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BEYOND GDP? WELFARE ACROSS COUNTRIES AND TIME

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ABSTRACT

We propose a simple summary statistic for a nation's flow of welfare, measured as a consumption equivalent, and compute its level and growth rate for a broad set of countries. This welfare metric combines data on consumption, leisure, inequality, and mortality. Although it is highly correlated with per capita GDP, deviations are often economically significant: Western Europe looks considerably closer to U.S. living standards, emerging Asia has not caught up as much, and many African and Latin American countries are farther behind due to lower levels of life expectancy and higher levels of inequality. In recent decades, rising life expectancy boosts annual growth in welfare by more than a full percentage point throughout much of the world. The notable exception is sub-Saharan Africa, where life expectancy actually declines.

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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 a pristine environment are just some of the major factors affecting living standards within a country that are incorporated imperfectly, if at all, in GDP. The detailed report by the Stiglitz Commission (see Stiglitz, Sen and Fitoussi, 2009) is the latest attempt to sort through the criticisms of GDP and seek practical recommendations for improvement. While there are significant conceptual and empirical hurdles to including a number of these factors in a welfare measure, standard economic analysis is arguably well-equipped to deal with at least some of them.

We propose a simple summary statistic for a nation's flow of welfare, measured as a consumption equivalent, and compute its level and growth rate for a broad 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), which calculated the welfare benefits of eliminating business cycles versus raising the growth rate.

An example is helpful. Suppose we wish to compare living standards in France and the United States. Standard measures of GDP per person are markedly lower in France: according to the Penn World Tables, France had a per capita GDP in 2000 of just 70 percent of the U.S. value. And consumption per person in France was even lower — only 66 percent of the U.S., even combining both private consumption and government consumption. However, other indicators looked better in France than in the United States in the year 2000. Life expectancy at birth was around 79 years in France versus 77 years in the United States. Leisure was higher in France — for example, Americans worked 1836 hours per year versus only 1591 hours for the French. Inequality was substantially lower in France: the Gini index for consumption was around 0.37 in the United States but only 0.25 in France.

Our welfare metric combines each of these factors with the level of consumption using an expected utility framework. This consumption-equivalent measure aims to answer questions such as: what proportion of consumption in the United States, given the U.S. values of leisure, life expectancy, and inequality, would deliver the same expected flow utility as the values in France? In our results, higher life expectancy, lower inequality, and higher leisure each add more than 10 percentage points to French welfare in terms of equivalent consumption. Rather than looking like 66 percent of the U.S. value, as it does based solely on consumption, France ends up with consumption-equivalent welfare equal to 97 percent of that in the United States. The gap in GDP per person is almost completely eliminated by incorporating life expectancy, leisure, and inequality.[1]

More generally, our main 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 0.95. Nevertheless, there are economically important differences between GDP per person and our consumption-equivalent welfare measure. Averaged across 134 countries, the typical deviation is around 46% — changes like what we see in France are quite common.

2. Average Western European living standards appear much closer to those in the United States (90% for welfare versus 71% for income) when we take into account Europe's longer life expectancy, additional leisure time, and lower levels of 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 by itself reduces welfare by more than 40% in most developing regions.

4. Growth rates are typically revised upward, with welfare growth averaging 2.54% between 1980 and 2000 versus income growth of 1.80%. A large boost from rising life expectancy of more than a full percentage point shows up throughout the world, with the notable exception of sub-Saharan Africa.

[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. The higher leisure in France partially compensates for their lower consumption.

5. There are large revisions to growth rates in both directions across countries: the standard deviation of the changes is 1.4 percentage points.

Underlying these coarse facts, the details for individual countries are often interesting. Here are three examples. First, consider growth in the United States. Falling leisure and rising inequality each reduce annual growth between 1980 and 2000 by about 0.2 percentage points, so a growth rate of 2.0 percent becomes 1.6 percent before a percentage point is added for rising life expectancy. Second, the horrific toll of AIDS, which is difficult to uncover in GDP per capita, stands out prominently in our welfare calculations. Welfare in South Africa and Botswana, for example, is reduced by more than 75 percent because of low life expectancy.

Finally, paralleling Alwyn Young's "Tale of Two Cities" for the growth rates in Hong Kong and Singapore is an equally striking fact about levels. Per capita GDP in Hong Kong and Singapore in 2000 was about 82 percent of that in the United States. The welfare numbers are dramatically different, however, with Hong Kong at 90 percent but Singapore falling to just 44 percent. The bulk of this difference is explained by Singapore's exceptionally high investment rate, which reduces its level of consumption for a given level of income.

This last example, together with our U.S.-France comparison, emphasizes an important point. High hours worked per capita and a high investment rate are well-known to deliver high GDP, 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 accurate picture of living standards.

This paper builds on a large collection of related work. Nordhaus and Tobin (1972) introduced a "Measure of Economic Welfare" (MEW) that combines consumption and leisure, values household work, and deducts urban disamenities for the United States over time. We try to 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 World Bank's Human Development Index combines income, life expectancy, and literacy into a single number, 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. Fleurbaey (2009) contains a more comprehensive review of attempts at constructing measures of social welfare.

One of the papers most closely related to ours is Becker, Philipson and Soares (2005). They 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. Even more closely related is Fleurbaey and Gaulier (2009), which constructs a full-income measure for 24 OECD countries, incorporating life expectancy, leisure, inequality, and unemployment. Our paper differs in many details, both methodological and empirical. For example, we focus on consumption instead of income, report results for 134 countries at all stages of development, and consider growth rates as well as levels. Overall, we present what we think is a more straightfoward, intuitive approach. 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 separately consider adjusting household income for inequality according to various social welfare functions and then, separately once again, consider differences in other 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 important limitations to the welfare metric we use, and a few deserve special mention at the outset. First, our flow measure is not the same as the present discounted value of utility. Second, we evaluate the allocations both within and across countries according to one set of preferences, though we do consider different functional forms and parameter values in our robustness checks. Third, we do not try to measure morbidity across individuals or countries. We use life expectancy as a very imperfect measure of health. Fourth, we make no account for direct utility benefits from the quality of the natural environment, public safety, political freedoms, and so on.

The rest of the paper is organized as follows. Section 2 lays out the simple theory underlying the calculations. Section 3 describes the "macro" data that we use in our initial calculations, and Section 4 discusses the main results. Section 5 explores the robustness of our basic calculations along a range of dimensions, including the shape of the utility function. Section 6 presents the results for more careful calculations that directly use micro data from household surveys. These calculations have numerous advantages over our macro statistics: leisure varies across people within countries, consumption inequality is not restricted to be log normal, and so on. However, because the data requirements are significantly more demanding, we are only able to carry out these more detailed calculations for a handful of countries. Section 7 provides a longer list of caveats that must accompany our calculations. Finally, Section 8 concludes.

2. Theory behind the Macro Calculation

Even though different countries invariably have different relative prices, 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, let's create a fictitious person possessing these preferences and call him "Rawls."

Behind the veil of ignorance, Rawls is confronted with a lottery. He will live for a year in a particular country, but he doesn't know whether he will be rich or poor, hardworking or living a life of leisure, or even whether or not some deadly disease will kill him before he gets a chance to enjoy his year. An example welfare calculation is this: what proportion of Rawls' consumption as a random person in the United States would make him indifferent to living that year in, say, China or France instead? 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 key individual "Rawls" we are referencing the veil of ignorance insight of Rawls (1971). 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 that gives equal weight to each person.

2.1. Setup: The Benchmark Case

Consumption and leisure/home production: Let C denote an individual's annual consumption and ℓ denote leisure or time spent in home production during the year. We assume that flow utility for Rawls is

$$u(C,\ell) = \bar{u} + \log C + v(\ell), \tag{1}$$

where $v(\ell)$ captures the utility from leisure or home production. In Section 5, we will consider preferences with more curvature over consumption and relax the additive separability with leisure, but this simpler specification turns out to be conservative and yields clean, easily-interpreted closed-form solutions.

Life expectancy: To evaluate the welfare consequences of mortality, put Rawls behind the veil of ignorance, and consider the case of Kenya. Behind the veil, Rawls could be assigned any age for his year in Kenya with equal probability. Rawls is then confronted with the cumulative mortality rate associated with that age in determining whether he dies or lives to consume for the year.

Let $S(a)$ denote the probability an individual survives to age a if faced with the cross-section of mortality rates in a country for a given year, and suppose the maximum age is 100. Integrating over the uniform age distribution since Rawls is assigned any age with equal probability and considering survival, the overall probability that Rawls is alive and gets to consume during his year is

$$p = \int_0^{100} S(a)da/100 = e/100, \tag{2}$$

where e is the standard measure of life expectancy at birth.[2] If consumption does not vary by age, as we will assume in our macro calculations, differences in age-specific mortality rates across countries end up being summarized by the standard life expectancy statistic. With probability $p = e/100$, Rawls lives out his year, receiving consumption and leisure. With probability $1 - p = 1 - e/100$, Rawls dies before getting to consume and is assigned a level of utility that is normalized to be zero (this is a free normalization of no consequence).

Therefore, with guaranteed consumption C and leisure ℓ, expected utility for Rawls is

$$p \cdot u(C, \ell) + (1 - p) \cdot 0 = e \cdot u(C, \ell)/100. \tag{3}$$

The "100" upper bound on life expectancy is an irrelevant constant, so from now on we will drop it.

Inequality: Rather than being a guaranteed constant, now suppose consumption in a country is log-normally distributed with arithmetic mean c and a standard deviation of log consumption given by σ. Furthermore, assume consumption and mortality are uncorrelated. As usual, $E[\log C] = \log c - \sigma^2/2$.[3] Behind the veil of ignorance, inequality reduces utility through the standard channel of diminishing marginal utility. A more sharply curved utility function would penalize inequality even more; we will explore this in our robustness checks below.

For the macro calculations, we do not have data on inequality in leisure within a

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[2]This last expression comes from a standard result in demography, obtained by integrating by parts: if $f(a)$ is the density of deaths by age, life expectancy $\int_0^{100} af(a)da$ is equal to the integral of the survival probabilities.

[3]Heathcote, Storesletten and Violante (2008) perform an analogous calculation for the impact of changes in labor market risk on welfare through both consumption and leisure volatility. See Battistin, Blundell and Lewbel (2009) for evidence that consumption is well approximated by a log-normal distribution in the U.K. and U.S.

country, so we suppress this channel for now. In our calculations using micro data later in the paper, this additional effect will be made explicit.

Rawlsian Utility: Given this setup, we can now specify overall expected utility. Behind the veil of ignorance — facing the survival schedule $S(a)$ and the log-normal distribution for consumption — expected utility for Rawls is

$$V(e, c, \ell, \sigma) = e\,(\bar{u} + \log c + v(\ell) - \frac{1}{2}\sigma^2). \tag{4}$$

2.2. The Welfare Calculation across Countries

Suppose Rawls could live as a random person in the United States or as a random person in some other country, indexed by i. By what factor, λ_i, must we adjust Rawls' consumption in the United States to make him indifferent between living in the two countries? With our setup above, the answer to this question satisfies

$$V(e_{us}, \lambda_i c_{us}, \ell_{us}, \sigma_{us}) = V(e_i, c_i, \ell_i, \sigma_i). \tag{5}$$

Given our benchmark functional form for utility (in particular additive separability of log consumption), the solution can be written explicitly as

$$\begin{aligned} \log \lambda_i \;=\; & \tfrac{e_i - e_{us}}{e_{us}}(\bar{u} + \log c_i + v(\ell_i) - \tfrac{1}{2}\sigma_i^2) && \text{Life Expectancy} \\ & + \log c_i - \log c_{us} && \text{Consumption} \\ & + v(\ell_i) - v(\ell_{us}) && \text{Leisure} \\ & - \tfrac{1}{2}(\sigma_i^2 - \sigma_{us}^2) && \text{Inequality} \end{aligned} \tag{6}$$

This expression provides a nice additive decomposition of the forces that determine welfare in country i relative to that in 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 are straightforward and denote the contributions of differences in consumption, leisure, and inequality.

It is also useful to decompose the *ratio* of our welfare measure to per capita GDP.

Let $\tilde{y}_i \equiv y_i/y_{us}$ denote per capita GDP relative to the United States. Subtracting the log of $\tilde{y}_i$ from both sides of the preceding equation yields the following decomposition:

$$\begin{aligned} \log \frac{\lambda_i}{\tilde{y}_i} \; = \; & \frac{e_i - e_{us}}{e_{us}}(\bar{u} + \log c_i + v(\ell_i) - \tfrac{1}{2}\sigma_i^2) && \text{Life Expectancy} \\ & + \log c_i/y_i - \log c_{us}/y_{us} && \text{Consumption Share} \\ & + v(\ell_i) - v(\ell_{us}) && \text{Leisure} \\ & -\tfrac{1}{2}(\sigma_i^2 - \sigma_{us}^2) && \text{Inequality} \end{aligned} \tag{7}$$

That is, 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.

2.3. Equivalent Variation versus Compensating Variation

The consumption-equivalent welfare measure we have described above is an equivalent variation: by what proportion must we adjust Rawls' consumption in the United States so that his welfare is equivalent to welfare in the other countries. Alternatively, we could consider a compensating variation measure: by what factor must we increase Rawls' consumption in country i to raise welfare there to the U.S. level? Inverting this number gives our compensating variation measure of welfare, λ_i^{cv}, which satisfies $V(e_{us}, c_{us}, \ell_{us}, \sigma_{us}) = V(e_i, c_i/\lambda_i^{cv}, \ell_i, \sigma_i)$.

Following the same logic as before, this welfare measure can be decomposed as

$$\begin{aligned} \log \lambda_i^{cv} \; = \; & \frac{e_i - e_{us}}{e_i}(\bar{u} + \log c_{us} + v(\ell_{us}) - \tfrac{1}{2}\sigma_{us}^2) && \text{Life Expectancy} \\ & + \log c_i - \log c_{us} && \text{Consumption} \\ & + v(\ell_i) - v(\ell_{us}) && \text{Leisure} \\ & -\tfrac{1}{2}(\sigma_i^2 - \sigma_{us}^2) && \text{Inequality} \end{aligned} \tag{8}$$

Comparing this decomposition to the decomposition for the equivalent variation in equation (6), one sees that they differ only in the first term. In particular, the equivalent variation essentially weights differences in life expectancy by a country's own flow utility, while the compensating variation weights differences in life expectancy by U.S. flow utility.[4]

This distinction turns out to make a large quantitative difference 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 negligible 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 in very poor countries much, 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.

Another way to frame the distinction is as follows. Equivalent variation scales down Rawls' consumption in the U.S. to match the near-zero flow utility in the poorest countries, so little further scaling down is needed for their low life expectancy. With compensating variation, in contrast, consumption is scaled up in the poorest countries in order to match flow utility in the U.S. — and further scaling up is needed to compensate for their low life expectancy at such high flow utility.

For our benchmark measure, we follow standard practice and report the geometric average of the equivalent variation and the compensating variation. In the robustness section, we will consider all three measures.

2.4. The Welfare Calculation over Time

Suppose the country i that we are comparing to is not China or France but rather the United States itself in an earlier year. In this case, one can divide by the number

[4] The other difference is that the equivalent variation scales the life expectancy term by e_{us}, while the compensating variation scales by e_i. This reflects the fact that the equivalent variation changes consumption in the United States, so it applies to all e_{us} periods, while the compensating variation scales consumption in country i, where it applies for e_i periods.

of periods, e.g. $T = 2000 - 1980 = 20$, and obtain a growth rate of the consumption equivalent. And of course we can do this for any country, not just the United States:

$$g_i \equiv -\frac{1}{T} \log \lambda_i. \tag{9}$$

This growth rate can similarly be decomposed into terms reflecting changes in life expectancy, consumption, leisure, and inequality, as in equation (6).[5]

3. Data and Calibration for the Macro Calculation

3.1. Data Sources

We require data on income, consumption, leisure, life expectancy, and inequality. The sources for this data are discussed briefly here.

Income and consumption: Our source for this data is the Penn World Tables, Version 6.3. In comparing consumption across countries, an important issue that arises is the role of government consumption. For example, in many European countries, the government purchases much of education and healthcare, whereas these are to a greater extent labeled as private consumption in the United States. One could make a case for subtracting these expenditures out of the U.S. data (as they are forms of investment, at least to some extent). The macro data from the Penn World Tables, however, does not allow this split to be done. As an alternative, we add private and government consumption together for all countries in constructing our benchmark measure of consumption. To see the difference this makes, consider the comparison of the United States and France. Per capita GDP in France is 70.1% of that in the United States. Private consumption in France is 57.5% of the U.S. value, while private plus public consumption is 66.3%.

[5] The issue of equivalent vs. compensating variations arises again in the growth rate. Treating the year 2000 as the benchmark — equivalent variation — means that the percentage change in life expectancy gets weighted by the flow utility in the initial year, 1980. Treating the year 1980 as the benchmark — compensating variation — weights the percentage change in life expectancy by flow utility in 2000. We average the equivalent variation and the compensating variation for growth rates, just as we do for levels.

Leisure/home production: We measure time spent in leisure or home production as the difference between a time endowment and time spent in employment. Our measure of time engaged in market work aims to capture both the extensive and intensive margins. For the extensive margin, the Penn World Tables, Version 6.3 provides a measure of employment, apparently taken from the Groningen Growth and Development Center. We divide this employment measure by the total adult population (using an adult/population ratio obtained from the World Bank). Our measure of the intensive margin is annual hours worked per worker. For OECD countries, this measure comes directly from SourceOECD. For non-OECD countries, we impute annual hours per worker using a measure of average weekly hours in manufacturing from the International Labour Office. The (post-imputation) data underlying our leisure measure are shown in Figure 1.[6]

Assuming a time endowment of $16 \times 365 = 5840$ hours per year (sleep is counted as neither work nor leisure), our measure of ℓ is

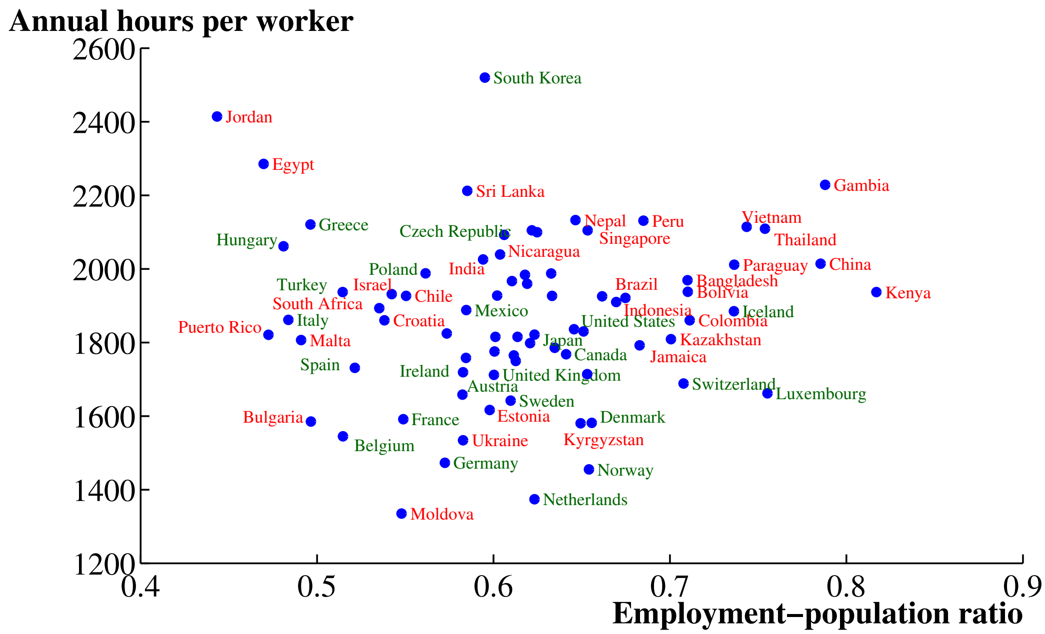
$$\ell = 1 - \frac{\text{annual hours worked per worker}}{16 \times 365} \cdot \frac{\text{employment}}{\text{adult population}}.^{7}$$

In the United States, the ratio of employment to adult population is 0.65 and average annual hours worked is 1,836. These values imply that the fraction of time devoted to leisure and home production is just under 80%. Germany has one of the highest values of ℓ in our data. Its employment-population ratio is 0.57 and average annual hours worked is only 1,473, so that the leisure fraction of the time endowment is 86%. To see why these basic numbers are so high, notice that workers, who are only about half the population, usually devote more than 2/3 of their time endowment to leisure, so leisure and home production are pretty high everywhere and vary by less than one might have thought.

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

[7] Dividing by the adult population imposes the assumption that adults and children have the same amount of leisure on average (e.g. because of schooling or child labor). An alternative of treating children's time as entirely leisure does not change our key points.

Figure 1: Intensive and Extensive Margins of Work



Note: Annual hours worked for countries with dark green names are taken from the OECD, while hours for countries with red names are imputed based on average weekly hours in manufacturing from the ILO.

Life expectancy: These data are taken directly from the World Bank's HNPStats database, http://go.worldbank.org/N2N84RDV00, series code SP.DYN.LE00.IN.

Inequality: The source for our inequality data is the UNU-WIDER World Income Inequality Database, Version 2.0c, dated May 2008. The WIID database reports income and consumption Gini coefficients from a variety of micro data sets for many countries and many years. We use consumption measures when they are available and infer consumption measures from income measures when only the latter are available. For the cross-sectional analysis, we average across available observations that meet a certain quality threshhold for the period 1990 to 2006. For the time-series analysis, we use data from 1974–1986 to construct a 1980 estimate and from 1994–2006 to construct a 2000 estimate.

According to Aitchison and Brown (1957, p. 112), when consumption is log-normally distributed the Gini coefficient G and the standard deviation of log consumption σ^2 are related by the following formula:[8]

$$G = 2\Phi\left(\frac{\sigma}{\sqrt{2}}\right) - 1 \tag{10}$$

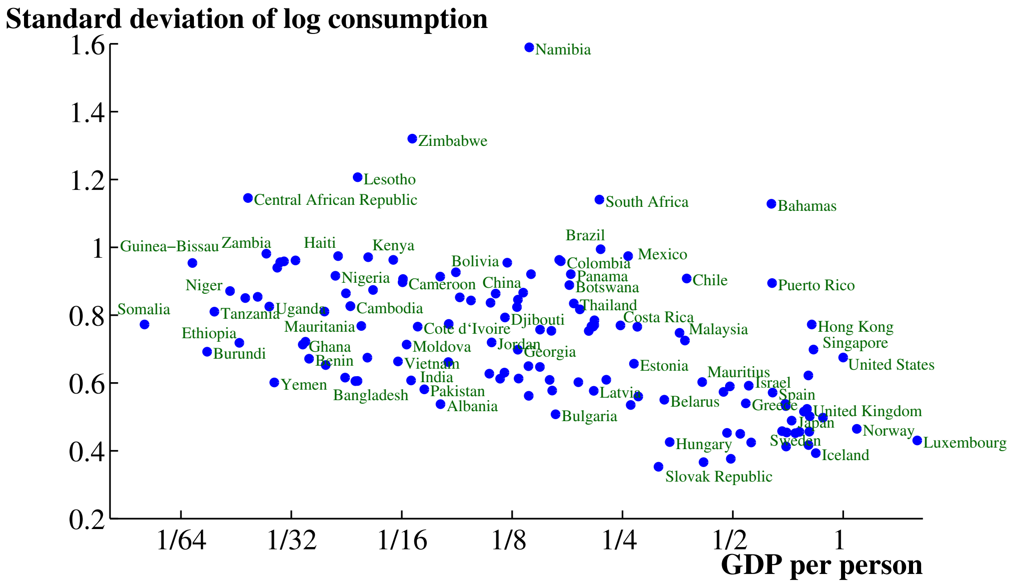
where $\Phi(\cdot)$ is the cdf of the standard normal distribution. We invert this formula and use it to compute the standard deviation given the Gini coefficients from the WIID database. The results are shown in Figure 2.

3.2. Calibration

To implement our calculation, we need to specify the utility function. Section 5 explores a range of robustness checks to our benchmark case, described here. Drawing from conventional specifications in the macroeconomics 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 $1-\ell$, this gives $v(\ell) = -\frac{\theta\epsilon}{1+\epsilon}(1-\ell)^{\frac{1+\epsilon}{\epsilon}}$, where ϵ denotes the Frisch elasticity itself.

[8]Somewhat confusingly, Aitchison and Brown use the letter L to denote the standard Gini coefficient relevant here and G to denote (the irrelevant) Gini's coefficient of mean difference.

Figure 2: Within-Country Inequality



Note: The standard deviation of log consumption within each economy is inferred from Gini coefficients taken from the World Income Inequality Database, Version 2.0c.

This leaves three parameters that we need to calibrate: the intercept in flow utility $\bar{u}$, the utility weight on leisure or home production θ, and the Frisch elasticity ϵ.

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 (2009) reconciles micro and macro estimates of the Frisch elasticity and recommends a value of 0.5 or 0.6. We take a Frisch elasticity of 1.0 in our benchmark calibration. As we discuss in the robustness section, the results are not sensitive to this choice.

To get the utility weight on leisure or home production, θ, recall that the first-order condition for the labor-leisure decision in many environments is $u_\ell/u_c = w(1-\tau)$, where w is the wage and τ is the marginal tax rate on labor income. For our benchmark calibration, we assume this first-order condition holds in the United States. Given our functional form assumptions, this leads to $\theta = w(1-\tau)(1-\ell)^{-1/\epsilon}/c$. Equating consumption to labor income as a rough empirical regularity in the U.S., where consumption and labor income both hover around 70% of GDP, this first-order condition implies $\theta = (1-\tau)(1-\ell)^{-\frac{1+\epsilon}{\epsilon}}$. We take the (average) marginal tax rate in the United States from Barro and Redlick (2009), who report a value of 0.387 for 1998–2002, consistent with the 40 percent rate used by Prescott (2004). Since $\ell_{us} = .7970$ in our data, our benchmark case sets $\theta = 14.883$.

Calibration of the intercept in flow utility, $\bar{u}$, is less familiar. The value of this parameter matters because of the role played by life expectancy: additional life means more periods of flow utility, so the level of flow utility is key to valuing differences in life expectancy. We choose $\bar{u}$ so that a 40-year old in the United States in 2000 has a value of remaining life equal to $4 million in 2000 prices. 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. At the other end of the spectrum, Ashenfelter and Greenstone (2004) support much lower values, less than $2 million. Our baseline value of $4 million is broadly consistent with this literature. This choice leads to $\bar{u} = 5.5441$ when consumption in the United States is normalized to 1 in the year 2000 and leisure is set equal to its observed value of 0.7970.[9]

4. Standards of Living: the Macro Calculation

We now carry out consumption-equivalent welfare calculations across countries and over time using the macro data. The calculation across countries is the quantitative implementation of equation (7). The calculation over time will be for the growth rate version of this expression, equation (9). More exactly, we average these equivalent variations with the compensating variation analogues. We present our results in the form of several "key points".

4.1. Across Countries

[9] For this exercise, we use the mortality data by age for the 2000–2005 period from the Human Mortality Database, http://www.mortality.org/cgi-bin/hmd/country.php?cntr=USA&level=1. We assume consumption grows at a constant annual rate of 2% as the individual ages.

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 0.95. Nevertheless, for any given country, the difference between the two measures can be important. Averaged across 134 countries, the typical deviation is about 46%.

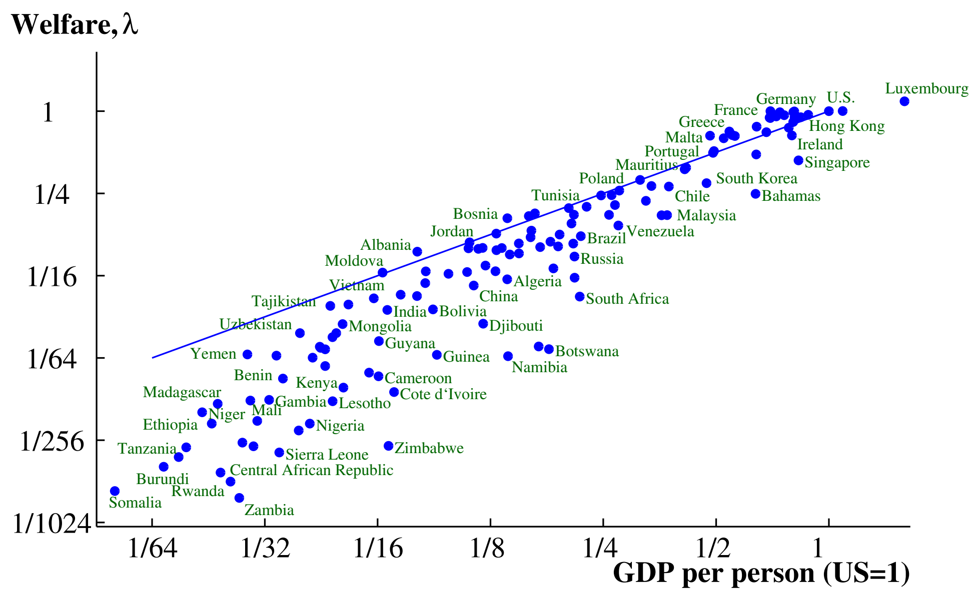
Figure 3 provides a useful overview of our findings for welfare across countries and illustrates our first point. The top panel plots the welfare measure, λ, against GDP per person for the year 2000. What emerges prominently from this figure is that the two measures are extremely highly correlated, with a correlation coefficient (for the logs) of 0.95. 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 1.81 in logs) than is income (standard deviation of 1.18 in logs).

The bottom panel provides a more revealing look at the deviations. This figure plots the ratio of welfare to per capita GDP across countries, and here we see substantial deviations from unity. Countries like France and Sweden have welfare measures that are over 30% higher than their income. At the other end of the spectrum, China and Singapore have welfares that are about half their incomes, while Botswana and Zimbabwe have ratios of 10 percent or less. The median absolute deviation from unity is 0.458 in logs.

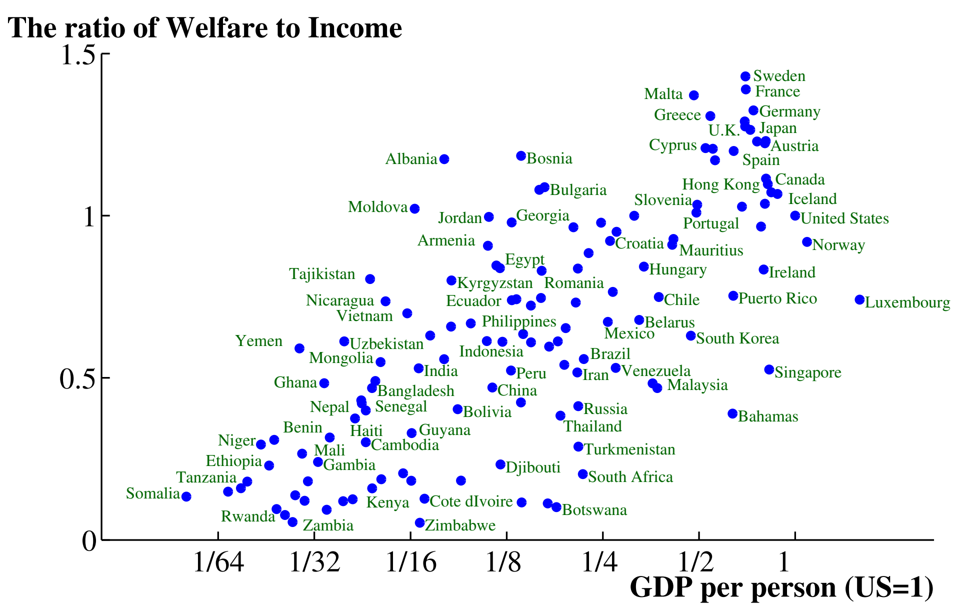
Key Point 2: Average Western European living standards appear much closer to those in the United States when we take into account Europe's longer life expectancy, additional leisure time, and lower levels of inequality.

Table 1 presents summary statistics for our welfare decomposition. Of particular interest at the moment are the regional averages. Per capita GDP in Western Europe is 71% of that in the United States. Welfare, in contrast, is 90% of the U.S. value, higher on average by about 24 log points (which we will often call "percent" or "percentage points" in the remainder of this paper). The last four columns of the

Figure 3: Welfare and Income across Countries, 2000



(a) Welfare and income are highly correlated at 0.95...



(b) ...but this masks substantial variation in the ratio of λ to GDP per capita. The median absolute deviation from unity is about 46%.

Table 1: Welfare and Income Summary Statistics, 2000

Country	Welfare λ	Per capita Income	Log Ratio	Decomposition: Life Exp.	C/Y	Leisure	Inequality
Average, unweighted	24.8	27.3	-0.659	-0.646	0.071	-0.026	-0.058
Average, pop-weighted	19.7	22.2	-0.611	-0.530	0.034	-0.065	-0.050
Median absolute dev.	...	...	0.458	0.390	0.175	0.076	0.101
Standard deviation	32.6	29.4	0.790	0.720	0.219	0.124	0.170
Regional Averages							
United States	100.0	100.0	0.000	0.000	0.000	0.000	0.000
Western Europe	90.1	71.0	0.235	0.086	-0.073	0.119	0.103
Eastern Europe	14.8	21.7	-0.473	-0.499	-0.020	0.041	0.006
Latin America	13.1	21.4	-0.518	-0.322	0.054	-0.031	-0.219
N. Africa, Middle East	11.1	15.9	-0.439	-0.464	-0.053	0.084	-0.006
Coastal Asia	9.3	13.2	-0.631	-0.467	0.010	-0.127	-0.047
Sub-Saharan Africa	1.1	5.3	-1.781	-1.707	0.217	-0.114	-0.177

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) and its compensating variation analogue. 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 134 countries, and regional averages are population weighted.

table show how this 24 percent difference breaks down. Higher life expectancy in Western Europe is worth about 9 percentage points. The lower consumption share *reduces* welfare by 7 percentage points. Higher leisure in Western Europe is worth 12 percentage points. Finally, lower inequality adds 10 percentage points.

Detail for a selection of countries is reported in Table 2; results for all countries and additional background data can be downloaded here. The evidence for France, Germany, Italy, and the United Kingdom all support this point. The welfare comparison largely eliminates the gap in per capita GDP for France and Germany and narrows it considerably in Italy and the U.K. This point applies more generally across Western Europe: for example, Austria, Netherlands, Germany, Sweden, Norway, and

Luxembourg all end up with even higher welfare than France.

Differences between welfare and income are also quite stark for East Asia, as shown in the middle rows of Table 2. According to GDP per person, Singapore and Hong Kong are close to U.S. income, at about 82%. The welfare measure substantially alters this picture. Hong Kong registers at 90% of U.S. welfare, while Singapore falls to 44%. A similar decline occurs in South Korea, from 47% in income to 30% in welfare. Both countries, and Japan as well, see their welfare limited sharply by their well-known low consumption shares. This force is largest for Singapore, where the consumption share of GDP is substantially below 0.5. This is the levels-analog of Alwyn Young's (1992) growth accounting point, of course. 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-income ratio. Similarly, leisure is low in Singapore and South Korea, also reducing welfare for a given level of income. Working hard and investing for the future are well-established means for raising GDP. Nevertheless, these approaches have costs that are not reflected in GDP itself.

Key Point 3: Many developing countries — including much of sub-Saharan Africa, Latin America, southern Asia, and China — are poorer than incomes suggest because of a combination of shorter lives and extreme inequality.

This point can be seen clearly in the regional averages for sub-Saharan Africa and Latin America at the bottom of Table 1. Countries in sub-Saharan Africa have welfare that is only about 1% of the U.S. level, much lower than their 5% relative income, largely because of very low life expectancy. In Latin America, lower life expectancy and higher inequality combine to hold their welfare down to 13% of the U.S. level on average, vs. 21% of U.S. income.

The details for a number of countries are reported in the lower half of Table 2, where the same story appears repeatedly. A life expectancy of only 65 years cuts Russia's welfare by nearly 70 percent. Massive inequality in Brazil (a standard deviation of log consumption of 0.99) lowers welfare by 27 percent. China is at 11% of U.S. per capita income in 2000, but only about 5% of U.S. welfare. China suffers

Table 2: Welfare and Income across Countries, 2000

Country	Welfare λ	Per capita Income	Log Ratio	*Decomposition* LifeExp	C/Y	Leisure	Inequality
United States	100.0	100.0	0.000	0.000	0.000	0.000	0.000
				77.0	0.762	0.797	0.675
Germany	98.0	74.0	0.281	0.057	-0.053	0.151	0.126
				77.9	0.722	0.856	0.452
France	97.4	70.1	0.329	0.119	-0.055	0.140	0.125
				78.9	0.721	0.850	0.454
Japan	91.5	72.4	0.235	0.247	-0.146	0.025	0.108
				81.1	0.658	0.806	0.489
Hong Kong	90.0	82.1	0.093	0.236	-0.064	-0.008	-0.071
				80.9	0.714	0.794	0.772
Italy	89.7	69.5	0.255	0.155	-0.113	0.130	0.083
				79.5	0.681	0.846	0.538
United Kingdom	89.0	69.8	0.243	0.045	0.036	0.076	0.086
				77.7	0.789	0.824	0.532
Singapore	43.6	82.9	-0.643	0.060	-0.581	-0.106	-0.016
				78.1	0.426	0.765	0.698
South Korea	29.7	47.1	-0.463	-0.068	-0.273	-0.184	0.063
				75.9	0.580	0.743	0.574
Mexico	17.4	25.9	-0.397	-0.173	-0.018	0.041	-0.247
				74.0	0.748	0.811	0.974
Brazil	12.2	21.8	-0.584	-0.380	0.123	-0.060	-0.266
				70.4	0.861	0.778	0.994
Russia	8.6	20.9	-0.886	-0.695	-0.126	0.005	-0.069
				65.3	0.672	0.799	0.771
Thailand	7.1	18.4	-0.959	-0.483	-0.111	-0.245	-0.120
				68.3	0.682	0.728	0.834
Indonesia	6.6	10.8	-0.489	-0.527	0.057	-0.050	0.031
				67.5	0.806	0.781	0.627
China	5.3	11.3	-0.755	-0.283	-0.088	-0.239	-0.145
				71.4	0.698	0.729	0.863
South Africa	4.4	21.6	-1.594	-1.376	0.122	0.083	-0.423
				56.1	0.861	0.826	1.140
India	3.5	6.6	-0.636	-0.818	0.148	-0.009	0.043
				62.5	0.883	0.794	0.607
Botswana	1.8	17.9	-2.292	-1.982	-0.171	0.028	-0.167
				48.9	0.642	0.807	0.889
Malawi	0.4	2.9	-2.113	-1.952	0.254	-0.186	-0.229
				46.0	0.982	0.743	0.956

Note: The second line for each country displays the raw data on life expectancy, the consumption share, leisure per adult, and the standard deviation of log consumption. See notes to Table 1. Results for additional countries can be downloaded here.

along every dimension: low life expectancy, low leisure, high inequality, and low consumption. Because of low life expectancy in India (62.5 years), Indian welfare is only 3.5% of U.S. welfare, whereas India's income ratio is 6.6%.

Finally, consider South Africa and Botswana. According to GDP per capita, these are relatively rich developing countries with about 20% of U.S. income. AIDS, however, has dramatically reduced life expectancy to around 50–55 years, which cuts welfare by more than 75% in these countries. Inequality in South Africa is among the highest in the world, with a standard deviation of log consumption of 1.1, which further reduces welfare by 42 log points. The net effect of these changes is to push welfare substantially below income: both countries have welfare measures below 5%, placing them close to China and India in welfare.

4.2. Over Time

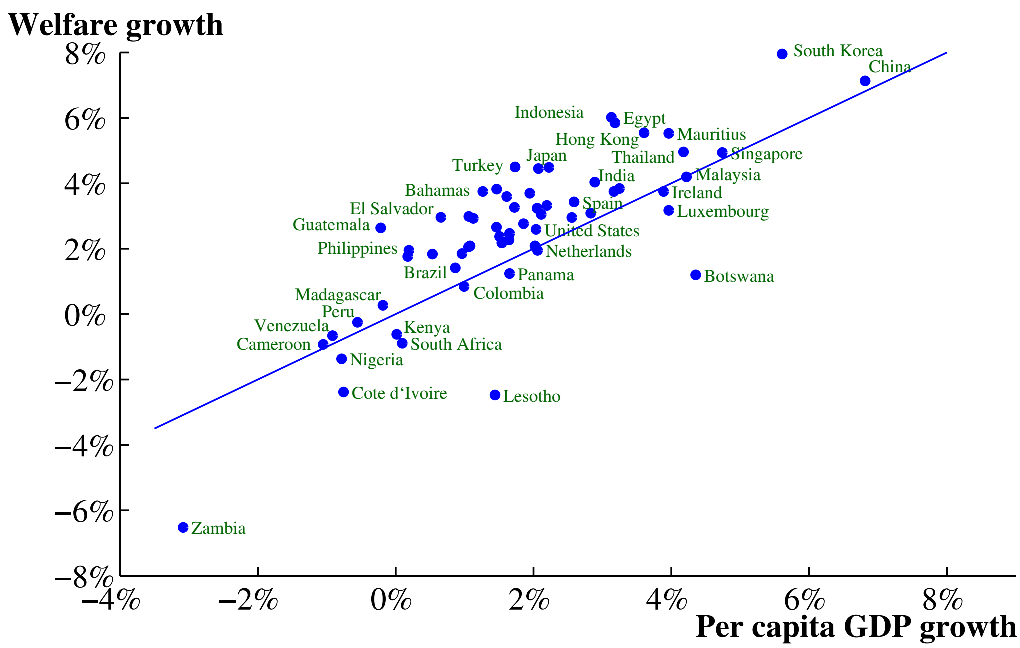
We turn now to constructions of welfare growth over time. That is, rather than comparing Rawls' expected utility from living in the United States versus another country in the same year, we consider how Rawls might value living in the same country in 1980 versus in 2000. The decomposition in equation (6) remains valid, only we now express it in growth rate terms as in equation (9). We begin with a point that summarizes the differences between welfare growth and growth in per capita GDP:

Key Point 4: Welfare growth averages 2.54% between 1980 and 2000, versus income growth of 1.80%. A large boost from growth in life expectancy, of over one percentage point per year, is partially offset by declining consumption shares and rising inequality.

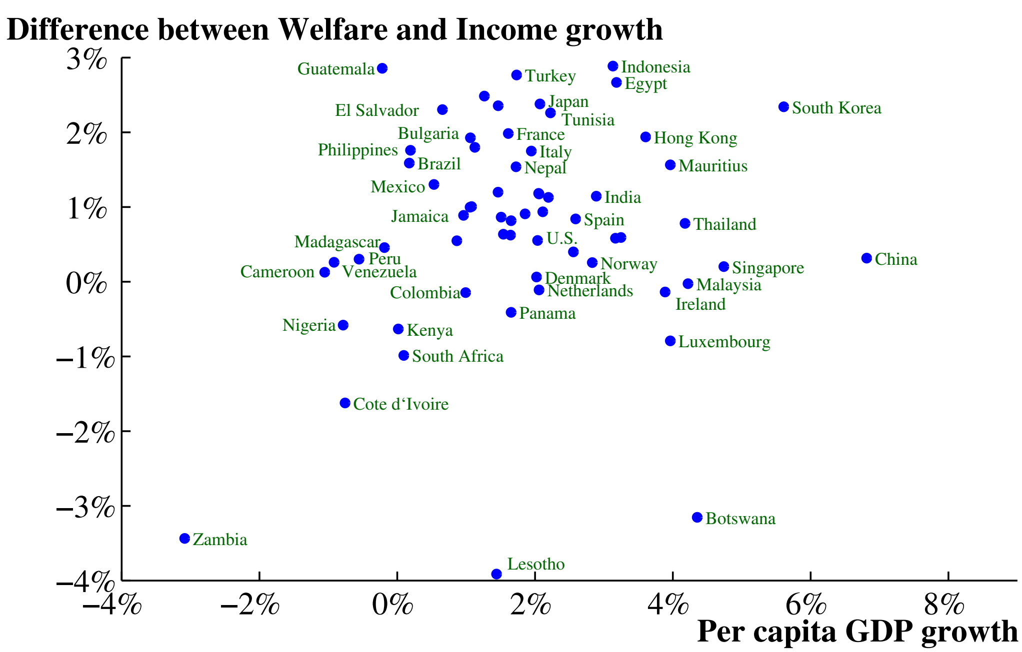
This point can be seen graphically in Figure 4. Welfare growth and income growth are strongly correlated at 0.82. Table 3 displays summary statistics and regional averages for welfare growth vs. income growth.

Key Point 5: The mean absolute deviation between welfare growth and income growth is 0.99 percentage points.

Figure 4: Welfare and Income Growth, 1980–2000



(a) The correlation between welfare growth and income growth is 0.82.



(b) The median absolute value of the difference between welfare and income growth is 0.99 percentage points.

Table 3: Welfare and Income Growth, 1980–2000

Country	Welfare λ	Per capita Income	Differ-ence	*Decomposition* Life Exp.	C/Y	Leisure	Inequa-lity
Average, unweighted	2.54	1.80	0.75	1.14	-0.27	0.03	-0.15
Average, pop-weighted	4.30	3.31	0.99	1.26	-0.06	0.07	-0.27
Median absolute dev.	...	...	1.26	1.41	0.49	0.28	0.29
Standard deviation	2.39	1.72	1.40	1.10	0.60	0.37	0.37
Regional Averages							
Coastal Asia	5.63	4.64	0.99	1.19	0.05	0.12	-0.36
Western Europe	3.27	2.00	1.27	1.29	-0.16	0.10	0.03
United States	2.59	2.04	0.55	1.09	-0.11	-0.18	-0.25
Latin America	1.57	0.41	1.15	1.78	0.05	-0.41	-0.26
Sub-Saharan Africa	-1.30	-0.54	-0.77	-0.15	-0.48	0.13	-0.27

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 62 countries, and regional averages are population weighted.

As the bottom panel of Figure 4 shows, there are interesting differences between welfare and income growth. The median absolute value of the difference between annual welfare and income growth from 1980 to 2000 is nearly a full percentage point.

Table 4 shows the welfare growth decomposition for select countries. Some of the major highlights are listed below:

U.S. growth: U.S. income growth averages 2.04% per year. Welfare growth is reduced by nearly half a percentage point a year because of declining leisure, rising inequality, and a falling consumption share. But rising life expectancy boosts growth by over one percentage point a year, so that on net welfare growth averaged 2.59%, 0.55% per year faster than income growth.

Japan: Despite its "lost decade" after 1990, Japan moves sharply up in the growth rankings when considering welfare instead of income. Between 1980 and 2000, income growth in both the United States and Japan averaged just over 2.0% per year.

Table 4: Welfare and Income Growth, 1980–2000

Country	Welfare λ	Per capita Income	Difference	*Decomposition* LifeExp	C/Y	Leisure	Ineq.
South Korea	7.95	5.61	2.34	2.41	-0.74	0.51	0.16
				65.8, 75.9	.671, .580	.718, .743	.580, .522
China	7.13	6.81	0.32	0.83	-0.07	0.08	-0.52
				65.5, 71.4	.708, .698	.727, .731	.443, .637
Indonesia	6.02	3.13	2.89	2.60	0.59	-0.22	-0.08
				54.8, 67.5	.717, .806	.784, .771	.622, .648
Hong Kong	5.54	3.61	1.94	1.70	0.42	0.37	-0.56
				74.7, 80.9	.656, .714	.771, .794	.681, .829
Singapore	4.94	4.74	0.20	1.67	-0.91	-0.20	-0.35
				71.5, 78.1	.511, .426	.777, .766	.622, .726
Turkey	4.50	1.73	2.77	2.08	-0.42	0.75	0.35
				61.4, 70.4	.871, .801	.778, .829	.831, .742
Japan	4.45	2.07	2.38	1.39	0.31	0.55	0.13
				76.1, 81.1	.618, .658	.771, .806	.543, .494
Malaysia	4.19	4.22	-0.03	1.35	-1.42	-0.16	0.20
				66.9, 72.6	.709, .533	.796, .786	.816, .765
India	4.03	2.89	1.14	1.25	0.12	0.10	-0.32
				55.7, 62.5	.862, .883	.788, .794	.565, .669
Ireland	3.75	3.89	-0.14	1.11	-1.31	-0.14	0.21
				72.7, 76.4	.718, .552	.840, .828	.589, .514
Italy	3.70	1.95	1.75	1.66	-0.09	0.13	0.06
				73.9, 79.5	.693, .681	.835, .846	.557, .536
France	3.60	1.61	1.98	1.44	-0.09	0.34	0.29
				74.2, 78.9	.734, .721	.822, .850	.560, .446
U.K.	3.32	2.19	1.13	1.25	-0.03	0.08	-0.17
				73.7, 77.7	.794, .789	.818, .824	.448, .520
United States	2.59	2.04	0.55	1.09	-0.11	-0.18	-0.25
				73.7, 77.0	.778, .762	.809, .797	.601, .680
Mexico	1.83	0.53	1.30	1.81	-0.01	-0.32	-0.19
				66.8, 74.0	.749, .748	.835, .811	.827, .871
Brazil	1.76	0.18	1.59	1.88	0.23	-0.44	-0.08
				62.8, 70.4	.822, .861	.796, .769	.957, .973
Botswana	1.20	4.35	-3.16	-2.72	-0.88	0.29	0.16
				60.5, 48.9	.766, .642	.783, .801	.906, .871
Colombia	0.85	0.99	-0.15	1.21	0.04	-0.74	-0.65
				65.7, 71.1	.849, .856	.801, .756	.780, .932
South Africa	-0.89	0.10	-0.99	-0.32	0.14	0.15	-0.96
				57.2, 56.1	.837, .861	.807, .818	.762, .981
Cote d'Ivoire	-2.38	-0.76	-1.62	-1.41	-0.75	0.30	0.24
				53.5, 47.4	.903, .777	.769, .787	.847, .788

Note: The second line for each country displays the raw data on life expectancy, the consumption share, leisure per capita, and the stdev of log consumption for 1980 and 2000. See notes to Table 3.

But increasing life expectancy, a rising consumption share, rising leisure, and falling inequality more than double Japan's welfare growth to 4.45% per year, almost two percentage points faster than U.S. growth over this period. Japan is one of the fastest growing economies in the world over this period when these additional components of welfare are included.

U.S. versus Western Europe: Income growth in the United States and Western Europe is roughly the same, at 2.0%. According to the welfare measure, however, Western Europe grows more than three-quarters of a percentage point faster at 3.3%, with life expectancy, leisure, and inequality all contributing to the difference.

Table 4 illustrates this point for France, Italy, and the United Kingdom. Income growth in France and Italy was somewhat slower than in the U.S. and U.K. Welfare growth in all three European countries rises sharply relative to the United States, however, with all three growing at rates of 3.3% or more. Growth in France more than doubles, from 1.6% to 3.6%. Life expectancy, leisure, and inequality all contribute to the gain.

China: According to our welfare measure, China is no longer the fastest growing country in the world from 1980 to 2000. China and South Korea swap places at the top of the list of fast-growing countries, with growth in South Korea rising to 8.0% and growth in China registering at 7.1%. Chinese welfare growth is slightly faster than its income growth, but its boost from higher life expectancy is tempered by rising inequality, which shaves off 0.5 percentage points per year from Chinese growth. South Korea gains the equivalent of 2.4% faster consumption growth from its 10 year jump in life expectancy (from 66 to 76).

Latin America: As shown in the regional averages reported in Table 3, Latin America gains the most of any region of the world from rising life expectancy — almost 1.8 percentage points. Unfortunately, declines in leisure and rising inequality offset a third of this gain.

AIDS in Africa: South Africa, Botswana, and Cote d'Ivoire all see their growth rate reduced sharply by AIDS. In South Africa, declining life expectancy slows growth by 0.3 percentage points, while rising inequality slows growth by another 1.0 percentage point. The net effect is to reduce South Africa's annual growth from 0.1% to -0.9%. Young (2005) pointed out that AIDS was a tragedy in Africa but that it might have beneficial effects on GDP performance by raising the amount of capital per worker. Our welfare measure provides one way of adding these two components together to measure the net cost which, as Young suspected, proves to be substantial. Botswana loses the equivalent of 2.7 percentage points of consumption growth from seeing its life expectancy fall from 60.5 to 48.9 years. Botswana's growth rate falls from one of the fastest in the world at 4.35% to well below average at 1.20%. Already poor sub-Saharan Africa fell further behind the richest countries from 1980 to 2000, and this contrast is magnified by focusing on welfare instead of income.

The new "Singapores": An important contributor to growth in GDP per person in many rapidly-growing countries is factor accumulation: increases in the investment rate and increases 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 of overall economic performance.

Table 4 shows that many of the world's fastest growing countries are imitating Singapore in this respect. In terms of welfare growth, Singapore, Malaysia, and Ireland all lose more than a full percentage point of annual growth to these channels. Equally interesting, the countries in this list remain among the fastest growing countries in the world as these negative effects are countered by large gains in life expectancy.

5. Robustness

Our benchmark results required particular assumptions about the functional form and parameter values of Rawls' utility function. Here we gauge the robustness of our calculations to alternative welfare measures and alternative specifications of utility.

Table 5: Robustness — Summary Results

Robustness check	— *Median absolute deviation* — Levels	Growth rate	# of countries with negative flow utility
Benchmark case	37.9	0.99	0
Equivalent variation	26.9	0.93	0
Compensating variation	44.2	1.03	0
$\gamma = 1.5, \bar{c} = 0$	32.9	0.61	52
$\gamma = 1.5, \bar{c} = .088$	38.6	0.86	6
$\gamma = 2.0, \bar{c} = .271$	41.4	0.96	6
θ from FOC for France	41.3	1.05	0
Frisch elasticity = 0.5	38.0	1.00	0
Frisch elasticity = 1.9	38.3	0.98	0
Value of Life = $3m	28.6	0.73	14
Value of Life = $5m	46.4	1.39	0

Note: The main entries in the table are the median absolute deviation of $\frac{\lambda_i}{\tilde{y}_i}$ from one in the levels case (not in logs) and $g_\lambda - g_y$ in the growth rate case. The last column reports the number of countries with negative flow utility in the year 2000 according to the levels calculation; the large count for $\gamma = 1.5, \bar{c} = 0$ suggests that this case should be viewed skeptically.

5.1. Equivalent Variation and Compensating Variation

To begin, recall that our benchmark results are based on the geometric average of the equivalent variation (EV) and compensating variation (CV). The first three rows of Table 5 display summary results for each of these three welfare measures, for both levels and growth rates. For the geometric average, the median absolute deviation from one of $\frac{\lambda_i}{y_i}$ (not in logs) is 0.379. Deviations of welfare from income are lower under equivalent variation (0.269) and higher under compensating variation (0.442).

As discussed earlier in Section 2.3, this distinction rests primarily on whether differences in life expectancy are valued using a country's own utility (for EV) or the U.S. utility (for CV). For rich countries, this makes little difference. Even for a country with moderate income, like China, the differences are relatively small. These facts are shown in Table 6, which displays our robustness results for two sample countries, France and China, in levels. (Table 7 does the same for growth rates).

The difference between EV and CV is most apparent for extremely poor countries. For example, consider Malawi. According to GDP per person, the United States is 34 times richer than Malawi. Our benchmark welfare measure raises this ratio to 284. This is the geometric average of an EV ratio of 68 and a CV ratio of 1178. The factor of 68 comes from an EV approach that puts little value on Malawi's low life expectancy: Malawi has such low flow utility that life is not particularly valuable according to our baseline preference specification. Alternatively, the CV calculation uses U.S. flow utility to value the shortfall in life expectancy, producing a truly enormous welfare ratio. The two approaches involve distinct, but arguably equally-interesting, thought experiments of scaling down U.S. consumption (EV) or scaling up foreign consumption (CV).

Fortunately, the "key points" we make in this paper are robust to using these three different welfare measures. This is apparent, for example, in the fact that even with the EV approach, Malawi is twice as poor as suggested by GDP per person. The differences only become larger as one moves to our other welfare metrics.

5.2. Alternative Utility Specifications

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

$$u(C,\ell) = \bar{u} + \frac{(C+\bar{c})^{1-\gamma}}{1-\gamma}\left(1+(\gamma-1)\frac{\theta\epsilon}{1+\epsilon}(1-\ell)^{\frac{1+\epsilon}{\epsilon}}\right)^{\gamma} - \frac{1}{1-\gamma}. \tag{11}$$

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

In the special case of $\bar{c} = 0$, 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).

Table 6: Robustness — Detailed Results for Welfare Levels

	Welfare	Log	— Decomposition —			
Country	λ	Ratio	LifeExp	C/Y	Leisure	Inequality
France (y=70.1):						
Benchmark case	97.4	0.329	0.119	-0.055	0.140	0.125
Equivalent variation	97.3	0.329	0.118	-0.055	0.140	0.125
Compensating variation	97.4	0.329	0.119	-0.055	0.140	0.125
$\gamma = 1.5, \bar{c} = 0$	102.8	0.383	0.097	-0.055	0.153	0.186
$\gamma = 1.5, \bar{c} = .088$	102.3	0.378	0.108	...	0.163	0.160
$\gamma = 2.0, \bar{c} = .271$	105.5	0.410	0.108	...	0.186	0.168
θ from FOC for France	109.0	0.442	0.114	-0.055	0.258	0.125
Frisch elasticity = 0.5	95.7	0.311	0.119	-0.055	0.123	0.125
Frisch elasticity = 1.9	98.3	0.339	0.119	-0.055	0.150	0.125
Value of Life = \$3m	94.1	0.295	0.085	-0.055	0.140	0.125
Value of Life = \$5m	100.7	0.363	0.152	-0.055	0.140	0.125
China (y=11.3):						
Benchmark case	5.3	-0.755	-0.283	-0.088	-0.239	-0.145
Equivalent variation	5.9	-0.644	-0.172	-0.088	-0.239	-0.145
Compensating variation	4.7	-0.866	-0.394	-0.088	-0.239	-0.145
$\gamma = 1.5, \bar{c} = 0$	5.5	-0.713	-0.161	-0.097	-0.269	-0.239
$\gamma = 1.5, \bar{c} = .088$	4.6	-0.903	-0.236	...	-0.440	-0.181
$\gamma = 2.0, \bar{c} = .271$	2.8	-1.380	-0.291	...	-0.863	-0.241
θ from FOC for France	4.4	-0.930	-0.256	-0.088	-0.441	-0.145
Frisch elasticity = 0.5	5.1	-0.796	-0.282	-0.088	-0.281	-0.145
Frisch elasticity = 1.9	5.4	-0.739	-0.284	-0.088	-0.222	-0.145
Value of Life = \$3m	5.9	-0.649	-0.177	-0.088	-0.239	-0.145
Value of Life = \$5m	4.8	-0.861	-0.389	-0.088	-0.239	-0.145

Note: See notes to Table 1.

Table 7: Robustness — Detailed Results for Welfare Growth

Country	Welfare growth	Difference vs IncGrowth	*Decomposition* LifeExp	C/Y	Leisure	Inequality
France (g_y=1.61%):						
Benchmark case	3.60	1.98	1.44	-0.09	0.34	0.29
Equivalent variation	3.48	1.87	1.33	-0.09	0.34	0.29
Compensating variation	3.71	2.09	1.55	-0.09	0.34	0.29
$\gamma = 1.5, \bar{c} = 0$	3.34	1.72	1.13	-0.09	0.26	0.45
$\gamma = 1.5, \bar{c} = .088$	3.55	1.94	1.25	...	0.43	0.37
$\gamma = 2.0, \bar{c} = .271$	3.66	2.05	1.27	...	0.53	0.38
θ from FOC for France	3.83	2.22	1.39	-0.09	0.63	0.29
Frisch elasticity = 0.5	3.53	1.91	1.44	-0.09	0.28	0.29
Frisch elasticity = 1.9	3.63	2.02	1.44	-0.09	0.38	0.29
Value of Life = $3m	3.16	1.55	1.01	-0.09	0.34	0.29
Value of Life = $5m	4.03	2.42	1.87	-0.09	0.34	0.29
China (g_y=6.81%):						
Benchmark case	7.13	0.32	0.83	-0.07	0.08	-0.52
Equivalent variation	6.82	0.01	0.53	-0.07	0.08	-0.52
Compensating variation	7.44	0.62	1.14	-0.07	0.08	-0.52
$\gamma = 1.5, \bar{c} = 0$	5.81	-1.01	-0.20	-0.08	0.05	-0.81
$\gamma = 1.5, \bar{c} = .088$	6.87	0.05	0.19	...	0.23	-0.31
$\gamma = 2.0, \bar{c} = .271$	7.20	0.38	0.16	...	0.47	-0.21
θ from FOC for France	7.00	0.18	0.64	-0.07	0.15	-0.52
Frisch elasticity = 0.5	7.14	0.32	0.82	-0.07	0.11	-0.52
Frisch elasticity = 1.9	7.13	0.31	0.84	-0.07	0.07	-0.52
Value of Life = $3m	6.52	-0.29	0.23	-0.07	0.08	-0.52
Value of Life = $5m	7.73	0.92	1.44	-0.07	0.08	-0.52

Note: See notes to Table 4.

Table 5 summarizes a range of robustness checks based on this general form for preferences. The one sentence summary is that, overall, the results for our benchmark case are quite representative and often become even stronger under the various alternatives we consider.

Several cases in Table 5 impose more curvature over consumption than in the log case. With $\gamma = 1.5$, the median absolute deviation from unity for the ratio of welfare to income falls somewhat to 0.329, down from 0.379 in the baseline case. Consumption inequality is more costly to Rawls with $\gamma = 1.5$ than in our baseline of $\gamma = 1$.

The final column of Table 5, however, reports the number of countries with *negative* flow utility in 2000. In the baseline case there are no such countries, which is reassuring. However, low average consumption, particularly when combined with high inequality and a high value of γ, can cause expected flow utility for Rawls to turn negative. Presumably these are not the preferences of individuals living in these countries. Nearly all of our empirical evidence on utility functions comes from people with relatively high consumption. Extrapolating these functional forms over 30-fold differences in consumption may be inappropriate, and this could be what the negative flow utilities among poor countries are signaling. When $\gamma = 1.5$ and $\bar{c} = 0$, a remarkable 52 countries exhibit negative expected utility. Obviously, the plausibility of this particular case is called into question.

Life is presumably very much worth living in all countries. This is why we inserted the additional parameter $\bar{c}$ in our more general utility function. With $\bar{c} > 0$, expected flow utility can remain positive in the presence of lower average consumption and wider consumption inequality. In the fifth row of Table 5 we consider $\bar{c} = 0.088$ along with $\gamma = 1.5$. This combination makes Rawls exactly indifferent between living and dying in Ethiopia, and thus lifts Rawls out of negative territory in all but 6 countries. This intercept has less impact on expected utility at much higher levels of consumption (think of adding 8.8% of U.S. consumption to everyone's actual consumption in OECD countries). With this combination, income and welfare differ by slightly more than in the baseline case (0.386 vs. 0.379).

The next row of Table 5 increases curvature further to $\gamma = 2$ at the same time boosting the intercept to $\bar{c} = 0.271$ to prevent Rawls from preferring death to life in many countries. The gaps between welfare and income become even wider.

We next consider a higher weight on leisure vs. consumption in utility. As in the baseline we have $\gamma = 1$ and $\bar{c} = 0$, but we now increase the value of θ. In particular, we choose θ to rationalize the higher choice of average leisure in France rather than the lower level seen in the U.S. (and use a marginal tax rate of 0.59 for France, taken from Prescott 2004). As shown in Table 5, increasing the importance of leisure in this way makes welfare and income differ more, both in levels and growth rates.

Toward the end of Table 5, we consider alternative values for the Frisch elasticity of labor supply, in particular 0.5 from Chetty (2009) and a high value of 1.9, at the upper end of Hall's (2009b) recommendation. These changes have little effect on our results.

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 2000 dollars is $3 million or $5 million rather than the baseline value of $4 million.

With a value of life of $3 million in the United States, the intercept in the utility function falls. Life is generally 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 in low lifespan developing countries like China; see Table 6. Overall, the median deviation between welfare and income falls from our benchmark value of 0.379 to a smaller but still quite substantial 0.286. Notice that in this case 14 countries exhibit negative expected utility.

With a U.S. value of life of $5 million, the contrast between welfare and income is sharper. The deviation between welfare and income rises to 0.464 rather than 0.379 in levels and by 1.40% per year rather than 0.99% per year in 1980–2000 growth rates. With more surplus to living, differences in the levels and growth rates of life expectancy naturally matter more to Rawls.

The bottom line of all these variations in the utility specification turns out to be straightforward: our benchmark results on the contrast between welfare and income hold up quite well in the alternatives we consider.

5.3. Adjusting the Consumption Share for Transition Dynamics

Our benchmark welfare measure incorporates current consumption. One may, however, also be interested in adjusting for transition dynamics: a low consumption share today may raise capital and therefore income in the future. To the extent that countries are in their steady states, our baseline statistic fully incorporates this force. However, if the investment rate is rising or falling toward a new level, an additional calculation may be interesting.

To gauge the potential importance of such dynamics, we compute the investment rate that would sustain the 2000 capital-output ratio as a steady state in each country. We then adjust the consumption share to the level implied by this alternative investment rate. That is, we consider what consumption shares are consistent with maintaining the 2000 capital-output ratio as a steady state.[10]

We plot these adjusted vs. actual consumption shares in Figure 5. Most countries lie near the 45 degree line, meaning most of the variation in consumption shares is persistent and therefore shows up in the current capital-output ratio.

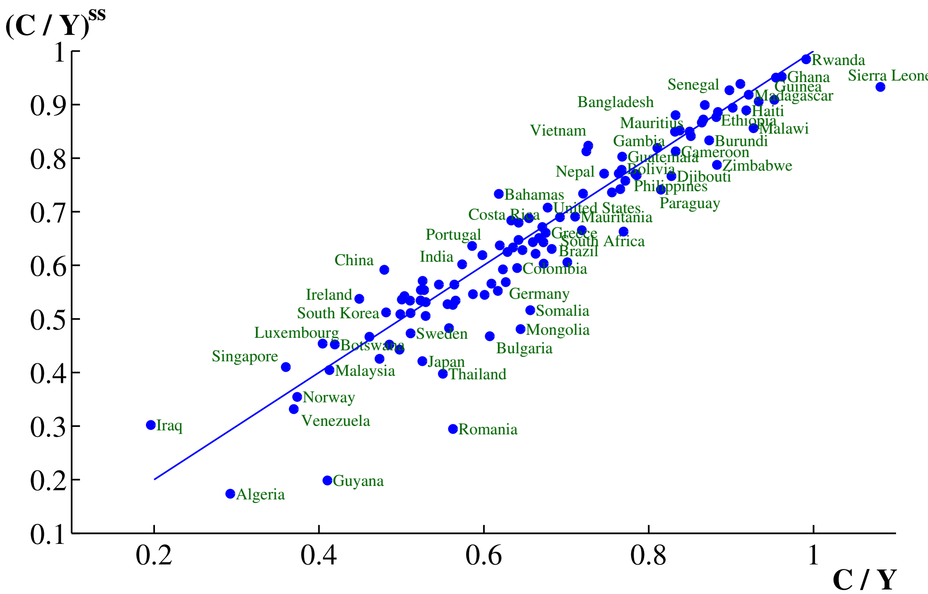
Table 8 reports the welfare calculations using the adjusted consumption shares. The biggest adjustments are to the consumption shares in Japan and Thailand (down over 10 percentage points as its investment rate fell leading up to 2000) and in China (up over 10 percentage points as its investment share was rising). Interestingly, this is the one robustness check that lowers Western Europe's position relative to our benchmark results. But the general finding that European welfare is significantly closer to U.S. values continues to hold. Overall, these calculations provide some reassurance that transition dynamics do not play a prominent role in our results.

[10]We construct physical capital stocks in 2000 using the perpetual inventory method assuming a depreciation rate of 6%. We calculate the "steady state" investment and consumption rates as follows:

$$\left(\frac{I_i}{Y_i}\right)^{ss} = (g+\delta)\cdot\frac{K_{i,2000}}{Y_{i,2000}}, \qquad \left(\frac{C_i}{Y_i}\right)^{ss} = \frac{C_{i,2000}}{Y_{i,2000}} - \left(\left(\frac{I_i}{Y_i}\right)^{ss} - \frac{I_{i,2000}}{Y_{i,2000}}\right)$$

where we assume $g+\delta$ is 9%.

Figure 5: Inferred vs. Actual C/Y



Note: This figure compares the observed consumption share of GDP with the share that would maintain the current capital-output ratio as a steady state. In countries where the investment rate has trended upward recently (e.g. China), this adjustment creates a higher consumption share. In countries where the investment rate has trended downward recently (e.g. Japan), this implies a lower consumption share.

Table 8: Robustness: Inferring C/Y from K/Y, 2000

Country	Per capita Income	Benchmark welfare	Welfare w/ C/Y adj.	Benchmark C/Y	Adjusted C/Y
United States	100.0	100.0	100.0	0.762	0.792
Germany	74.0	98.0	86.9	0.722	0.666
France	70.1	97.4	89.9	0.721	0.693
Japan	72.4	91.5	73.7	0.658	0.554
Hong Kong	82.1	90.0	86.6	0.714	0.715
Italy	69.5	89.7	82.1	0.681	0.649
United Kingdom	69.8	89.0	86.1	0.789	0.795
Israel	55.2	66.7	66.2	0.725	0.749
Singapore	82.9	43.6	46.9	0.426	0.477
South Korea	47.1	29.7	30.1	0.580	0.611
Mexico	25.9	17.4	17.2	0.748	0.765
Brazil	21.8	12.2	11.3	0.861	0.832
Russia	20.9	8.6	...	0.672	...
Thailand	18.4	7.1	5.4	0.682	0.529
Indonesia	10.8	6.6	5.9	0.806	0.737
China	11.3	5.3	5.9	0.698	0.810
South Africa	21.6	4.4	4.2	0.861	0.845
India	6.6	3.5	3.5	0.883	0.911
Botswana	17.9	1.8	1.8	0.642	0.677
Malawi	2.9	0.4	0.3	0.982	0.911

Note: This table makes a coarse adjustment for the difference between the current consumption share and the steady state consumption share, which is particularly a problem in countries where the investment rate may have been trending recently. Specifically, we treat the 2000 capital-output ratio as a steady state and recover the consumption share that is implied. The table reports welfare when this adjustment is made.

Table 9: Household Surveys

Country	Survey	Year	# of Households
U.S.	CES	2006	12,671
		2005	12,915
		2002	13,171
		1993	8,872
		1984	9,233
France	EBF	2005	25,025
		1984	32,728
India	NSS	2004–2005	602,518
		1983–1984	622,912
Mexico	ENIGH	2002	71,176
		1984	23,390
South Africa	HIS	1993	38,749

Notes: CES = U.S. Consumer Expenditure Survey. NSS = Indian National Sample Survey. EBF = French Family Budge Survey. ENIGH = Mexican National Survey of Household Income and Expenditure. HIS = South African Integrated Household Survey. The Indian NSS in 1983-1984 has a separate schedule (and separate households) for consumer expenditures (316,061 individuals) and time use (622,912 individuals).

6. Micro Calculations

With enough micro data, we can relax some of the strong assumptions imposed on us by macro data constraints. Here we describe advantages of using Household Survey data, modify the welfare expressions to exploit micro data, and show how the welfare numbers are affected. To preview, we have results for selected years in the U.S., France, India, Mexico, and South Africa. See Table 9 for a list of the country-years we use.[11] This richer micro data matters for welfare calculations but does not overturn any of our Key Points.

[11] 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 a few of the same datasets for the U.S. and Mexico. For some of their 10 countries, however, we do not have access to data on hours worked.

6.1. Advantages of Micro Data

Recall that, for a number of countries (especially developed ones), the Gini coefficients are based on income rather than consumption. Household Surveys containing data on consumption expenditures enable us to calculate consumption inequality directly rather than inferring it from income inequality.

With micro data, furthermore, we can allow for an arbitrary distribution of consumption instead of assuming a log-normal distribution. As empirical income and wealth distributions often feature long right tails, this flexibility could be crucial for measuring the welfare costs of inequality.[12]

With 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 nondurable expenditures inclusive of services (such as rent and owner-occupied housing).[13]

In all cases, the micro datasets we use include the reported age composition of each household. We allocate consumption to each household member — so far equally (i.e., per capita), although we could alternatively use an adult-equivalent definition or allocate a higher fraction of consumption to adults. By allocating expenditures to individuals we presumably get a better measure of inequality within countries, for example if poorer households tend to be larger. We can take into account household size and age composition in a way the Gini coefficients do not.

The household surveys we analyze include information related to hours worked for the adults and at least older children in the household. For the children below the age covered in the survey (12 Mexico, 16 in France and South Africa), we assume zero hours worked. Importantly, the surveys ask about time spent in self-employment, including subsistence agriculture.

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

[12]Top-coding does not occur for consumption in our Indian, Mexican and South African samples. It seems to arise infrequently in the U.S. data when durables are excluded.

[13]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.

estimate the welfare cost of leisure inequality, just as we estimate the welfare cost of consumption inequality (again for an arbitrary distribution).

Finally, from behind the Rawlsian veil, age-specific consumption and leisure interact with age-specific mortality to determine expected utility. We therefore combine data from Household Surveys with mortality rates by age in 1990, 2000, and 2006 compiled by the World Health Organization.[14]

6.2. Theory for the Micro Calculations

As with the macro data, we will implement a geometric average of the equivalent and compensating variations in consumption based on the micro data. For brevity, here we present only the formulas for the equivalent variation.

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 in age group a in country i as N^i_a. We make the convenient assumption that the number of possible outcomes of consumption and leisure is synonymous with the number of 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:

$$\bar{\omega}^i_{ja} \equiv \frac{\omega^i_{ja}}{\sum_{j=1}^{N^i_a} \omega^i_{ja}} \tag{12}$$

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

$$V^i = \frac{1}{100} \sum_{a=1}^{100} S^i_a \sum_{j=1}^{N^i_a} \bar{\omega}^i_{ja} u(c^i_{ja}, \ell^i_{ja}), \tag{13}$$

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, $V^i(\lambda)$ denotes expected utility for Rawls in country i if consumption is reduced by proportion λ in all realizations of consumption and leisure. Our

[14] http://apps.who.int/whosis/database/life_tables/life_tables.cfm. 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.

consumption-equivalent welfare metric λ^i continues to be defined implicitly by

$$V^{us}(\lambda^i) = V^i(1). \tag{14}$$

For the micro calculations we will stick with the benchmark utility function and parameter values. Because of additive utility over log consumption plus an intercept and a leisure term, we get

$$V^{us}(\lambda^i) = \frac{1}{100}\sum_{a=1}^{100} S_a^{us}[u_a^{us} + \log(\lambda^i)], \tag{15}$$

where

$$u_a^{us} \equiv \bar{u} + \sum_{j=1}^{N_a^{us}} \bar{\omega}_{ja}^{us}[\log(c_{ja}^{us}) + v(\ell_{ja}^{us})]. \tag{16}$$

We can then solve for the scaling of consumption that equates expected utility:

$$\log(\lambda^i) = \frac{1}{\sum_{a=1}^{100} S_a^{us}}\sum_{a=1}^{100}[(S_a^i - S_a^{us})u_a^i + S_a^{us}(u_a^i - u_a^{us})]. \tag{17}$$

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

$$s_a^{us} \equiv \frac{S_a^{us}}{\sum_{a=1}^{100} S_a^{us}} \tag{18}$$

$$\Delta s_a^i \equiv \frac{S_a^i - S_a^{us}}{\sum_{a=1}^{100} S_a^{us}} \tag{19}$$

Denote demographically-adjusted average consumption and leisure levels and utility terms as:

$$\bar{c}^i \equiv \sum_{a=1}^{100} s_a^{us} \sum_{j=1}^{N_a^i} \bar{\omega}_{ja}^i c_{ja}^i \tag{20}$$

$$\bar{\ell}^i \equiv \sum_{a=1}^{100} s_a^{us} \sum_{j=1}^{N_a^i} \bar{\omega}_{ja}^i \ell_{ja}^i \tag{21}$$

$$E \log c^i \equiv \sum_{a=1}^{100} s_a^{us} \sum_{j=1}^{N_a^i} \bar{\omega}_{ja}^i \log(c_{ja}^i) \tag{22}$$

$$Ev(\ell^i) \equiv \sum_{a=1}^{100} s_a^{us} \sum_{j=1}^{N_a^i} \bar{\omega}_{ja}^i v(\ell_{ja}^i). \tag{23}$$

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

$$\begin{aligned}
\log \lambda_i \ = \ & \textstyle\sum_{a=1}^{100} \Delta s_a^i u_a^i && \text{Life Expectancy} \\
& + \log \bar{c}_i - \log \bar{c}_{us} && \text{Consumption} \\
& + v(\bar{\ell}_i) - v(\bar{\ell}_{us}) && \text{Leisure} \\
& + E \log c^i - \log \bar{c}^i - (E \log c^{us} - \log \bar{c}^{us}) && \text{Consumption Inequality} \\
& + \big(Ev(\ell^i) - v(\bar{\ell}^i) - (Ev(\ell^{us}) - v(\bar{\ell}^{us}))\big) && \text{Leisure Inequality}
\end{aligned} \tag{24}$$

Table 10 provides the decomposition of consumption-equivalent welfare based on equation (24) for France in 2005, India in 2005, Mexico in 2002, and South Africa in 1993 – each relative to the U.S. in the same year. In contrast to our macro calculations, these micro calculations take into account age-specific mortality (interacted with age-specific consumption and leisure), an arbitrary distribution of consumption (rather than requiring log-normality), and leisure inequality. See the Micro Data Appendix for more details.

The French micro calculation for 2005 (France has roughly 4% higher welfare than the U.S.) is not too far from the macro calculation for 2000 (3% lower welfare in France). The individual components are within a few percentage points, too, except for leisure inequality. We had no macro data on leisure inequality. According to the micro data, France exhibits less leisure inequality than the U.S. does, boosting French welfare by over 10 percentage points.

In India we arrive at higher welfare in the micro calculation (4.9% relative to

Table 10: Micro Calculations of Welfare Levels

	Welfare λ	Income	Log Ratio	Life Exp.	*Decomposition* C/Y	Leis.	Cons. Ineq.	Leis. Ineq
France	103.8	68.7	.413	.132	-0.088	.117	.116	.135
(macro)	97.4	70.1	.329	.119	-0.055	.140	.125	...
India	4.9	8.0	-.487	-.614	.102	.002	.050	-.027
(macro)	3.5	6.6	-.636	-.818	.148	.009	.043	...
Mexico	18.7	25.7	-.319	-.146	-.013	.019	-.170	-.010
(macro)	17.4	25.9	-.397	-.173	-.018	.041	-.247	...
S Africa	8.5	22.6	-.744	-.609	.217	.084	-.427	-.008
(macro)	4.4	21.6	-1.594	-1.376	.122	.083	-.423	...

Notes: See Table 9 for sources. The first row for each country is the latest year for which we have a Household Survey: 2005 for France, 2005 for India, 2002 for Mexico, 1993 for South Africa — each compared to the same year in the U.S. The macro entries are for the year 2000, and are the same as the corresponding entries in Table 2.

the U.S. in 2005) than in the macro calculation (3.5% relative to the U.S. in 2000). There is a markedly smaller penalty for India's lower life expectancy in the micro computation. The reason is that the percentage gap in cumulative survival rates between India and the U.S. happens to rise with age, whereas flow utility is higher for the young due to their leisure time. The macro calculation assumed the same flow utility at all ages, and hence put more weight on the sizable gap in cumulative survival at higher ages. As discussed in the Micro Data Appendix, the results on Indian leisure should be taken with particular caution.

Mexico looks similar in the 2002 micro calculation (18.7% of U.S. welfare) and the 2000 macro calculation (17.4%). The individual components differ only modestly and in offsetting ways. Mexico's life expectancy is only a few years behind the U.S., and the gap in survival rates is flat with age.

In South Africa welfare is starkly higher in the micro calculation (8.5% relative to the U.S. in 1993) than in the macro calculation (4.4% relative to the U.S. in 2000). Again the reason is a smaller deduction for low life expectancy in the micro data.

Table 11: Micro Calculations of Welfare Growth Rates

	Welfare Growth	Income Growth	Diff	—— *Decomposition* —— Life Exp.	C/Y	Leis.	Cons. Ineq.	Leis. Ineq
France	2.46	1.64	0.82	.91	-.10	-.02	.00	.03
(macro)	3.60	1.61	1.98	1.44	-.09	.34	.29	...
India	3.69	3.68	.01	.52	-.38	.02	-.17	.01
(macro)	3.11	2.89	.22	.48	.12	-.06	-.32	...
Mexico	1.24	0.83	.41	.78	-.13	-.08	-.24	-.07
(macro)	0.61	0.53	.08	1.14	-.01	-.87	-.19	...
U.S.	2.39	1.94	.45	.70	.00	-.33	-.01	.09
(macro)	2.08	2.04	.05	.76	-.11	-.36	-.25	...

Notes: See Table 9 for sources. The first row for each country is the difference between the first and last year for which we have a Household Survey: 1984–2005 for France and India, 1984–2002 for Mexico, and 1984–2006 for the U.S. The macro entries are for 1980–2000 and are the same as in Table 4.

More important than the age profile of flow utility, here, is simply the difference in timing between the micro (1993) and macro (2000) calculations. South African life expectancy fell more than three years from 1993 to 2000 as the AIDS epidemic took its horrific toll.

We now turn to micro-based calculations of welfare *growth* in France, India, Mexico and the U.S.[15] Table 11 provides the decomposition of consumption-equivalent welfare growth.

In France, we continue to find welfare growing more briskly than income – about 3/4 of a percentage point per year faster from 1984 to 2005. This is entirely due to rising life expectancy. The gap was even larger in the macro calculation. Unlike in the macro data, leisure does not rise in the micro calculation in part because of the difference in time periods: according to the OECD, hours worked fell sharply in France from 1980 to 1984, and our micro sample begins in 1984 rather than 1980. And the rise in life expectancy is not worth as much, according to micro data, be-

[15] Recall we have only a single year's cross-section for South Africa.

cause it occurred more for the middle-aged (with low leisure) rather than the young (with high leisure).

In India, we find that welfare grew similarly to income (at 3.7% per year from 1983–2005). In our macro calculation, welfare actually grew 20 basis points faster than income — mostly because C/Y actually rose from 1980–2000, whereas it fell from 1983–2005.

In Mexico, household surveys suggest welfare rose a little more quickly than income per year from 1984 to 2002 (1.2% annual growth in welfare vs. 0.8% annual growth in incomes). The primary reason was rising life expectancy. The same statements are true of the macro results, although the macro calculations featured bigger gains from longer lives offset by falling leisure.

In the U.S., the Consumer Expenditure Survey yields an estimate of welfare growth that is 45 basis points faster than income growth from 1984–2006. Gains from rising life expectancy were offset by falling average time devoted to leisure.[16] The CES evinces no rise in consumption inequality, as emphasized by Krueger and Perri (2006). In contrast, our macro calculation inferred rising consumption inequality from rising income inequality, so that welfare and income growth were quite similar from 1980–2000. According to Aguiar and Bils (2009), savings and Engel Curves in the CES suggest that consumption inequality did rise as much as income inequality in the U.S. over this period.

On the issue of consumption inequality, with the micro data an additional robustness check is possible. Recall that our measure of average consumption includes government consumption per capita (e.g., on public education and health care). Yet both the macro Gini coefficients and the preceding micro calculations were based on inequality in *private* consumption alone. This is tantamount to assuming that private consumption is proportional to total consumption. A polar assumption would be that there is *no* variation in government consumption across individuals. We therefore recalculate all of the consumption inequality terms in Table 10 and Table 11 after adding equal per capita government consumption to all

[16] For the U.S. we also calculate a modest boost from falling leisure inequality. Using Time Use Surveys over a longer span, Aguiar and Hurst (2007) report rising leisure inequality in the U.S.

individuals within a given country-year. This naturally lowers the costs of inequality, especially in South Africa but also in India (where it falls by roughly half).

To summarize, the exact welfare numbers are clearly sensitive to using Household Surveys directly to measure consumption inequality, average leisure, leisure inequality, and the benefits of longer lives. But, reassuringly, none of the key points we took away from the macro calculations is reversed in these micro calculations. In terms of levels, France is much closer to the U.S. in welfare than income. In contrast, each of the following widens the welfare vs. income gaps with the U.S.: lower life expectancy in India, higher inequality in Mexico, and both shorter lives and greater consumption inequality in South Africa. Rising life expectancy carries welfare growth above income growth in France, Mexico and the U.S. alike.

7. Caveats

Before concluding, we briefly discuss some of the serious limitations to our welfare measure.

Our flow welfare index does not get at discounted lifetime utility. To the extent consumption, leisure, or life expectancy exhibit transition dynamics or even trend breaks (as with China after 1978), lifetime utility could differ markedly from our snapshot. This is all the more true if individual utility is not separable over time so that mobility in consumption and leisure matter. If an individual or even whole economy is transitioning to a higher level of consumption, current levels of consumption can be too pessimistic about lifetime utility. We did note, however, that most observed cross-country differences in consumption-output ratios reflect persistent (steady state) differences rather than transition dynamics.

In a recursive world, one could take a value function approach, identifying the state variables that matter for discounted welfare. Relevant states might include the stocks of human and physical capital, TFP in producing final goods and health, and the degree of consumption insurance.[17] An advantage of this complementary value

[17] Related, Basu, Pascali, Schiantarelli and Serven (2010) suggest that total factor productivity growth may, under quite general circumstances, be interpreted as a measure of welfare growth.

function approach is that it might shed light on underlying policy distortions, as opposed to simply evaluating outcomes.

We evaluate outcomes in terms of a single utility function both within and across countries. In contrast, preference heterogeneity (at least within countries) is a routine assumption in labor economics and public finance. See Weinzierl (2009) for a recent discussion of how preference heterogeneity can affect optimal taxation. Although we believe it is beyond the scope of this paper, one could try to use household data to quantify preference heterogeneity within countries.

A related issue is whether countries differ in the efficiency of time spent in home production. For example, human capital is surely useful at home (e.g. in childcare) as well as in the market. To the extent the benefits take the form of future consumption, our flow welfare index could pick this up eventually. Also, if leisure is more productive because of a higher quality and quantity of consumer durables, then this could arguably be dealt with by nonseparable momentary utility between consumption and leisure.

Our narrow utility over consumption and leisure ignores altruism, for example within families. Given the big differences in family size and population growth rates across countries (e.g., Tertilt (2005)), incorporating intergenerational altruism could have a first order effect on welfare calculations.

Our measure of health focuses on the easier-to-measure extensive margin (quantity of life), following a long tradition; see especially Nordhaus (2003). However, the intensive margin (quality of life) is obviously important as well. To the extent we include health spending in our measure of consumption, one could argue we are capturing the intensive margin across countries, and maybe even double-counting the extensive margin. But this ignores differences in the natural disease environment that may cause differences in morbidity for a given amount of health spending (e.g. the prevalence of malaria). Moreover, in the cross-section within countries, health may be negatively correlated with health spending (e.g. across age groups).[18]

[18]A large recent literature also emphasizes the possible causal links between health and growth: for example Acemoglu and Johnson (2007), Bleakley (2007), Weil (2007), Feyrer, Politi and Weil (2008), and Aghion, Howitt and Murtin (2010).

Some of our parameter values implied negative *average* flow utility in the very poorest countries. This understates welfare in these countries, to put it mildly. With estimates of the value of life in some of the poorest countries, one could get a sense for how badly this misses the mark.[19] One could also incorporate heterogeneity in mortality rates within a country; Edwards (2010) suggests that this may be quantitatively significant in his extension of the Becker, Philipson and Soares (2005) growth rates.

We have neglected the natural environment more generally. The quality of the air, water, and so on provide utility for a given amount of market consumption and leisure and help sustain future consumption. See, for example, U.S. Bureau of Economic Analysis (1994), Dasgupta (2001) and Arrow et al. (2004).

There have been various efforts to quantify the economic costs of crime (including prevention), such as Anderson (1999). Possibly related, Nordhaus and Tobin (1972) subtracted urban disamenities in calculating their Measure of Economic Welfare.

The data we use for aggregate real consumption per capita is converted into dollars using estimated PPP exchange rates. The underlying price ratios are supposed to be for comparable-quality goods and services. But in practice it can be difficult to fully control for quality differences, especially for education and health. And the current methodology makes no attempt to quantify differences in variety across countries. Any errors in the PPP exchange rate for consumption will contaminate the consumption portion of our welfare index.

Related, households in a given country may face different price indices (inclusive of variety and quality). If so, then expenditures are not proportional to true consumption within countries, as we have assumed. If true price indices are positively correlated with expenditures (i.e., prices are lower in poorer areas), then the Gini coefficients we use overstate consumption inequality.

Finally, we have not experimented with non-standard preferences such as habit formation or keeping up with the Joneses. Doing so could imply smaller differences

[19] In this vein, Kremer, Leino, Miguel and Zwane (2009) use valuation of clean water in rural Kenya to estimate the implied value of averting a child death at between $769 and $3006.

in flow utility from gaps in average consumption across countries. How these alternative preferences would affect the welfare costs of inequality is less clear.

8. Conclusion

For a given specification of preferences, we calculate consumption-equivalent welfare for various countries and years using widely available data on average consumption, average leisure, consumption inequality, and average life expectancy. Several findings stand out.

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, rising life expectancy accounts for about 1/3 of welfare growth in the U.S. and Western Europe and all of average welfare growth in Latin America (given declining welfare from other sources). In contrast, life expectancy actually declines between 1980 and 2000 in many countries in sub-Saharan Africa, reducing welfare and expanding the development gap between these countries and the rest of the world.

For a small set of countries (the U.S., France, India, Mexico, and South Africa), we exploited household surveys on consumption and leisure. With such micro data we can incorporate all of the above, plus leisure inequality and age-specific mortality. These "micro" results are broadly similar to our findings with "macro" data.

Our calculations entail many strong assumptions. We therefore checked robustness to alternative welfare measures and alternative utility functions over consumption and leisure. Our benchmark calculations are quite representative of the differences between welfare and income we see in the robustness checks. For the limited set of countries for which we analyzed micro data, we were able to drop several simplifying assumptions (e.g. log-normally distributed consumption).

With the requisite data, one could relax many more of our assumptions. Life expectancy surely differs by more than age 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 try to estimate the present discounted value of welfare.[20]

One could carry out similar calculations across geographic regions within countries, or for that matter 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.

A Data Appendix

Extended results for all countries as well as the basic data used in our calculations is available at http://www.stanford.edu/~chadj/BasicDataRawls10.xls. A detailed data appendix and descriptions of the programs used to compute the results are available at http://www.stanford.edu/~chadj/Rawls-DataAppendix200.pdf.

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[20]With time-separable utility, repeated cross-sections would suffice. Dealing with nonseparability over time, however, would seem to require longer household panels than are known to us.

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