development, and consider growth rates as well as levels. Boarini, Johansson and d'Ercole (2006) is another related paper that focuses on OECD countries. They construct a full-income measure by valuing leisure using wages and combining it with per capita GDP. They consider adjusting household income for inequality according to various social welfare functions and, separately, consider differences in social indicators such as life expectancy and social capital. Our approach differs in using expected utility to create a single statistic for living standards in a much larger set of countries.

There are many limitations to the welfare metric we use, and a few deserve special mention at the outset. First, we evaluate the allocations both within and across countries according to one set of preferences. We do consider different functional forms and parameter values in our robustness checks. Second, we do not try to measure morbidity. We use life expectancy as a very imperfect measure of health. Third, we make no account for direct utility benefits from the quality of the natural environment, public safety, or political freedom.

The rest of the paper is organized as follows. Section 2 lays out the simple theory underlying the calculations. Section 3 describes the micro data that we use for our main results in Section 4. Section 5 explores robustness. Section 6 presents results for a large set of countries using publicly-available data. Section 7 concludes.

2. Theory

Comparing GDPs across countries requires the use of a common set of prices. Similarly, although people in different countries may have different preferences, we compare welfare across countries using a common specification for preferences. To be concrete, we consider a fictitious person possessing these preferences and call him "Rawls."

Behind the veil of ignorance, Rawls is confronted with a lottery. He will live his entire life in a particular country. He doesn't know whether he will be rich or poor, hardworking or living a life of leisure, or even whether some deadly disease will kill him before he gets a chance to enjoy much of his life. Over his life, he will draw from the cross-section distributions of consumption and leisure and from the cross-section mortality distribution corresponding to each age in a particular year. What proportion of Rawls' annual consumption living his life in the United States would make him indifferent to living life instead in, say, China or France? Call the answer to this question λ_{China} or λ_{France}. This is a consumption-equivalent measure of the standard of living. In the interest of brevity, we will sometimes simply call this "welfare," but strictly speaking we mean a consumption-equivalent measure.

A quick note on a possible source of confusion. In naming our individual "Rawls" we are referencing the veil of ignorance emphasized by Rawls (1971) and Harsanyi (1953). In contrast, we wish to distance ourselves from the maximin social welfare function advocated by Rawls that puts all weight on the least well-off person in society. While that is one possible case we could consider, it is extreme and far from our benchmark case. As we discuss next, our focus is a utilitarian expected utility calculation giving equal weight to each person.

2.1. The Main Setup

Let C denote an individual's annual consumption and ℓ denote leisure plus time spent in home production. Expected lifetime utility is then

$$U = \mathbb{E} \sum_{a=1}^{100} \beta^a u(C_a, \ell_a) S(a), \tag{1}$$

where $S(a)$ is the probability an individual survives to age a and the expectations operator applies to the uncertainty with respect to consumption and leisure. To implement our welfare calculation, let $U_i(\lambda)$ denote expected lifetime utility in country i if consumption is multiplied by a factor λ at each age:

$$U_i(\lambda) = \mathbb{E}_i \sum_{a=1}^{100} \beta^a u(\lambda C_{ai}, \ell_{ai}) S_i(a). \tag{2}$$

By what factor, λ_i, must we adjust Rawls' consumption to make him indifferent between living his life as a random person in the U.S. and living in some other country i? The answer to this question satisfies

$$U_{us}(\lambda_i) = U_i(1). \tag{3}$$

The remainder of this paper implements this calculation in a variety of ways, both across countries to compare levels of welfare and over time to compute measures of welfare growth. For each country-year, we use cross-sectional data on consumption and leisure and cross-sectional data on mortality by age, treating individuals as drawing from this cross-section (adding growth) over their lifetime.

2.2. An Illustrative Example

To see how we implement this calculation, an example is helpful. This example makes strong assumptions to get simple results that are useful for intuition. We will relax many of these assumptions in the next subsection. First, assume that flow utility for Rawls is

$$u(C,\ell) = \bar{u} + \log C + v(\ell), \tag{4}$$

where $v(\ell)$ captures the utility from leisure and home production. Next, suppose that consumption in each country is lognormally distributed across people at a point in time, independent of age and mortality, with arithmetic mean c_i and a variance of log consumption of σ_i^2. Then $E[\log C] = \log c - \sigma^2/2$. Over time, assume that consumption grows at a constant rate g. Finally, assume for now that leisure is constant across ages and certain. Under these assumptions, expected lifetime utility is given by

$$U_i^{\text{simple}} = [\sum_a \beta^a S_i(a)] \cdot (\bar{u} + \log c_i + v(\ell_i) - \frac{1}{2} \cdot \sigma_i^2) + g \cdot \sum_a \beta^a S_i(a) a. \tag{5}$$

In the special case in which $\beta = 1$ and $g = 0$, the terms involving the survival rates simplify. In particular, $e \equiv \sum_a S(a)$ equals life expectancy at birth, and we have

$$U_i^{\text{simple}} = e_i(\bar{u} + \log c_i + v(\ell_i) - \frac{1}{2} \cdot \sigma_i^2). \tag{6}$$

That is, lifetime utility is just the product of life expectancy and expected flow utility from each year. In this special case, consumption equivalent welfare in (3) becomes:

$$\begin{aligned} \log \lambda_i^{\text{simple}} \;=\;& \tfrac{e_i - e_{us}}{e_{us}}(\bar{u} + \log c_i + v(\ell_i) - \tfrac{1}{2}\sigma_i^2) && \text{Life expectancy} \\ & + \log c_i - \log c_{us} && \text{Consumption} \\ & + v(\ell_i) - v(\ell_{us}) && \text{Leisure} \\ & - \tfrac{1}{2}(\sigma_i^2 - \sigma_{us}^2). && \text{Inequality} \end{aligned} \tag{7}$$

This expression provides an additive decomposition of the forces that determine welfare in country i relative to the United States. The first term captures the effect of differences in life expectancy: it is the percentage difference in life expectancy weighted by how much a year of life is worth — the flow utility in country i. The remaining three terms denote the contributions of differences in consumption, leisure, and inequality. At the end of the paper, we will use (7) to compute consumption-equivalent welfare for a large sample of countries using readily available data sources.[3]

2.3. Welfare Calculations using Micro Data

While the example above is helpful for intuition, our micro data is much richer, allowing far fewer assumptions. Let the triplet $\{j, a, i\}$ represent individual j of age $a \in \{1, ..., 100\}$ in country i. Denote the sampling weight on individual j in country i as ω^i_{ja}, and the number of individuals of age a in country i as N^i_a. We make the convenient assumption that the possible levels of consumption and leisure match the levels seen for individuals in the sample in each age group in each country-year. Within each age group, we normalize the sampling weights to sum to 1:

$$\bar{\omega}^i_{ja} \equiv \frac{\omega^i_{ja}}{\sum_{j=1}^{N^i_a} \omega^i_{ja}} \tag{8}$$

Behind the veil of ignorance, expected utility for Rawls in country i is

$$U^i = \sum_{a=1}^{100} \beta^a S^i_a \sum_{j=1}^{N^i_a} \bar{\omega}^i_{ja} u(c^i_{ja} e^{ga}, \ell^i_{ja}), \tag{9}$$

where S^i_a is the probability of surviving to age a in country i. Note that each age group is weighted by country-specific survival rates rather than local population shares. As before, $U^i(\lambda)$ denotes expected utility for Rawls in country i if consumption is reduced by proportion λ in all realizations of consumption and leisure. Our consumption-equivalent welfare metric λ^i continues to be defined implicitly by $U^{us}(\lambda^i) = U^i(1)$.

For our benchmark case, we assume the utility function in equation (4). In Section 5 we will consider preferences with more curvature over consumption and relax the addi-

[3]This decomposition, and the richer one below using micro data, is not without problems. For example, consumption of healthcare, food, and shelter all influence life expectancy. With better data and a deeper understanding of how life expectancy is produced, one could make better comparisons.

tive separability with leisure, but this simpler specification turns out to be conservative and yields clean, easily-interpreted closed-form solutions. Because of additive utility over log consumption plus an intercept and a leisure term, we get

$$U^{us}(\lambda^i) = \sum_{a=1}^{100} \beta^a S_a^{us} [u_a^{us} + \log(\lambda^i)], \tag{10}$$

where

$$u_a^{us} \equiv \bar{u} + ga + \sum_{j=1}^{N_a^{us}} \bar{\omega}_{ja}^{us} [\log(c_{ja}^{us}) + v(\ell_{ja}^{us})]. \tag{11}$$

We can then solve for the scaling of consumption that equates expected utility in the U.S. and country i:

$$\log(\lambda^i) = \frac{1}{\sum_a \beta^a S_a^{us}} \sum_a \beta^a [(S_a^i - S_a^{us}) u_a^i + S_a^{us}(u_a^i - u_a^{us})]. \tag{12}$$

Rawls requires compensation to move from the U.S. to country i to the extent that survival rates are higher in the U.S. (multiplied by flow utility in country i) and to the extent that flow utility is higher in the U.S.

To ease notation, define lower case survival rates (in levels and differences) as normalized by the sum of U.S. survival rates:[4]

$$s_a^{us} \equiv \frac{\beta^a S_a^{us}}{\sum_a \beta^a S_a^{us}} \tag{13}$$

$$\Delta s_a^i \equiv \frac{\beta^a (S_a^i - S_a^{us})}{\sum_a \beta^a S_a^{us}}. \tag{14}$$

Denote demographically-adjusted average consumption, leisure, utility from consumption, and utility from leisure as:

$$\bar{c}^i \equiv \sum_a s_a^{us} \sum_{j=1}^{N_a^i} \bar{\omega}_{ja}^i c_{ja}^i e^{ga} \tag{15}$$

$$\bar{\ell}^i \equiv \sum_a s_a^{us} \sum_{j=1}^{N_a^i} \bar{\omega}_{ja}^i \ell_{ja}^i \tag{16}$$

[4] Here and elsewhere, the sum over ages is always from 1 to 100.

$$E \log c^i \equiv \sum_a s_a^{us} \sum_{j=1}^{N_a^i} \bar{\omega}_{ja}^i \log(c_{ja}^i e^{ga}) \tag{17}$$

$$Ev(\ell^i) \equiv \sum_a s_a^{us} \sum_{j=1}^{N_a^i} \bar{\omega}_{ja}^i v(\ell_{ja}^i). \tag{18}$$

Because of additivity in log consumption, we again get an additive decomposition of welfare differences in terms of consumption equivalents:

$$\begin{aligned}
\log \frac{\lambda_i}{\tilde{y}_i} = \quad & \textstyle\sum_a \Delta s_a^i u_a^i && \text{Life expectancy} \\
& + \log \bar{c}_i / y_i - \log \bar{c}_{us} / y_{us} && \text{Consumption share} \\
& + v(\bar{\ell}_i) - v(\bar{\ell}_{us}) && \text{Leisure} \\
& + E \log c^i - \log \bar{c}^i - (E \log c^{us} - \log \bar{c}^{us}) && \text{Consumption inequality} \\
& + Ev(\ell^i) - v(\bar{\ell}^i) - (Ev(\ell^{us}) - v(\bar{\ell}^{us})) && \text{Leisure inequality}
\end{aligned} \tag{19}$$

where $\tilde{y}_i \equiv y_i / y_{us}$. Looking at welfare relative to income simply changes the interpretation of consumption in the decomposition. The consumption term now refers to the *share* of consumption in GDP. A country with a low consumption share will have lower welfare relative to income, other things equal. Of course, if this occurs because the investment rate is high, this will raise welfare in the long run (as long as the economy is below the golden rule). Nevertheless, flow utility will be low *relative* to per capita GDP.

2.4. Equivalent Variation versus Compensating Variation

The welfare metric above is an *equivalent* variation: by what proportion must we adjust Rawls' consumption in the U.S. so that his welfare equals that in other countries. Alternatively, we could consider a *compensating* variation: by what factor must we increase Rawls' consumption in country i to raise welfare there to the U.S. level. Inverting this number gives a compensating variation measure of welfare, λ_i^{cv}. The resulting welfare measure is very similar to the equivalent variation decomposed in equation (19), with one key difference: in the life expectancy term in the first line of the equation, the equivalent variation weights differences in survival probabilities by a country's own flow utility, while the compensating variation weights differences by U.S. flow utility.[5]

[5] Another related difference is that the denominator of Δs_a^i becomes the cumulative discounted survival in the country under consideration, rather than in the U.S.

This distinction turns out to matter greatly for poor countries. In particular, flow utility in the poorest countries of the world is estimated to be small, so their low life expectancy has a surprisingly small effect on the equivalent variation: flow utility is low, so it makes little difference that people in such a country live for 50 years instead of 80 years. Thus large shortfalls in life expectancy do not change the equivalent variation measure much in very poor countries, which seems extreme. In contrast, the compensating variation values differences in life expectancy using the U.S. flow utility, which is estimated to be large. Such differences then have a substantial effect on consumption-equivalent welfare. For our benchmark measure, we take a conservative approach and report the equivalent variation. In the robustness section, we show that the compensating variation strengthens our main results.

2.5. The Welfare Calculation over Time

Suppose the country i that we are comparing to is not China or France but rather the U.S. itself in an earlier year. In this case, one can divide by the number of periods, e.g. $T = 2007 - 1980 = 27$, and obtain a growth rate of the consumption equivalent. And of course we can do this for any country, not just the U.S.:

$$g_i \equiv -\frac{1}{T}\log\lambda_i. \tag{20}$$

This growth rate can similarly be decomposed into terms reflecting changes in life expectancy, consumption, leisure, and inequality, as in equation (19).[6]

3. Micro Data and Calibration

To calculate consumption-equivalent welfare, we use Household Survey data from the U.S., Brazil, China, France, India, Indonesia, Italy, Malawi, Mexico, Russia, South Africa, Spain and the U.K. See Table 1 for a list of the datasets, years, and sample sizes.[7] A de-

[6]The issue of equivalent vs. compensating variation arises in the growth rate too. Treating 2007 as the benchmark — an equivalent variation — means that the percentage change in life expectancy gets weighted by the flow utility in 1980. Treating 1980 as the benchmark — a compensating variation — weights the percentage change in life expectancy by flow utility in 2007. We average the equivalent and compensating variations for growth rates, as is common practice in the literature.

[7]Krueger, Perri, Pistaferri and Violante (2010) describe an impressive set of recent papers tracking inequality in earnings, consumption, income and wealth over time in 10 countries. We use the cleaned

Table 1: Household Surveys

Country	Survey	Year	# of Individuals in the sample
U.S.	CE	2007, 2006, 2005	14,870, 32,184, 32,892
		2004, 2003, 2002	34,064, 34,650, 33,474
		2001, 1993, 1984	31,884, 22,449, 23,825
Brazil	POF/PNAD	2008	189,752 (cons.) and 373,099 (leisure)
		2003	182,036 (cons.) and 370,491(leisure)
China	CHIP	2004	58,160
France	EBF	2005 and 1984	25,361 and 33,225
India	NSS	2004–2005	602,518
		1983–1984	316,061 (cons.) and 622,912 (leisure)
Indonesia	SUSENAS	2006 and 1993	1,107,594 and 290,763
Italy	SHIW	2006 and 1987	19,407 and 24,970
Malawi	IHS	2004	50,822
Mexico	ENIGH	2006 and 1984	83,559 and 23,985
Russia	RLMS	2007 and 1998	9,784 and 8,998
South Africa	HIS	1993	38,749
Spain	ECPF/ECPH	2001	24,905 (cons.) and 13,985 (leisure)
U.K.	FES	2005 and 1985	10,289 and 13,465

Notes: CE = U.S. Consumer Expenditure Survey. POF = Consumer Expenditure Survey in Brazil. PNAD = National Household Sample Survey in Brazil. CHIP = China Household Income Project. EBF = French Family Budge Survey. NSS = Indian National Sample Survey. SUSENAS = Indonesian National Socioeconomic Survey. SHIW = Italian Survey of Household Income and Wealth. IHS = Malawian Integrated Household Survey. ENIGH = Mexican National Survey of Household Income and Expenditure. RLMS = Russian Longitudinal Monitoring Survey. HIS = South African Integrated Household Survey. ECPH = European Community Household Panel (for Spain). ECPF = Spanish Continuous Household Budget Survey. FES = U.K. Family Expenditure Survey.

tailed data appendix and descriptions of the programs used in this paper are available in the Online Appendix.

Household Surveys enable us to calculate consumption inequality for an arbitrary distribution of consumption instead of assuming (say) a log-normal distribution.[8] With

datasets they made available for Italy, Russia, Spain, and the U.S.

[8]Top-coding does not occur for consumption in our countries other than the U.S. It seems to arise infrequently in the U.S. data when durables are excluded.

household-level data we can be more confident that consumption is defined consistently across countries and time. For every country we exclude expenditures on durable goods and focus on nondurables and services (including rent and owner-occupied housing among services).[9]

The micro data we use report the age composition of each household. We allocate consumption equally to each household member. We can take into account household size and age composition in a way that publicly available Gini coefficients do not.

Our household surveys include hours worked for adults and at least older children in the household. For the children below the age covered in the survey, we assume zero hours worked. Importantly, the surveys ask about time spent in self-employment, including subsistence agriculture. We calculate leisure as (5840 – hours worked in the year)/5840, where 5840 = 16 hours a day * 365 days.[10]

As with consumption, having leisure by age allows us to deal with differences in the age composition of the population across countries and time. Moreover, we can estimate the welfare cost of leisure inequality, just as we estimate the welfare cost of consumption inequality (again using the observed distribution).

From behind the Rawlsian veil, consumption and leisure interact with mortality to determine expected utility. We combine data from Household Surveys with mortality rates by age from the World Health Organization.[11]

3.1. Summary statistics from the micro data

This section aggregates our underlying micro data in various ways to shed light on the components of our welfare calculation.

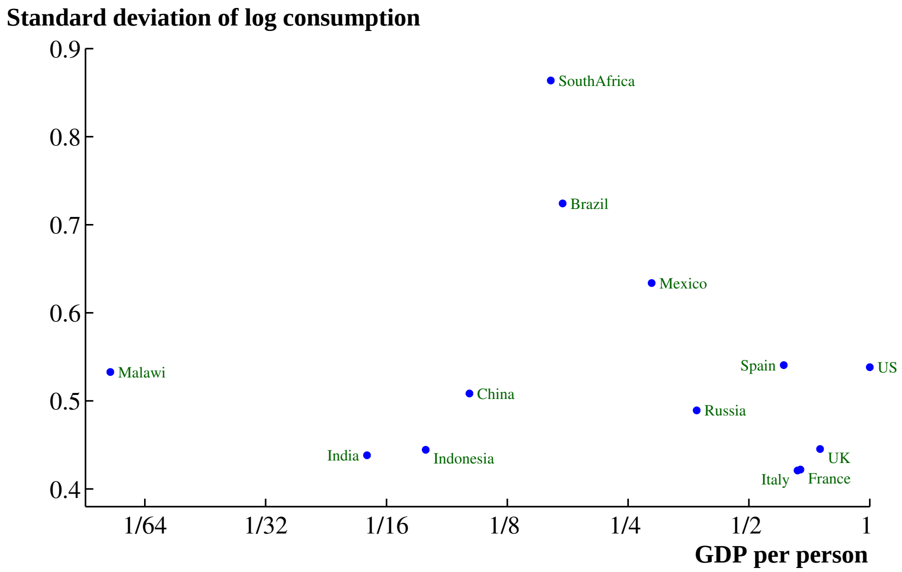
Consumption: Figure 1 reports the standard deviation of log consumption across people in our Household Survey countries. We divide household expenditures equally across people in each household, and add per capita government consumption in the

[9] In principle we would like to include the service flow from the stock of durable goods. But most Household Surveys cover only lumpy durable expenditures rather than household stocks of durable goods.

[10] For countries such as the U.S., we have weeks worked per year as well hours worked per week. For most countries, however, the Household Surveys only cover hours per week, so we draw on OECD and other sources for weeks worked per worker. See the Online Appendix.

[11] http://apps.who.int/whosis/database/life_tables/life_tables.cfm. We use data from 1990, 2000, and 2011, interpolating to get needed years in between. For the very poorest countries, the adult mortality rates are inferred from child mortality rates. See http://www.who.int/whr/2006/annex/06_annex1_en.pdf for "uncertainty ranges" associated with WHO mortality rates.

Figure 1: Within-Country Inequality



Note: The standard deviation of log consumption within each economy is measured from the household surveys listed in Table 1. We use survey-specific sampling weights and U.S. survival rates across ages using an analog of equation (17), with no discounting or growth.

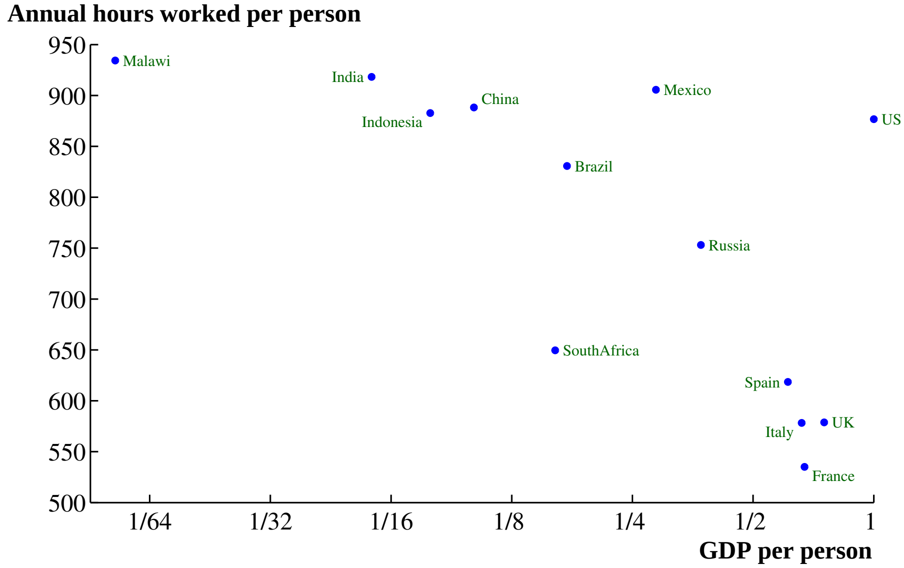
same year from the Penn World Tables 8.0. We use sampling weights and discount using U.S. survival rates by age, analogous to the way we construct the mean of log consumption in equation (17). The resulting inequality is highest in South Africa, Brazil and Mexico. Inequality is lower in France, Italy and the U.K. than in the U.S.

Leisure: Figure 2 summarizes annual hours worked per person in our Household Surveys. Figure 3 reports the standard deviation across people of annual hours worked.[12] Hours worked are substantially lower in France, Italy, Spain and the U.K. than in the U.S., as has been widely noted. More novel, *inequality* of hours worked is lower in these same countries than in the U.S.

Mortality rates: Figure 4 presents life expectancy in years from the World Health Organization for our baseline Household Survey years. It ranges from 50 in Malawi, the poorest country, to above 75 in the richest countries.

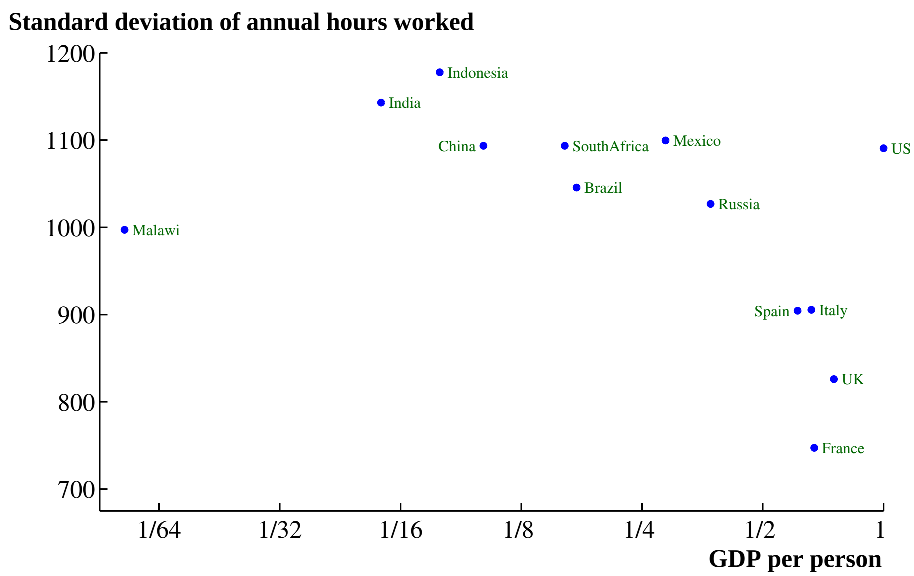
[12] Parente, Rogerson and Wright (2000) argue that barriers to capital accumulation explain some of the variation in market hours worked. Like us, they emphasize that the gain in home production can partially offset the loss in market output. Prescott (2004) attributes some of the OECD differences in hours worked to differences in tax rates, as do Ohanian, Raffo and Rogerson (2008).

Figure 2: Annual Hours Worked across Countries



Note: The measure shown here of annual hours worked per capita is computed from the household surveys noted in Table 1, using survey-specific sampling weights and U.S. survival rates across ages as in equation (16), with no time discounting.

Figure 3: Inequality in Annual Hours Worked

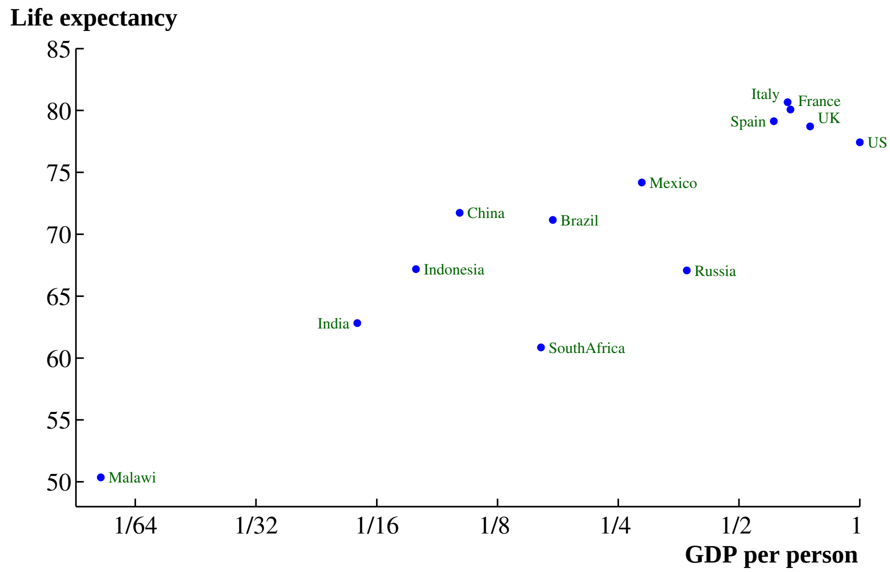


Note: See notes to Figure 2.

3.2. Calibration

To implement our calculation, we need to specify the baseline utility function. (In Section 5 we will explore a range of robustness checks to our choices here.) Following

Figure 4: Life Expectancy



Note: Life expectancy at birth in each country is measured as the sum over all ages of the probability of surviving to each age, using life tables from the World Health Organization.

the macro literature, we assume utility from leisure takes a form that implies a constant Frisch elasticity of labor supply (that is, holding the marginal utility of consumption fixed, the elasticity of labor supply with respect to the wage is constant). Since labor supply in our setting is $1-\ell$, in terms of the utility function in equation (4) this gives $v(\ell) = -\frac{\theta\epsilon}{1+\epsilon}(1-\ell)^{\frac{1+\epsilon}{\epsilon}}$, where ϵ denotes the Frisch elasticity. This leaves five parameters to be calibrated: the growth rate g, the discount factor β, the Frisch elasticity ϵ, the utility weight on leisure or home production θ, and the intercept in flow utility $\bar{u}$.

We choose a common growth rate of 2% per year. An alternative would be to try to forecast future growth rates for each country, but such forecasts would have very large standard errors, particularly since we would need forecasts for every year over the next century. We set the discount factor to $\beta = 0.99$. Recall that there is already additional discounting inherent in the expected utility calculation because of mortality.

Surveying evidence such as Pistaferri (2003), Hall (2009a,b) suggests a benchmark value for the Frisch elasticity of 0.7 for the intensive (hours) margin and 1.9 for the extensive and intensive margins combined. Chetty (2012) reconciles micro and macro estimates of the Frisch elasticity and recommends a value of 0.5 or 0.6 for the intensive margin. We consider a Frisch elasticity of 1.0 for our benchmark calibration, which implies that the disutility from working rises with the square of the number of hours worked. As we discuss in the robustness section, the results are not sensitive to this choice.

To get the utility weight on the disutility from working, θ, recall that the first-order condition for the labor-leisure decision is $u_\ell/u_c = w(1-\tau)$, where w is the real wage and τ is the marginal tax rate on labor income. Our functional forms then imply $\theta = w(1-\tau)(1-\ell)^{-1/\epsilon}/c$. For our benchmark calibration, we assume this first-order condition holds for the average prime-age worker (25-55 years old) in the U.S. Consumer Expenditure Survey (CE) in 2006. We take the marginal tax rate in the U.S. from Barro and Redlick (2011), who report a value of 0.353 for 2006. Taking into account the ratio of earnings to consumption and average leisure among 25-55 year olds of $\ell_{us} = 0.656$ in the CE, we arrive at $\theta = 14.2$.[13]

Calibration of the intercept in flow utility, $\bar{u}$, is less familiar. This parameter is critical for valuing differences in mortality. We choose $\bar{u}$ so that a 40 year old, facing the consumption and leisure uncertainty in the 2006 U.S. distribution, has a value of remaining life equal to $6 million in 2007 prices.[14] In their survey of the literature, Viscusi and Aldy (2003) recommend values in the range of $5.5–$7.5 million. Murphy and Topel (2006) choose a value of around $6 million. Our baseline value of $6 million is broadly consistent with this literature. This choice leads to $\bar{u} = 5.00$ when aggregate consumption per capita in the U.S. is normalized to 1 in 2007. With these preferences, the implied value of life will be substantially lower in poor countries; see Kremer, Leino, Miguel and Zwane (2011) for evidence consistent with this implication. Wider evidence on the value of life in developing countries is admittedly scant.

4. Welfare across Countries and over Time

We begin with levels of consumption-equivalent welfare for the 13 countries for which we have detailed micro data. The calculation is based on equation (19), implemented for the most recent year we have household survey data and with Penn World Tables

[13] We scale up CE consumption expenditures in three ways. First, we add in durables expenditures in 2006, to approximate their flow value. Second, we take into account that CE expenditures were only 61.9 percent of NIPA consumption in that year. Third, we scale up consumption by the Penn World Tables 8.0 ratio of (private plus public consumption)/(private consumption) for the U.S. in 2006.

[14] For this computation, we use the same data and parameters that we use later in the paper to compute λ. For example, we discount the future at rate $\beta = 0.99$ and allow consumption to grow at 2% per year.

8.0 data on consumption and income. Our first finding can be summarized as follows:

Key Point 1: **GDP per person is an excellent indicator of welfare across the broad range of countries: the two measures have a correlation of 0.98. Nevertheless, for any given country, the difference between the two measures can be important. Across 13 countries, the median deviation is about 35%.**

Figure 5 illustrates this first point. The top panel plots the welfare measure, λ, against GDP per person. What emerges prominently is that the two measures are extremely highly correlated, with a correlation coefficient (for the logs) of 0.98. Thus per capita GDP is a good proxy for welfare under our assumptions. At the same time, there are clear departures from the 45-degree line. In particular, many countries with very low GDP per capita exhibit even lower welfare. As a result, welfare is more dispersed (standard deviation of 1.51 in logs) than is income (standard deviation of 1.27 in logs).

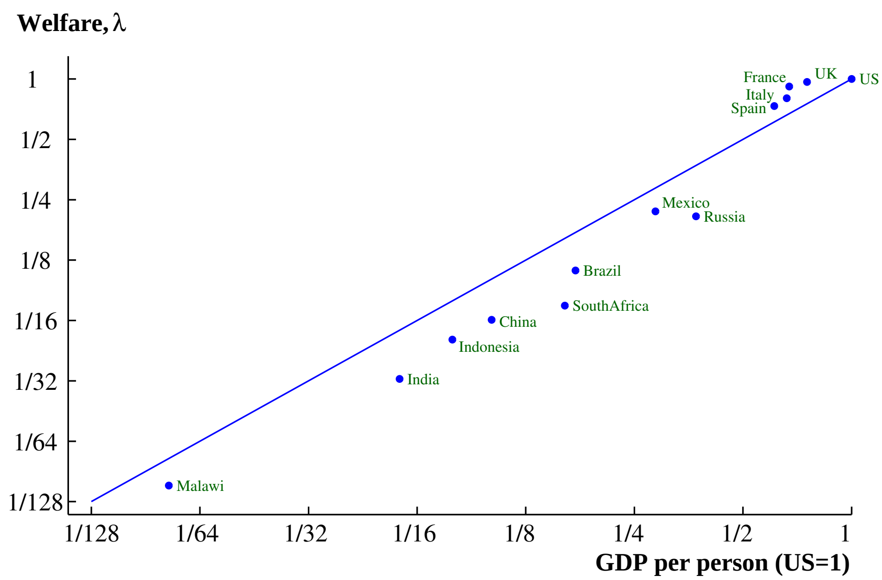
The bottom panel provides a closer look at the deviations. This figure plots the ratio of welfare to per capita GDP across countries. The European countries have welfare measures 22% higher than their incomes. The remaining countries, in contrast, have welfare levels that are typically 25 to 50 percent below their incomes. The way to reconcile these large deviations with the high correlation between welfare and income is that the "scales" are so different. Incomes vary by more than a factor of 64 in our sample — i.e. 6300 percent — whereas the deviations are on the order of 25 to 50 percent.

Key Point 2: **Average Western European living standards appear much closer to those in the United States when we take into account Europe's longer life expectancy, additional leisure time, and lower levels of inequality.**

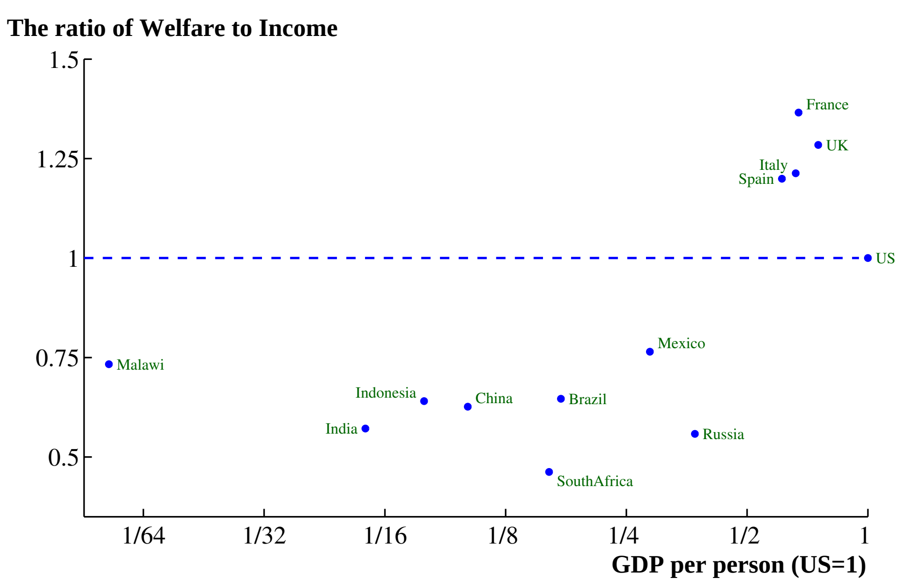
Table 2 provides a closer look at the welfare decomposition based on (19). The U.K., France, Italy, and Spain all have per capita incomes around 2/3 that in the U.S. Consumption-equivalent welfare is about 22 log points higher, averaging 85 percent of that in the U.S.

Consider the case of France. Income in France is 67 percent of the U.S. level. Longer life expectancy, additional leisure, and lower inequality of consumption and leisure each boost welfare. Taken together, consumption-equivalent welfare is more than 90 percent of the U.S. level. The green numbers in the table help to make sense of this difference. Mortality rates are significantly lower in France than in the U.S. Life expectancy is 80.1 years in France versus 77.4 years in the U.S. This difference adds 15 log

Figure 5: Welfare and Income across Countries



(a) Welfare and income are highly correlated at 0.98...



(b) ...but this masks substantial variation in the ratio of λ to GDP per capita.

Table 2: Welfare across Countries

	Welfare λ	Income	Log Ratio	*Decomposition* Life Exp.	C/Y	Leisure	Cons. Ineq.	Leis. Ineq
U.S.	100.0	100.0	0.000	0.000	0.000	0.000	0.000	0.000
				77.4	0.897	877	0.538	1091
U.K.	96.6	75.2	0.250	0.086	-0.143	0.073	0.136	0.097
				78.7	0.823	579	0.445	826
France	91.8	67.2	0.312	0.155	-0.152	0.083	0.102	0.124
				80.1	0.790	535	0.422	747
Italy	80.2	66.1	0.193	0.182	-0.228	0.078	0.086	0.075
				80.7	0.720	578	0.421	905
Spain	73.3	61.1	0.182	0.133	-0.111	0.070	0.017	0.073
				79.1	0.786	619	0.541	904
Mexico	21.9	28.6	-0.268	-0.156	-0.021	-0.010	-0.076	-0.005
				74.2	0.879	906	0.634	1100
Russia	20.7	37.0	-0.583	-0.501	-0.248	0.035	0.098	0.032
				67.1	0.733	753	0.489	1027
Brazil	11.1	17.2	-0.436	-0.242	0.004	0.005	-0.209	0.006
				71.2	0.872	831	0.724	1046
S. Africa	7.4	16.0	-0.771	-0.555	0.018	0.054	-0.283	-0.006
				60.9	0.887	650	0.864	1093
China	6.3	10.1	-0.468	-0.174	-0.311	-0.016	0.048	-0.014
				71.7	0.658	888	0.508	1093
Indonesia	5.0	7.8	-0.445	-0.340	-0.178	-0.001	0.114	-0.041
				67.2	0.779	883	0.445	1178
India	3.2	5.6	-0.559	-0.440	-0.158	-0.019	0.085	-0.028
				62.8	0.785	918	0.438	1143
Malawi	0.9	1.3	-0.310	-0.389	0.012	-0.020	0.058	0.028
				50.4	0.923	934	0.533	997

Notes: The table shows the consumption-equivalent welfare calculation based on equation (19). See Table 1 for sources and years. The second line for each country shows life expectancy, the ratio of consumption to income, annual hours worked per capita, the standard deviation of log consumption, and the standard deviation of annual hours worked, all computed from the cross-sectional micro data, with no discounting or growth.

points to welfare. With respect to leisure, average annual hours worked per capita in the U.S. are 877 versus only 535 in France: the average person in France works less than two-thirds as much as the average person in the U.S. The implied difference in leisure adds 8 log points to welfare.

Next, consider consumption inequality. The standard deviation of log consumption in the French micro data is 0.422 versus 0.538 in the U.S. To see how this affects welfare, consider a hypothetical in which consumption is log-normally distributed. In this case, lower inequality adds $.5(.538^2 - .422^2) = .056$, or 5.6 percent, to welfare. Without imposing the log-normal approximation we get 10.2 log points. Interestingly, with our additively separable preferences and behind the veil-of-ignorance approach it does not matter to our calculation whether consumption inequality is permanent from birth or i.i.d. at each age. Rawls values the consumption uncertainty in exactly the same way.

Finally, consider leisure inequality. Our baseline preferences specify a Frisch elasticity of labor supply of one, which implies a disutility from working that depends on the square of annual hours worked. The standard deviation of annual hours per capita is 1091 in the U.S. versus 747 in France. With convex costs of working, this heterogeneity adds 12 log points to welfare in France. One can combine this number with the consumption inequality number to say that lower inequality raises welfare in France relative to the U.S. by more than 20 log points.

The exact numbers — either for France or for the other European countries — depend on the specific assumptions we make. As we will show later, however, the general point that welfare in Western Europe is much closer to U.S. levels than the income comparisons suggest is quite robust.

Key Point 3: Many developing countries — including all eight of the non-European countries in our sample — are poorer than incomes suggest because of a combination of shorter lives, low consumption shares, and extreme inequality.

The country details are reported in the lower half of Table 2. The same story appears repeatedly. A life expectancy of only 67 years cuts Russia's welfare by 50 log points, or around 40 percent. South Africa's high mortality leads to a life expectancy of 61 years in 1993 (even lower by 2007 we'll see later), which reduces welfare by 55 logs points. Interestingly, the even lower life expectancy in Malawi of just over 50 years only reduces welfare there by 39 log points. Why the difference?

As can be seen in equation (19) or (7), the loss from low life expectancy is weighted by the value of flow utility — the utility lost from living one year less. Malawi is much poorer than South Africa, so its shortfall in life expectancy is penalized less.[15] As we will

[15] Table A3 in the Online Appendix reports the implied value of life in each of our 13 countries.

show, this is a key place where the equivalent variation differs from the compensating variation. The compensating variation weights differences in mortality by U.S. flow utility. In the robustness section, we'll see this leads to much larger welfare differences.

A second reason that welfare is lower than income in several countries is that average consumption – as a share of income – is low relative to the United States. Utility depends on consumption, not income, and a low consumption share of income implies lower consumption. Of course, an offsetting effect is that the low consumption share may raise consumption in the future. To the extent that countries are close to their steady states, this force is already incorporated in our calculation. However, in countries with recent upward trends in the investment rate, our calculation will understate steady-state welfare. China is an obvious candidate for this qualification, though correcting for this has a modest effect.[16]

High consumption inequality is a final force contributing to lower welfare in many developing countries, with the sharpest examples being Brazil and South Africa. Consumption inequality in Brazil reduces welfare by 21 percent and in South Africa by 28 percent. In contrast, the effects of leisure and leisure inequality are relatively small in developing countries: annual hours worked per person and its heterogeneity are similar to levels in the U.S.

4.1. Growth Rates

We turn now to welfare growth over time. Rather than comparing Rawls' expected utility from living in the U.S. versus another country in the same year, we now consider how Rawls might value living in the same country at two different points in time. The decomposition in equation (19) remains valid, only we now express it in growth rate terms as in (20). We begin with a point that summarizes the differences between welfare growth and growth in per capita GDP:

Key Point 4: Welfare growth averages 3.1% between the 1980s and mid-2000s, versus income growth of 2.1%, across the seven countries for which we have household surveys during these periods. A boost from rising life expectancy of about 1 percentage point per year accounts for the difference.

[16] For example, see Table 8 of Jones and Klenow (2010).

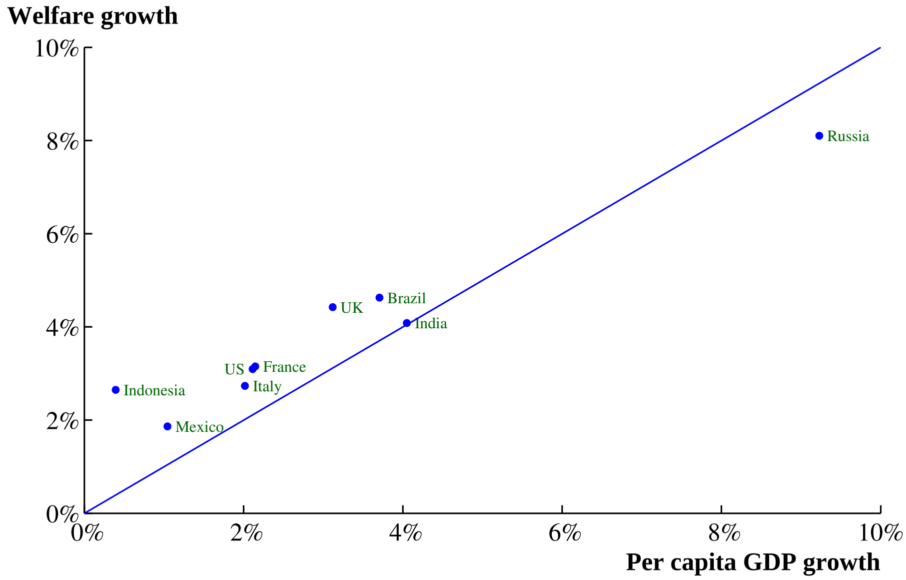
Table 3: Welfare Growth

	Welfare Growth	Income Growth	Diff	Decomposition: Life Exp.	c/y	Leis.	Cons. Ineq.	Leis. Ineq.
Russia (98-07)	8.10	9.23	-1.13	0.93	-1.53	-0.29	-0.02	-0.22
				65.5,67.1	.842,.745	707,801	.469,.498	997,1043
Brazil (03-08)	4.63	3.71	0.92	1.54	-0.84	-0.06	0.06	0.23
				71.2,72.9	.865,.829	845,854	.722,.720	1050,1021
U.K. (85-05)	4.42	3.12	1.30	1.16	0.12	-0.01	-0.02	0.05
				75.4,78.7	.793,.827	588,596	.391,.447	860,832
India (83-05)	4.08	4.05	0.03	1.14	-1.04	0.04	-0.13	0.02
				57.6,62.8	.973,.768	964,952	.416,.429	1156,1149
France (84-05)	3.15	2.15	1.00	1.04	0.10	-0.05	-0.16	0.07
				77.1,80.1	.782,.790	480,534	.391,.422	793,747
U.S. (84-06)	3.09	2.11	0.98	0.89	0.51	-0.10	-0.24	-0.08
				75.0,77.4	.812,.892	810,889	.508,.539	1054,1094
Italy (87-06)	2.73	2.02	0.72	1.33	0.03	-0.17	-0.24	-0.22
				76.6,80.7	.728,.719	410,587	.382,.421	782,909
Indo. (93-06)	2.65	0.39	2.25	1.43	0.81	0.18	-0.16	-0.00
				62.3,67.2	.705,.780	976,912	.421,.445	1188,1193
Mexico (84-06)	1.87	1.05	0.82	1.09	0.26	-0.23	-0.16	-0.14
				70.8,74.2	.838,.872	754,909	.663,.631	1045,1101
Average	3.86	3.09	0.77	1.17	-0.17	-0.08	-0.12	-0.03
Average*	3.14	2.13	1.02	1.15	0.11	-0.05	-0.16	-0.04

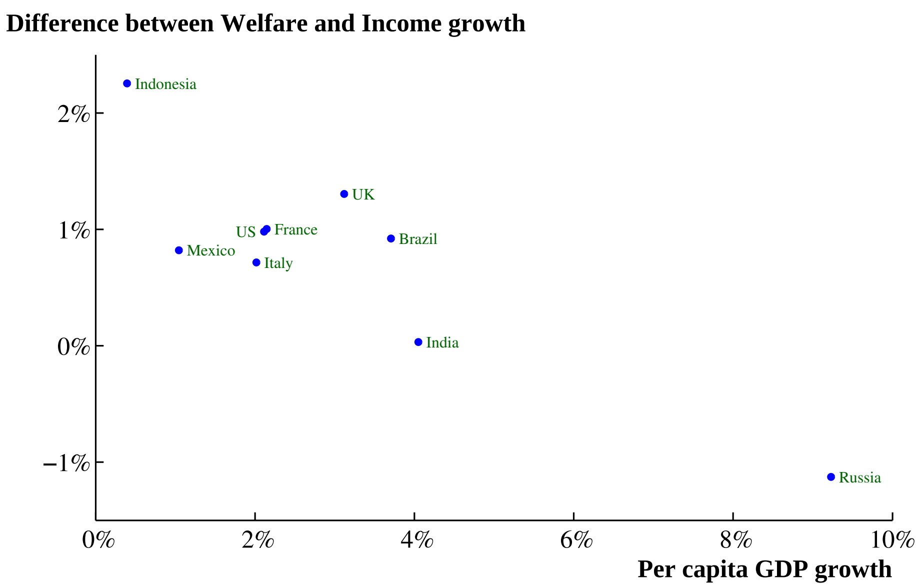
Note: The table shows a decomposition for average annual consumption-equivalent welfare growth based on equation (20). Years are shown in parentheses. *Average* denotes the average across the nine countries, while *Average** excludes Russia and Brazil. The second line for each country displays the raw data on life expectancy, the ratio of consumption to income, annual hours worked per capita, the standard deviation of log consumption, and the standard deviation of annual hours worked, for the start and ending year, computed with no discounting or growth.

Figure 6 documents a high correlation (0.97) between welfare growth and income growth across our micro dataset countries. Russia is an obvious outlier – our household survey years of 1998 and 2007 correspond to a period of rapid Russian growth. The lower panel of the figure shows that the typical country gains about a percentage point of growth when shifting from income to welfare. Growing at 3% instead of 2% per year, living standards double in 24 years instead of 36 years; over a century, this leads to a 20-fold increase rather than a 7-fold increase.

Figure 6: Welfare and Income Growth



(a) The correlation between welfare growth and income growth is 0.97.



(b) The median absolute value of the difference between welfare and income growth is 0.95 percentage points.

The source of the gain is evident in Table 3. As shown in the last row of the table, the bulk of the gain for the average country results from the life expectancy term. Living standards are rising mostly because of rising consumption per year of life. But the fact that we can enjoy our consumption over a longer lifetime is also important.[17]

The details of specific countries lead to additional insights. Falling leisure and rising inequality have reduced growth by roughly half a percentage point in the U.S., Italy, and Mexico. For example, in the U.S. annual hours worked per person rose from 810 to 889 between 1984 and 2006. We estimate that this falling leisure reduced consumption-equivalent welfare growth by about a tenth of a percentage point per year. According to the Consumer Expenditure Survey, consumption inequality rose, reducing growth by another 24 basis points.[18] Finally, rising leisure inequality reduces U.S. welfare growth another 8 basis points. Taken together, these three channels reduce consumption-equivalent welfare growth in the U.S. by 42 basis points per year.

Mexico and Italy exhibit similar patterns. Falling leisure reduces welfare growth by 0.17 percentage points per year in Italy and 0.23 percentage points per year in Mexico. Rising consumption and leisure inequality,combined, reduce growth by 0.46 and 0.30 percentage points per year in Italy and Mexico. The sum of these three forces is therefore about 0.63 percentage points per year in Italy and 0.53 percentage points per year in Mexico.

5. Robustness

Here we gauge the robustness to alternative assumptions, such as about the utility function. Table 4 shows that the gap we find between welfare and income is quite robust. More detailed results — including decompositions for France, China, and Indonesia — are available in an Online Appendix.

The second row of Table 4 indicates that, if we do not discount or incorporate growth, the differences between welfare and income are somewhat smaller than in the baseline case. A similar finding applies if we evaluate utility only for those age 2 and older;

[17] Nordhaus (2003) offered a back-of-the-envelope calculation suggesting that rising life expectancy over the 20th century was as important to welfare as consumption growth. Our calculation using micro data for a range of countries supports the tenor or his, though our estimate is closer to one-half.

[18] The CES displays a relatively small increase in consumption inequality, as emphasized by Krueger and Perri (2006). According to Aguiar and Bils (2013), savings and Engel Curves in the CES suggest that consumption inequality rose as much as income inequality in the U.S. over this period.

Table 4: Robustness — Summary Results

Robustness check	— *Median absolute deviation* — Levels	Growth rate
Benchmark case	35.4	0.98
No discounting/growth ($\beta = 1$, $g = 0$)	29.7	0.94
Ages 2 and above	31.4	0.91
Ages 40 and above	35.7	1.62
Compensating variation	44.1	...
$\gamma = 1.0$, $\underline{c} = 0^a$	35.9	0.74
$\gamma = 1.5$, $\underline{c} = 0.05^a$	36.9	0.60
$\gamma = 2.0$, $\underline{c} = 0.20^a$	45.2	0.74
θ from FOC for France	35.4	0.96
Frisch elasticity = 0.5	35.1	1.04
Frisch elasticity = 2.0	35.1	0.95
Kids get adult leisure	35.2	0.80
Value of Life = \$5m	29.9	0.85
Value of Life = \$7m	39.6	1.11

Note: Entries are the median absolute deviation of $\frac{\lambda_i}{\tilde{y}_i}$ from 100% in the levels case and $g_\lambda - g_y$ in the growth rate case. (a) The sample size changes when we move to the CRRA/CFE preferences. In particular, we require both consumption and leisure to come from the same household survey, which rules out Brazil and Spain (and India for growth). Also, countries for which the growth rate starts before 1990 use the 1990 mortality rates in the initial year with no correction in the CRRA/CFE case (the numbers are scaled to reflect the changing years in the log case, where the terms can be separated additively). The case of $\gamma = 1$ and $\underline{c} = 0$ is reported separately here to reflect the changing sample size and treatment of mortality growth (otherwise, it is identical to the benchmark case).

differences in infant mortality matter, but do not drive the results. Evaluating expected utility only for those age 40 and older has little effect on level comparisons, but widens the growth rate differences (from a median of 1.0% to 1.6% per year).

5.1. Equivalent Variation and Compensating Variation

Recall that our benchmark results are based on equivalent variations (EV). Table 4 indicates that the median gap between welfare and income relative to the U.S. is 44 percent if we use compensating variations (CV), compared to the 35 percent we get in the baseline with EV.

As discussed in Section 2, the distinction between EV and CV rests primarily on whether differences in life expectancy are valued using a country's own flow utility (for EV) or the U.S. flow utility (for CV). For rich countries, this makes little difference. Even for a country with moderate income, like China, the differences are relatively small. The difference between EV and CV is more apparent for extremely poor countries. Consider Malawi. Our EV-based welfare ratio for the U.S. vs. Malawi, which weights Malawi's lower life expectancy by its own utility flow, is 106 (i.e., over 100 times the consumption-equivalent in the U.S. as in Malawi). The CV-based welfare ratio, which uses U.S. flow utility to value the shortfall in Malawi's life expectancy, is comparatively enormous at 796.

5.2. Alternative Utility Specifications

Our benchmark utility function adds log consumption, a leisure term, and an intercept. This yields an additive decomposition of welfare differences. Now consider a more general utility function with non-separable preferences over consumption and leisure:

$$u(C,\ell) = \bar{u} + \frac{(C+\underline{c})^{1-\gamma}}{1-\gamma}\left(1+(\gamma-1)\frac{\theta\epsilon}{1+\epsilon}(1-\ell)^{\frac{1+\epsilon}{\epsilon}}\right)^{\gamma} - \frac{1}{1-\gamma}. \tag{21}$$

This functional form reduces to our baseline specification when $\gamma = 1$ and $\underline{c} = 0$.

When $\underline{c} = 0$, this is the "constant Frisch elasticity" functional form advocated by Shimer (2009) and Trabandt and Uhlig (2009). The parameter ϵ is the constant Frisch elasticity of labor supply (the elasticity of time spent working with respect to the real wage, holding fixed the marginal utility of consumption).

Several cases in Table 4 impose more curvature over consumption than in the log case. With $\gamma = 1.5$ — and $\underline{c} = 0.05$ to prevent Rawls from preferring death to life in poor countries like Malawi — the median absolute percentage deviation of welfare from income rises a little, and the growth deviation falls somewhat.[19] Consumption inequality is more costly to Rawls with $\gamma = 1.5$ than in our baseline of $\gamma = 1$.

The next row of Table 4 increases curvature further to $\gamma = 2$, while at the same time boosting the intercept to $\underline{c} = 0.20$. The median gap between welfare and income

[19] Even with log utility, it is conceivable for expected lifetime utility to be negative if consumption is sufficiently low. In our baseline case, this does not occur for any country, and in fact expected flow utility at each age is also positive in all countries. When we boost γ above one, however, this is no longer true. We pick a "round" value for $\underline{c}$ that ensures that all countries (with Malawi being the most binding case) have positive expected lifetime utility.

becomes notably wider at 45 percent.

We next consider a higher weight on leisure versus consumption in utility. As in the baseline we have $\gamma = 1$ and $\underline{c} = 0$, but we now increase the value of θ. In particular, we choose θ to rationalize the higher choice of average leisure in France than in the U.S. Increasing the importance of leisure in this way makes little difference.

Toward the end of Table 4, we consider alternative values for the Frisch elasticity of labor supply: 0.5 from Chetty (2012) or 2.0 at the upper end of Hall's (2009b) recommended range. These changes, too, have little effect on our results.

In our baseline case we assumed kids enjoy 100 percent leisure time. An alternative would be to assume kids' leisure is the same as adults' leisure, on average. As shown in Table 4, this change does not move us far from our baseline numbers.

Our final robustness check is to change the intercept in the utility function. We set the intercept so that the remaining value of life for a 40 year old in the U.S. in 2005 dollars is \$5 million or \$7 million rather than the baseline value of \$6 million. With a value of life of \$5 million in the U.S., the intercept in the utility function falls. Life is worth less in all countries, so differences in life expectancy play a smaller role. This reduces the welfare gain from higher longevity in European countries like France and mitigates the welfare loss from low lifespan in developing countries like China. Overall, the median deviation between welfare and income falls from our benchmark value of 35% to a smaller but still substantial 30%.

With a U.S. value of life of \$7 million, the contrast between welfare and income is sharper. The deviation between welfare and income rises to almost 40% rather than 35% in levels, and to 1.1% per year rather than 1.0% per year in 1980–2007 growth rates. With more utility from a year of life, differences in the levels and growth rates of life expectancy naturally matter more.

6. Measuring Welfare for a Broad Range of Countries

We now calculate consumption-equivalent welfare for a broader set of countries and years. The caveat is that much stronger assumptions are required because of data limitations; these calculations are based on the "illustrative example" given at the start of the paper in equation (7). We assume consumption is lognormally distributed and is independent of age. We assume $\beta = 1$ and $g = 0$ so that survival rates can be summarized by a single statistic – life expectancy, which is widely available. We will refer to this as a "macro" calculation, as it relies on publicly-available multi-country datasets instead of micro data from household surveys.

The data sources for the macro calculation are discussed in detail in our Online Appendix. Briefly, we use Penn World Table 8.0 to measure income, consumption, employment, and population. This source also provides hours worked for 52 (mostly rich) countries. We use the UNU-WIDER World Income Inequality Database, Version 3.0a, which is itself a summary of micro surveys, to measure consumption inequality; this database reports Gini coefficients which we convert to the standard deviation of log consumption under the assumption of log normality.[20] Finally, life expectancy is from the World Bank's HNPStats database.[21]

6.1. Comparing Results using Macro and Micro Data

To begin, we assess the accuracy of our macro calculations by comparing them to the detailed micro results we reported earlier. Table 5 shows the comparison, where we match the macro calculation to the same year used in the micro calculation.

The correlation of $\log \lambda$ (computed for the same year) using macro and micro data is 0.999. The mean log deviation between the two measures is 0.0007, while the mean *absolute* log deviation is 0.0674. Thus on average the macro calculation seems to work quite well, and the average deviation between the two measures is about 6.7 percent, much of it explained by the absence of leisure inequality from our macro calculation.

This evidence suggests that calculations using publicly-available multi-country data sets are potentially informative. With this motivation, the remainder of this section considers welfare calculations for a broad set of countries using the "macro" approach.

6.2. Results for a Broad Set of Countries

Figure 7 provides an overview of welfare across countries using the macro data. The top panel plots the welfare measure, λ, against GDP per person for the year 2007 – both relative to the U.S. As in the micro results, the two measures are very highly correlated,

[20]Consumption inequality data are directly available for 68 mostly developing countries. For 49 mostly rich countries, we infer consumption inequality from inequality in disposable income. When inequality data are not available, we assign a zero value to the contribution of inequality in our accounting exercise.

[21]http://go.worldbank.org/N2N84RDV00, series code SP.DYN.LE00.IN.

Table 5: Welfare and Income across Countries: Macro vs. Micro Data

	Welfare			*Decomposition*				
	λ	Income	Log Ratio	Life Exp.	C/Y	Leisure	Cons. Ineq.	Leis. Ineq
U.S.	100.0	100.0	0.000	0.000	0.000	0.000	-0.000	...
(micro)	100.0	100.0	0.000	0.000	0.000	0.000	0.000	0.000
U.K.	87.4	75.2	0.150	0.088	0.009	0.010	0.044	...
(micro)	96.6	75.2	0.250	0.086	-0.143	0.073	0.136	0.097
France	86.4	67.2	0.251	0.164	-0.080	0.061	0.106	...
(micro)	91.8	67.2	0.312	0.155	-0.152	0.083	0.102	0.124
Italy	75.4	66.1	0.132	0.190	-0.148	0.025	0.065	...
(micro)	80.2	66.1	0.193	0.182	-0.228	0.078	0.086	0.075
Spain	73.0	61.1	0.178	0.136	-0.045	0.038	0.049	...
(micro)	73.3	61.1	0.182	0.133	-0.111	0.070	0.017	0.073
Mexico	22.0	28.6	-0.261	-0.085	-0.045	-0.008	-0.123	...
(micro)	21.9	28.6	-0.268	-0.156	-0.021	-0.010	-0.076	-0.005
Russia	20.9	37.0	-0.572	-0.507	-0.129	0.007	0.058	...
(micro)	20.7	37.0	-0.583	-0.501	-0.248	0.035	0.098	0.032
Brazil	11.2	17.2	-0.428	-0.227	-0.036	-0.007	-0.157	...
(micro)	11.1	17.2	-0.436	-0.242	0.004	0.005	-0.209	0.006
SouthAfrica	6.7	16.0	-0.869	-0.499	-0.030	0.087	-0.427	...
(micro)	7.4	16.0	-0.771	-0.555	0.018	0.054	-0.283	-0.006
Indonesia	5.6	7.8	-0.340	-0.302	-0.091	0.039	0.015	...
(micro)	5.0	7.8	-0.445	-0.340	-0.178	-0.001	0.114	-0.041
China	5.6	10.1	-0.592	-0.141	-0.230	-0.066	-0.155	...
(micro)	6.3	10.1	-0.468	-0.174	-0.311	-0.016	0.048	-0.014
India	3.5	5.6	-0.470	-0.339	-0.170	0.052	-0.013	...
(micro)	3.2	5.6	-0.559	-0.440	-0.158	-0.019	0.085	-0.028
Malawi	1.1	1.3	-0.152	-0.184	0.074	0.033	-0.075	...
(micro)	0.9	1.3	-0.310	-0.389	0.012	-0.020	0.058	0.028

Note: The first row for each country reports the welfare decomposition obtained using our macro data sources. The second row repeats the micro results provided earlier. The year varies by country and corresponds to the latest year for which we have household survey data.

Table 6: Macro Welfare Summary Statistics, 2007

Country	Welfare λ	Per capita Income	Log Ratio	Decomposition: Life Exp.	Decomposition: C/Y	Decomposition: Leisure	Decomposition: Cons. Ineq.
Average, unweighted	25.2	31.1	-0.296	-0.205	-0.093	0.029	-0.026
Average, pop-weighted	19.4	23.0	-0.423	-0.213	-0.175	0.014	-0.049
Median absolute dev.	...	...	0.276	0.211	0.139	0.047	0.055
Standard deviation	29.6	36.7	0.385	0.239	0.290	0.052	0.114
Regional Averages							
United States	100.0	100.0	0.000	0.000	0.000	0.000	0.000
Western Europe	81.9	73.4	0.110	0.136	-0.132	0.028	0.077
Eastern Europe	23.2	32.6	-0.348	-0.364	-0.057	0.012	0.061
Latin America	14.6	20.8	-0.376	-0.161	-0.067	0.008	-0.156
N. Africa, Middle East	11.5	18.6	-0.347	-0.232	-0.190	0.082	-0.007
Coastal Asia	9.3	14.1	-0.578	-0.218	-0.281	-0.008	-0.071
Sub-Saharan Africa	2.2	4.4	-0.505	-0.464	0.008	0.046	-0.095

Note: Log Ratio denotes the log of the ratio of λ to per capita GDP (US=100). The decomposition applies to this ratio; that is, it is based on equation (7). The log Ratio is the sum of the last four terms in the table: the life expectancy effect, the consumption share of GDP, leisure, and inequality. (Of course, the sum does not hold for the median absolute deviation or the standard deviation.) Sample size is 152 countries, and regional averages are population weighted.

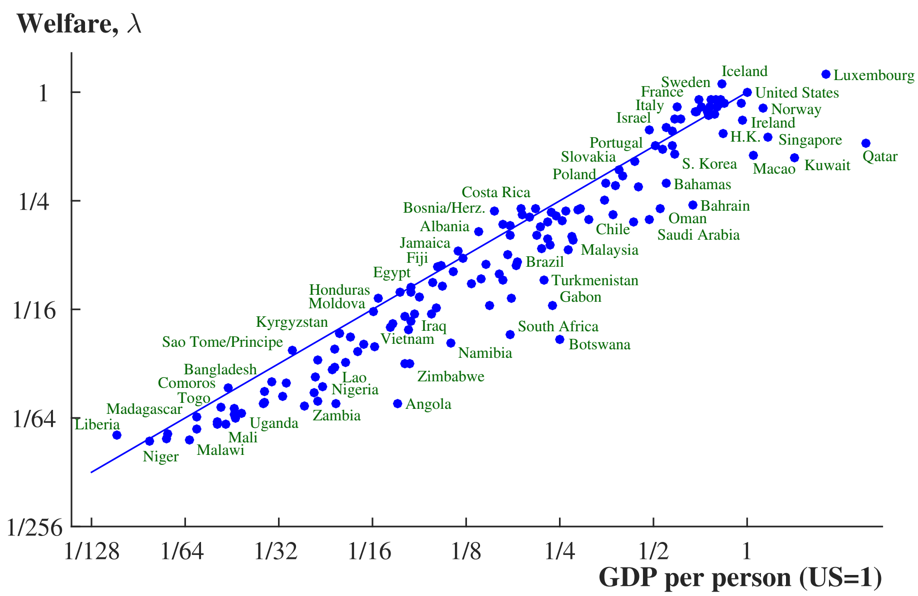
with a correlation (in logs) above 0.95. At the same time, there are clear departures from the 45-degree line.

Table 6 summarizes the macro welfare comparisons, which reinforce the key points from the micro data. First, Western Europe is much closer to the U.S. in welfare than in income: income levels are about 73 percent of the U.S., while consumption-equivalent welfare averages 82 percent. Higher life expectancy in Western Europe adds about 13 percent to welfare on average, higher leisure adds 3 percent, and lower consumption inequality adds 8 percent.

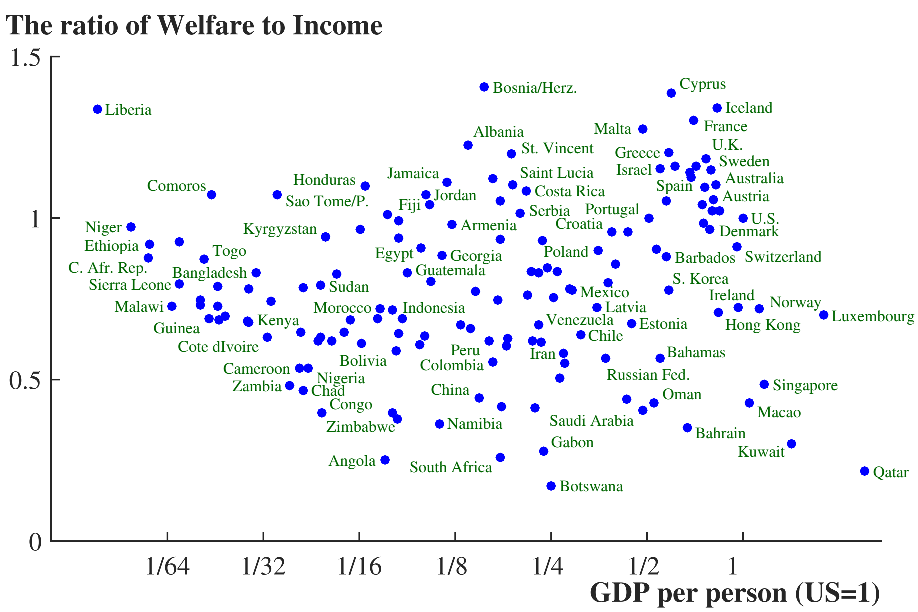
Other regions exhibit the opposite pattern: welfare is systematically lower than income. Lower life expectancy reduces their welfare between 16 and 46 percent. Higher consumption inequality in Sub-Saharan Africa and Latin America reduce their welfare around 10 and 16 percent, respectively. Finally, low consumption shares play an import role in Western Europe and Coastal Asia, reducing welfare by 13 and 28 percent.

The macro data allows us to look at many more countries. Missing data is sometimes a problem, most often for annual hours per worker and consumption inequality.

Figure 7: Welfare using Macro Data, 2007



(a) Welfare and income are highly correlated at 0.96...



(b) ...but this masks substantial variation in the ratio of λ to GDP per capita. The mean absolute deviation from unity is about 27%.

In these cases, we assign U.S. values to the missing observations so that no correction to the income measure is made. Table 7 shows welfare levels for a selection of countries in 2007.[22]

OECD: The key point we made regarding Western Europe shows up for France, Sweden, Germany, and Japan: all have higher welfare than their incomes suggest, largely due to higher life expectancy, higher leisure, and lower consumption inequality. Norway stands out as an interesting exception. It receives the usual positive contributions from these "European" forces. However, these effects are more than offset by Norway's extremely low consumption share. This is readily understood in the context of the North Sea oil discovery: Norway is consuming much less than its current income to smooth the oil revenues into the future. Ireland shows a related pattern, with its high investment rate and low consumption share.

East Asia: Differences between welfare and income are also quite stark for East Asia. According to GDP per person, Singapore and Hong Kong are rich countries on par with the U.S. The welfare measure substantially alters this picture. Singapore declines dramatically, from an income 117% of the U.S. to a welfare of just half that at 57%. A sizable decline also occurs for South Korea, from 58% for income to 45% for welfare. Both countries, and Japan as well, see their welfare limited sharply by low consumption shares. This force is largest for Singapore, where the consumption share of GDP is below 0.5. This is the levels analogue of Alwyn Young's (1992) growth accounting point. Singapore has sustained a very high investment rate in recent decades. This capital accumulation raises income and consumption in the long run, but the effect on consumption is less than the effect on income, which reduces the welfare-to-income ratio. Leisure is also low in Singapore and South Korea, further reducing welfare relative to income. Working hard and investing for the future are well-established means of raising GDP. Nevertheless, these approaches have costs that are not reflected in GDP.

Botswana and South Africa: According to GDP per capita, these are relatively rich developing countries with about 20% of U.S. income. AIDS, however, has dramatically reduced their life expectancy to around 52 years, lowering welfare by more than 85 log points in these countries. Inequality in both countries is also among the highest in the world, with a standard deviation of log consumption of more than 1.0 – reducing

[22] Results for our complete sample of 152 countries are available at http://www.stanford.edu/~chadj/BeyondGDP400.xls.

Table 7: Welfare across Countries in 2007: Macro Data

Country	Welfare λ	Per capita Income	Log Ratio	—— *Decomposition* —— LifeExp	C/Y	Leisure	C Ineq.
United States	100.0	100.0	0.000	0.000	0.000	0.000	0.000
				77.8	0.845	836	0.658
France	91.5	70.3	0.263	0.176	-0.085	0.067	0.106
				80.8	0.776	613	0.471
Sweden	91.2	79.4	0.139	0.181	-0.186	0.010	0.135
				80.9	0.701	807	0.404
Japan	82.8	71.3	0.149	0.265	-0.154	-0.026	0.063
				82.5	0.724	907	0.554
Norway	81.0	112.8	-0.331	0.148	-0.598	0.019	0.100
				80.4	0.464	780	0.483
Germany	77.4	74.4	0.039	0.098	-0.195	0.047	0.089
				79.5	0.695	687	0.506
Ireland	69.6	96.4	-0.325	0.069	-0.454	-0.022	0.082
				79.0	0.536	896	0.519
Hong Kong	59.0	83.4	-0.345	0.239	-0.433	-0.151	-0.000
				82.4	0.548	1194	0.658
Singapore	56.7	117.1	-0.726	0.139	-0.685	-0.180	-0.000
				80.4	0.426	1251	0.658
South Korea	45.2	58.3	-0.254	0.078	-0.290	-0.118	0.076
				79.3	0.632	1125	0.531
Argentina	21.8	26.2	-0.181	-0.121	-0.108	0.048	-0.000
				75.1	0.759	684	0.658
Chile	19.7	30.9	-0.451	0.029	-0.254	-0.026	-0.199
				78.5	0.655	908	0.912
Thailand	10.9	18.1	-0.507	-0.158	-0.207	-0.043	-0.099
				73.5	0.687	951	0.794
South Africa	4.5	17.4	-1.351	-0.931	-0.053	0.061	-0.427
				51.0	0.801	636	1.135
Botswana	4.3	25.1	-1.767	-0.852	-0.574	-0.008	-0.333
				52.1	0.476	859	1.048
Vietnam	4.0	5.9	-0.378	-0.082	-0.269	-0.020	-0.006
				74.2	0.645	893	0.668
Zimbabwe	3.1	8.3	-0.972	-0.983	0.155	-0.050	-0.094
				45.8	0.986	969	0.789
Kenya	1.9	2.8	-0.388	-0.394	0.104	0.059	-0.157
				54.4	0.938	644	0.865

Note: The table shows the consumption-equivalent welfare calculation based on equation (7). The second line for each country shows life expectancy, the ratio of consumption to income, annual hours worked per capita, and the standard deviation of log consumption. Results for additional countries can be downloaded at http://www.stanford.edu/~chadj/BeyondGDP400.xls.

Table 8: Macro Welfare Growth Summary Statistics, 1980–2007

Country	Welfare λ	Per capita Income	Differ-ence	Decomposition: Life Exp.	C/Y	Leisure	Cons. Ineq.
Average, unweighted	2.39	1.75	0.64	0.98	-0.26	-0.08	0.00
Average, pop-weighted	3.35	3.05	0.30	0.95	-0.53	-0.09	-0.03
Median absolute dev.	...	...	0.92	1.05	0.59	0.08	0.00
Standard deviation	2.21	1.92	1.35	0.78	1.05	0.14	0.11
Regional Averages							
Coastal Asia	4.04	4.33	-0.29	0.82	-0.89	-0.13	-0.09
Western Europe	3.36	2.29	1.07	1.29	-0.22	0.02	-0.02
United States	3.11	2.06	1.05	0.93	0.35	-0.08	-0.15
Latin America	2.87	1.61	1.27	1.37	-0.23	-0.13	0.25
Sub-Saharan Africa	0.48	0.15	0.33	0.31	0.03	-0.03	0.02

Note: Average annual growth rates. The decomposition applies to the "Difference," that is, to the difference between the first two data columns. Sample size is 128 countries, and regional averages are population weighted.

welfare by more than 33 log points. The combined effect of these changes is to push welfare substantially below income: both countries have welfare below 5% of that in the U.S., placing them in the middle of the pack of poor economies.

6.3. Growth Rates

Table 8 reports summary statistics for welfare growth. These statistics enhance our understanding of Key Point 4 above regarding life expectancy and growth. Western Europe, the United States, and Latin America all exhibit welfare growth a full percentage point higher than income growth between 1980 and 2007. The key driving force behind this faster growth is rising life expectancy, which adds about 1.3 percentage points to growth in Europe and Latin America and around 0.8 percentage points in the United States and Coastal Asia. Tragically, Sub-Saharan Africa has experienced a much smaller boost (0.3 percentage points), as discussed further below.

Table 9 illustrates how welfare growth differs from income growth for select countries. Some of the major highlights:

Japan: Despite its "lost decade" after 1990, Japan moves sharply up in the growth rankings when considering welfare instead of income. Between 1980 and 2007, income

Table 9: Welfare Growth with Macro Data, 1980–2007

Country	Welfare λ	Per capita Income	Difference	LifeExp	C/Y	Leisure	C Ineq.
				Decomposition			
S. Korea	8.08	6.39	1.69	2.30	-0.36	-0.25	0.00
				65.8,79.3	.696,.632	970,1125	.531,.531
Turkey	5.98	2.36	3.62	3.08	0.30	0.24	0.00
				56.6,72.8	.747,.810	782, 543	.742,.742
Singapore	5.98	5.39	0.58	1.54	-0.61	-0.34	0.00
				71.7,80.4	.503,.426	1058,1251	.658,.658
China	4.81	5.87	-1.06	0.52	-1.35	-0.23	0.00
				67.0,72.6	.783,.544	848,1009	.863,.863
Ireland	4.10	4.68	-0.58	1.29	-1.96	-0.17	0.25
				72.5,79.0	.910,.536	763, 896	.655,.540
Japan	3.99	2.12	1.87	1.21	0.49	0.24	-0.07
				76.1,82.5	.635,.724	1063, 907	.542,.577
Indonesia	3.77	2.25	1.52	1.20	0.40	-0.14	0.06
				57.6,67.7	.700,.781	597, 737	.661,.635
Hong Kong	3.66	3.65	0.02	1.39	-1.11	-0.26	0.00
				74.7,82.4	.740,.548	1043,1194	.658,.658
U.K.	3.58	2.51	1.07	1.22	0.11	0.03	-0.29
				73.7,79.4	.833,.859	824, 799	.467,.613
Brazil	3.57	1.96	1.61	1.39	-0.25	-0.10	0.57
				62.5,72.1	.845,.789	825, 898	1.06,.904
India	3.34	3.58	-0.24	0.91	-0.86	-0.06	-0.23
				55.3,64.1	.889,.704	608, 670	.580,.677
Italy	3.33	1.93	1.41	1.47	-0.12	-0.07	0.14
				73.9,81.3	.750,.725	704, 767	.636,.574
France	3.31	1.57	1.74	1.41	0.06	0.11	0.15
				74.1,80.8	.762,.776	723, 613	.566,.490
U.S.	3.11	2.06	1.05	0.93	0.35	-0.08	-0.15
				73.7,77.8	.770,.845	771, 836	.624,.686
Botswana	2.94	6.27	-3.32	-1.10	-2.00	-0.22	0.00
				60.5,52.1	.817,.476	674, 859	1.05,1.05
Malaysia	2.65	2.50	0.15	0.92	-0.69	-0.08	0.00
				67.4,73.4	.681,.565	600, 684	.748,.748
Mexico	2.35	0.68	1.67	1.64	0.05	-0.23	0.20
				66.6,76.0	.801,.811	668, 859	.923,.861
Colombia	1.02	0.40	0.62	1.04	-0.37	-0.05	0.00
				65.5,72.8	.884,.800	709, 756	1.10,1.10
S. Africa	0.10	0.50	-0.40	-1.04	0.80	-0.16	0.00
				57.0,51.0	.645,.801	439, 636	1.14,1.14

Note: The second line for each country displays the raw data on life expectancy, the consumption share, annual hours worked per capita, and the stdev of log consumption for 1980 and 2007. See notes to Table 8.

growth in both the U.S. and Japan averaged just over 2.0% per year. But rising life expectancy, rising consumption relative to GDP, and rising leisure nearly double Japan's welfare growth to 4.0% per year, almost a full percentage point faster than U.S. welfare growth of 3.1% over this period.

AIDS in Africa: Young (2005) pointed out that AIDS was a tragedy in Africa, but that it might boost GDP per worker by raising capital per worker. Our welfare measure provides one way of adding these two components together to measure the net cost. As Young suspected, the net cost proves to be substantial. Botswana loses the equivalent of 1.1 percentage points of consumption growth from seeing its life expectancy fall from 60.5 to 52.1 years, similar to the loss in South Africa. Botswana's growth rate falls from one of the fastest in the world at 6.27% to the much more modest 2.94%. Already poor, sub-Saharan Africa falls further behind the richest countries from 1980 to 2007, and more so for welfare than for income.

The new "Singapores": An important contributor to growth in GDP per person in many rapidly-growing countries is factor accumulation: increases in investment rates and in hours worked. This point was emphasized by Young (1992) in his study of Hong Kong and Singapore. Yet this growth comes at the expense of current consumption and leisure, so growth in GDP provides an incomplete picture.

Table 9 shows that many of the world's fastest growing countries are like Singapore in this respect. In terms of welfare growth, China, Ireland, Hong Kong and Botswana all lose more than a full percentage point of annual growth to these channels, while South Korea and India lose more than a half percentage point. These countries remain among the fastest growing countries in the world, however, as these negative effects are countered by large gains in life expectancy.

7. Conclusion

For a given specification of preferences, we calculate consumption-equivalent welfare for various countries and years using data on consumption, leisure, consumption inequality, leisure inequality, and mortality by age. Our main finding is that cross-country inequality in welfare is even greater than inequality in incomes. More specifically, our findings can be summarized as follows:

First, the correlation between our welfare index and income per capita is very high.

This is because average consumption differs so much across countries and is strongly correlated with income. Second, living standards in Western Europe are much closer to those in the United States than it would appear from GDP per capita. Longer lives with more leisure time and more equal consumption in Western Europe largely offset their lower average consumption *vis a vis* the United States. Third, in most developing economies, welfare is markedly lower than income, due primarily to shorter lives but also to more inequality. Finally, economic growth in many countries of the world (the exception being Sub-Saharan Africa) is about 50% faster than previously appreciated, a boost almost entirely due to declining mortality.

Our calculations entail many strong assumptions. We therefore checked and confirmed robustness to alternative welfare measures and alternative utility functions over consumption and leisure. With the requisite data, one could relax more of our assumptions. Mortality by age surely differs within countries (e.g. by education). Preferences over consumption and leisure must differ within countries, perhaps mitigating the welfare cost of unequal outcomes. Where household data is available going back far enough, one could better estimate the present discounted value of welfare.[23]

One could carry out similar calculations across geographic regions within countries, or across subgroups of a country's population (e.g., by gender or race). Even more ambitious, but conceivable, would be to try to account for some of the many important factors we omitted entirely, such as morbidity, the quality of the natural environment, crime, political freedoms, and intergenerational altruism. We hope our simple measure proves to be a useful building block for work in this area.

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